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Space Administration
Langley Research Center

Scientific and Technical
Information Program Office

Scientific and Technical Aerospace Reports

STAR

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NASA STI Program ... in Profile

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Introduction

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STAR subject coverage includes all aspects of aeronautics and space research and development, supporting basic and applied research, and application, as well as aerospace aspects of Earth resources, energy development, conservation, oceanography, environmental protection, urban transportation and other topics of high national priority. The listing is arranged first by 11 broad subject divisions, then within these divisions by 76 subject categories and includes two indexes: subject and author.

STAR includes citations to Research & Development (R&D) results reported in:

- NASA, NASA contractor, and NASA grantee reports
- Reports issued by other U.S. Government agencies, domestic and foreign institution, universities, and private firms
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- Other U.S. Government agency and foreign patents and patent applications
- Domestic and foreign dissertations and theses

The NASA STI Program

The NASA Scientific and Technical Information (STI) Program was established to support the objectives of NASA's missions and research to advance aeronautics and space science. By sharing information, the NASA STI Program ensures that the U.S. maintains its preeminence in aerospace-related industries and education, minimizes duplication of research, and increases research productivity.

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NASA Center for AeroSpace Information (CASI)

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National Technical Information Service (NTIS)

The National Technical Information Service serves the American public as a central resource for unlimited, unclassified U.S. Government scientific, technical, engineering, and business related information. For more than 50 years NTIS has provided businesses, universities, and the public timely access to well over 2 million publications covering over 350 subject areas. Visit NTIS at http://www.ntis.gov.

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The U.S. Patent and Trademark Office (USPTO)

The U.S. Patent and Trademark Office provides online access to full text patents and patent applications. The database includes patents back to 1976 plus some pre-1975 patents. Visit the USPTO at http://www.uspto.gov/patft/.

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Subject Term Index

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SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

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01
AERONAUTICS (GENERAL)

Includes general research topics related to manned and unmanned aircraft and the problems of flight within the Earth's atmosphere. Also includes manufacturing, maintenance, and repair of aircraft. For specific topics in aeronautics, see *categories 02 through 09*. For information related to space vehicles *see 12 Astronautics*.

20040066090 NASA Wallops Flight Center, Wallops Island, VA, USA
Optical Strain Measurement of an Inflated Cylinder using Photogrammetry with Application to Scientific Balloons
Blandino, Joseph R.; Sterling, Jerry; Baginski, Frank; Steadman, Eric; Black, Jonathan T.; Pappa, Richard S.; April 2004; 13 pp.; In English; 45th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, 19-22 Apr. 2004, Palm Springs, CA, USA
Contract(s)/Grant(s): 23-319-03-01
Report No.(s): AIAA Paper 2004-1500; Copyright; Avail: CASI; A03, Hardcopy

A study is presented using photogrammetry to measure the biaxial strain in an inflated cylinder. Two cylinders constructed from polyethylene and each approximately 222 mm in diameter and 930 mm in length were studied. The first had a 0.038 mm wall thickness while the second had a 0.02 mm wall thickness. The cylinders were inflated to a maximum pressure of 1379 Pa. The strain was determined from data collected from 60 retro-reflective targets arranged in a 12 x 5 grid. The uncertainty of the measurement system was determined to be 0.08, 0.04 and 0.06 mm in the x, y, and z directions respectively. The hoop and meridional strains determined from displacement data were compared to values obtained from a finite element analysis of a related proxy problem. The predicted hoop strains showed good agreement over the entire range of pressures while the meridional strains showed good agreement at the lower pressures.
Author
Balloons; Optical Measurement; Photogrammetry; Strain Measurement; Cylinders; Mathematical Models

02
AERODYNAMICS

Includes aerodynamics of flight vehicles, test bodies, airframe components and combinations, wings, and control surfaces. Also includes aerodynamics of rotors, stators, fans, and other elements of turbomachinery. For related information see also *34 Fluid Mechanics and Thermodynamics*.

20040066081 NASA Ames Research Center, Moffett Field, CA, USA
On Improving Efficiency of Differential Evolution for Aerodynamic Shape Optimization Applications
Madavan, Nateri K.; January 2004; 9 pp.; In English; 10th AIAA/ISSMO Multidisciplinary Analysis & Optimization Conference, 30 Aug. - 1 Sep. 2004, Albany, NY, USA; No Copyright; Avail: CASI; A02, Hardcopy

Differential Evolution (DE) is a simple and robust evolutionary strategy that has been provEn effective in determining the global optimum for several difficult optimization problems. Although DE offers several advantages over traditional optimization approaches, its use in applications such as aerodynamic shape optimization where the objective function evaluations are computationally expensive is limited by the large number of function evaluations often required. In this paper various approaches for improving the efficiency of DE are reviewed and discussed. Several approaches that have proven effective for other evolutionary algorithms are modified and implemented in a DE-based aerodynamic shape optimization method that uses a Navier-Stokes solver for the objective function evaluations. Parallelization techniques on distributed computers are used to reduce turnaround times. Results are presented for standard test optimization problems and for the

inverse design of a turbine airfoil. The efficiency improvements achieved by the different approaches are evaluated and compared.
Author
Shape Optimization; Algorithms; Mathematical Models; Aerodynamic Configurations

20040067895 National Transportation Safety Board, Washington, DC
National Transportation Safety Board Aircraft Accident Report: Loss of Pitch Control During Takeoff, Air Midwest Flight 5481, Raytheon (Beechcraft) 1900D, N233YV, Charlotte, North Carolina, on January 8, 2003
Feb. 26, 2004; 216 pp.; In English
Report No.(s): PB2004-910401; NTSB/AAR-04/01; NOTATION-7545B; No Copyright; Avail: CASI; A10, Hardcopy
This report explains the accident involving Air Midwest (doing business as US Airways Express) flight 5481, a Raytheon (Beechcraft) 1900D, N233YV, which crashed shortly after takeoff from Charlotte-Douglas International Airport, Charlotte, North Carolina. The safety issues discussed this report include maintenance work practices, oversight, and quality assurance; maintenance training; aircraft weight and balance programs; Federal Aviation Administration oversight; and cockpit voice recorders on Beech 1900D airplanes.
NTIS
Aerodynamic Balance; Aircraft Accidents; Maintenance Training; Quality Control; Safety Management

03
AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; airport ground operations; flight safety and hazards; and aircraft accidents. Systems and hardware specific to ground operations of aircraft and to airport construction are covered in *09 Research and Support Facilities (Air)*. Air traffic control is covered in *04 Aircraft Communications and Navigation*. For related information see also *16 Space Transportation and Safety* and *85 Technology Utilization and Surface Transportation*.

20040062462 National Inst. for Occupational Safety and Health, Cincinnati, OH, USA
NIOSH Health Hazard Evaluation Report: HETA No. 2002-0354-2931, Horizon Air, Seattle, Washington
Tubbs, R. L.; Feb. 2004; 24 pp.; In English
Report No.(s): PB2004-104739; HETA-2002-0354-2931; No Copyright; Avail: CASI; A03, Hardcopy
A request for a health hazard evaluation (HHE) from flight attendants at Horizon Air in Seattle, Washington, was received by the National Institute for Occupational Safety and Health (NIOSH) on September 23, 2002. The flight attendants were concerned that their long work shifts may result in overexposure to noise from the airplanes to which they were assigned. Particular concern was noted about Horizon Air's fleet of turboprop aircraft when the noise and vibration suppression (NVS) system was inoperable. An initial site visit was made to Horizon Air in Portland, Oregon on November 12, 2002, to meet with a management official and the local flight attendant's union president to describe the survey. Once approval to operate noise measuring equipment aboard aircraft was obtained, a survey of the three types of aircraft used by Horizon Air, the Bombardier Q200 and Q400 turboprop and CRJ regional jet, was conducted from May 19-22, 2003. Two examples of each aircraft type were chosen by the company, and the NIOSH investigator traveled on several scheduled flights to capture noise levels in the front, middle, and rear of the passenger cabin. One-third octave band spectra were integrated for 15-second periods and stored in the noise analyzer for later analysis. Five minutes of the noise exposures encountered during take-off, landing, and at cruising altitude were stored for each aircraft. This measurement protocol allowed for the reporting of one-third octave band noise spectra for the various riding locations along with overall A-weighted and unweighted noise levels. An estimate of the flight attendants' noise dose was calculated from the spectral measurements collected on each flight.
NTIS
Air Transportation; Noise; Flight Crews

20040067954 Commerce Dept., Washington, DC, USA
National Aviation Weather Program. Mid-Course Assessment. Accident Reduction Trends Confirm Value of Coordinated R&D Programs
Aug. 2003; In English
Report No.(s): PB2004-104237; FCM-R20-2003; No Copyright; Avail: National Technical Information Service (NTIS)
This report presents a mid-course assessment of progress toward the goal of reducing weather-related fatal accidents by 80 percent over ten years. In February 1997, the White House Commission on Aviation Safety and Security recommended an

80 percent reduction in fatal aviation accidents from all causes as a ten-year national goal. In its 1999 report on National Aviation Weather Initiatives, the National Aviation Weather Program Council identified initiatives being pursued by federal agencies in collaboration with their industry and university partners. The Initiatives report also discussed an 80 percent reduction in weather-related accidents as an overall measure of success. To assess progress toward this goal, this report examines trends in weather-related accidents for clearly defined categories of aircraft and weather hazards. In each category, an 80 percent reduction from the average accident rate just before and during 1997 is used as a benchmark for assessing success in reducing accident risk.
NTIS
Aircraft Safety; Flight Conditions; Flight Hazards; Weather; Aircraft Accidents

20040068095 Georgia Inst. of Tech., Atlanta, GA, USA
Human Factors Considerations for Safe Recovery from Faults In Flight Control Systems
Pritchett, Amy; Belcastro, C. M., Technical Monitor; [2003]; 5 pp.; In English
Contract(s)/Grant(s): NCC1-401; No Copyright; Avail: CASI; A01, Hardcopy

It is now possible - and important - to develop systems to help resolve Flight Control System (FCS) faults. From a human factors viewpoint, it is imperative that these systems take on roles, and provide functions, that are the most supportive to the pilot, given the stress, time pressure and workload they may experience following a FCS fault. FCS fault recovery systems may provide several different functions, including alerting, control assistance, and decision aiding. The biggest human factors questions are in the role suitable for the technology, and its specific functioning to achieve that role. Specifically, for these systems to be effective, they must meet the fundamental requirements that (1) they alert pilots to problems early enough that the pilot can reasonably resolve the fault and regain control of the aircraft and that (2) if the aircraft s handling qualities are severely degraded the HMS provide the appropriate stability augmentation to help the pilot stabilize and control the aircraft. This project undertook several research steps to develop such systems, focusing on the capabilities of pilots and on realistically attainable technologies. The ability to estimate which functions are the most valuable will help steer system development in the directions that can establish the highest safety levels.
Derived from text
Flight Control; Human Factors Engineering; Flight Safety

20040068116 NASA Langley Research Center, Hampton, VA, USA
Transportation Network Topologies
Holmes, Bruce J.; Scott, John M.; [2004]; 12 pp.; In English; 4th Integrated Communications, Navigation and Surveillance Conference, 26-30 Apr. 2004, Fairfax, VA, USA; Original contains color illustrations
Contract(s)/Grant(s): 23-137-10-99; No Copyright; Avail: CASI; A03, Hardcopy

A discomforting reality has materialized on the transportation scene: our existing air and ground infrastructures will not scale to meet our nation's 21st century demands and expectations for mobility, commerce, safety, and security. The consequence of inaction is diminished quality of life and economic opportunity in the 21st century. Clearly, new thinking is required for transportation that can scale to meet to the realities of a networked, knowledge-based economy in which the value of time is a new coin of the realm. This paper proposes a framework, or topology, for thinking about the problem of scalability of the system of networks that comprise the aviation system. This framework highlights the role of integrated communication-navigation-surveillance systems in enabling scalability of future air transportation networks. Scalability, in this vein, is a goal of the recently formed Joint Planning and Development Office for the Next Generation Air Transportation System. New foundations for 21PstP thinking about air transportation are underpinned by several technological developments in the traditional aircraft disciplines as well as in communication, navigation, surveillance and information systems. Complexity science and modern network theory give rise to one of the technological developments of importance. Scale-free (i.e., scalable) networks represent a promising concept space for modeling airspace system architectures, and for assessing network performance in terms of scalability, efficiency, robustness, resilience, and other metrics. The paper offers an air transportation system topology as framework for transportation system innovation. Successful outcomes of innovation in air transportation could lay the foundations for new paradigms for aircraft and their operating capabilities, air transportation system architectures, and airspace architectures and procedural concepts. The topology proposed considers air transportation as a system of networks, within which strategies for scalability of the topology may be enabled by technologies and policies. In particular, the effects of scalable ICNS concepts are evaluated within this proposed topology. Alternative business models are appearing on the scene as the old centralized hub-and-spoke model reaches the limits of its scalability. These models include growth of point-to-point scheduled air transportation service (e.g., the RJ phenomenon and the 'Southwest Effect'). Another is a new business model for on-demand, widely distributed, air mobility in jet taxi services. The new businesses forming

around this vision are targeting personal air mobility to virtually any of the thousands of origins and destinations throughout suburban, rural, and remote communities and regions. Such advancement in air mobility has many implications for requirements for airports, airspace, and consumers. These new paradigms could support scalable alternatives for the expansion of future air mobility to more consumers in more places.
Author
Transportation Networks; Air Transportation; Management Methods; Topology

05
AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes all stages of design of aircraft and aircraft structures and systems. Also includes aircraft testing, performance, and evaluation, and aircraft and flight simulation technology. For related information see also *18 Spacecraft Design, Testing and Performance*; and *39 Structural Mechanics*. For land transportation vehicles see *85 Technology Utilization and Surface Transportation*.

20040066087 NASA Dryden Flight Research Center, Edwards, CA, USA
Development and Testing of a Drogue Parachute System for X-37 ALTV/B-52H Separation
Whitmore, Stephen A.; Cobleigh, Brent R.; Jacobson, Steven R.; Jensen, Steven C.; Hennings, Elsa J.; May 2004; 43 pp.; In English; 42nd AIAA Aerospace Sciences Meeting and Exhibit, 5-8 Jan. 2004, Reno, NV, USA
Contract(s)/Grant(s): WU 760-90-00-SE-53-00-37A
Report No.(s): NASA/TM-2004-212044; H-2552; No Copyright; Avail: CASI; A03, Hardcopy

Multiple scenarios were identified in which the X-37 approach and landing test vehicle (ALTV) catastrophically recontacts the B-52H carrier aircraft after separation. The most cost-effective recontact risk mitigation is the prelaunch deployment of a drogue parachute that is released after the X-37 ALTV has safely cleared the B-52H. After release, a fully-inflated drogue parachute takes 30 min to reach ground and results in a large footprint that excessively restricts the days available for flight. To reduce the footprint, a passive collapse mechanism consisting of an elastic reefing line attached to the parachute skirt was developed. At flight loads the elastic is stretched, allowing full parachute inflation. After release, drag loads drop dramatically and the elastic line contracts, reducing the frontal drag area. A 50-percent drag reduction results in an approximately 75-percent ground footprint reduction. Eleven individual parachute designs were evaluated at flight load dynamic pressures in the High Velocity Airflow System (HIVAS) at the Naval Air Warfare Center (NAWC), China Lake, California. Various options for the elastic reefing system were also evaluated at HIVAS. Two best parachute designs were selected from HIVAS to be carried forward to flight test. Detailed HIVAS test results are presented in this report.
Author
X-37 Vehicle; Test Vehicles; Approach and Landing Tests (Sts); B-52 Aircraft; Flight Tests; Stage Separation; Drag Chutes

20040066091 NASA Ames Research Center, Moffett Field, CA, USA
On the Use of CAD and Cartesian Methods for Aerodynamic Optimization
Nemec, M.; Aftosmis, M. J.; Pulliam, T. H.; July 2004; 17 pp.; In English; International Conference in Computational Fluid Dynamics 3, ICCFD3, 12-16 Jul. 2004, Toronto, Ontario, Canada; No Copyright; Avail: CASI; A03, Hardcopy

The objective for this paper is to present the development of an optimization capability for Curt3D, a Cartesian inviscid-flow analysis package. We present the construction of a new optimization framework and we focus on the following issues: 1) Component-based geometry parameterization approach using parametric-CAD models and CAPRI. A novel geometry server is introduced that addresses the issue of parallel efficiency while only sparingly consuming CAD resources; 2) The use of genetic and gradient-based algorithms for three-dimensional aerodynamic design problems. The influence of noise on the optimization methods is studied. Our goal is to create a responsive and automated framework that efficiently identifies design modifications that result in substantial performance improvements. In addition, we examine the architectural issues associated with the deployment of a CAD-based approach in a heterogeneous parallel computing environment that contains both CAD workstations and dedicated compute engines. We demonstrate the effectiveness of the framework for a design problem that features topology changes and complex geometry.
Derived from text
Aerodynamic Configurations; Cartesian Coordinates; Computer Aided Design; Optimization; Topology

20040066092 NASA Langley Research Center, Hampton, VA, USA
Variable Stiffness Spar Wind-Tunnel Model Development and Testing
Florance, James R.; Heeg, Jennifer; Spain, Charles V.; Ivanco, Thomas G.; Wieseman, Carol D.; Lively, Peter S.; [2004]; 11 pp.; In English; 45th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dyamics and Materials Conference, 19-22 Apr. 2004, Palm Springs, CA, USA
Contract(s)/Grant(s): 23-762-20-31
Report No.(s): AIAA Paper 2004-1588; No Copyright; Avail: CASI; A03, Hardcopy

The concept of exploiting wing flexibility to improve aerodynamic performance was investigated in the wind tunnel by employing multiple control surfaces and by varying wing structural stiffness via a Variable Stiffness Spar (VSS) mechanism. High design loads compromised the VSS effectiveness because the aerodynamic wind-tunnel model was much stiffer than desired in order to meet the strength requirements. Results from tests of the model include stiffness and modal data, model deformation data, aerodynamic loads, static control surface derivatives, and fuselage standoff pressure data. Effects of the VSS on the stiffness and modal characteristics, lift curve slope, and control surface effectiveness are discussed. The VSS had the most effect on the rolling moment generated by the leading-edge outboard flap at subsonic speeds. The effects of the VSS for the other control surfaces and speed regimes were less. The difficulties encountered and the ability of the VSS to alter the aeroelastic characteristics of the wing emphasize the need for the development of improved design and construction methods for static aeroelastic models. The data collected and presented is valuable in terms of understanding static aeroelastic wind-tunnel model development.
Author
Aeroelasticity; Wind Tunnel Models; Wings; Aerodynamic Characteristics; Wind Tunnel Tests

20040067894 Naval Air Systems Command, Patuxent River, MD, USA
Assessment of Helicopter Structural Usage Monitoring System Requirements
McCool, K.; Barndt, G.; Apr. 2004; 34 pp.; In English
Report No.(s): PB2004-105466; No Copyright; Avail: CASI; A03, Hardcopy

The objective of this study was to perform a data-driven assessment of various aspects of the helicopter structural usage monitoring process and to identify key issues and requirements that must be addressed prior to using the monitoring information for part life extensions or maintenance credits. Structural usage monitoring is defined in this report to be the identification of the aircraft usage spectrum flight regimes for any given instant in the aircraft or component life. With this aircraft maneuver, or regime information, the fatigue damage accumulation on helicopter components can be tracked. The ultimate goal of a structural monitoring system is to produce more insight into exactly how an aircraft is being used once it is fielded. This information can be compared to design assumptions and then part life extensions (or reductions) can potentially be granted. During this study, several structural monitoring system design issues are addressed, including the types of aircraft parameters to be monitored, the data rates at which those parameters should be monitored, as well as a recommended algorithm development and validation approach. The results of this report set the recommended basic design criteria for developing a reliable regime recognition software module for commercial as well as military rotorcraft.
NTIS
Algorithms; Design Analysis; Structural Design

20040067897 United Technologies Research Center, East Hartford, CT, USA
Commercial Off-the-Shelf Real-Time Operating System and Architectural Considerations
Krodel, J.; Feb. 2004; 62 pp.; In English
Report No.(s): PB2004-105462; DOT/FAA/AR-03/77; No Copyright; Avail: CASI; A04, Hardcopy

This report investigates the safety aspects of using commercial-off-the-shelf (COTS) real-time operating system (RTOS) software in aviation systems. Because of the complexity and unknown integrity of many COTS RTOSs, there are a number of concerns regarding their use in aircraft systems, as they may potentially affect aircraft safety. Previous Federal Aviation Administration-sponsored research in this area identified COTS RTOS as a potential focus area for COTS in aviation software applications. This follow-on work considers the use of partition-supporting COTS RTOS in aviation systems. This report specifically studies the hardware and software architectural issues of embedded aviation software systems, with a particular focus on systems with the multilevel criticality partitioning provided by COTS RTOS. As a representative example, this report also discusses the PowerPC microprocessor architecture and how its architecture relates to the safety aspects of COTS RTOS running on this processor.
NTIS
Aircraft Safety; Commercial Off-the-Shelf Products; Real Time Operation

07
AIRCRAFT PROPULSION AND POWER

Includes primary propulsion systems and related systems and components, e.g., gas turbine engines, compressors, and fuel systems; and onboard auxiliary power plants for aircraft. For related information see also *20 Spacecraft Propulsion and Power; 28 Propellants and Fuels*; and *44 Energy Production and Conversion*.

20040065831 Defence Science and Technology Organisation, Fishermans Bend, Australia
Validation of an Upgraded Vibration Measurement System for RAAF F404 Engine Test Cells
Marsden, P. R.; December 2003; 51 pp.; In English
Report No.(s): DSTO-TN-0530; DODA-AR-012-991; Copyright; Avail: Other Sources

Ground testing of the F404 engines of the F/A-18 Hornet at RAAF Williamtown and Tindal, essential to the continued safe operation of the aircraft, has been limited in its effectiveness by outdated test equipment. An upgraded vibration measurement system purchased by TFSPO will enable both test stands to to reliably and effectively implement the engine work package procedures, and identify faults. This report details the integration of the hardware components, and the testing and calibration of the system pre and post installation. Laboratory tests and installed comparisons with the existing system indicate that the new equipment is functioning correctly.
Author
Engine Tests; Calibrating; Fault Detection

09
RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, runways, hangars, and aircraft repair and overhaul facilities; wind tunnels, water tunnels, and shock tubes; flight simulators; and aircraft engine test stands. Also includes airport ground equipment and systems. For airport ground operations see *03 Air Transportation and Safety*. For astronautical facilities see *14 Ground Support Systems and Facilities (Space)*.

20040065892 Centre National de la Recherche Scientifique, Villeurbanne, France
What Can We Learn from the Ages of Valles Marineris Landslides on Martian Impact History?
Quantin, C.; Mangold, N.; Allemade, P.; Delacourt, C.; Lunar and Planetary Science XXXV: Martian Aeolian and Mass Wasting Processes: BLowing and Flowing; 2004; 2 pp.; In English; See also 20040065882; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Crater population studies allow to determine the relative ages of the main geological units of the surface of Mars [1,2,3]. The absolute chronology deduced from these crater counts depends on the impact sources flux to the terrestrial planets through time. Studies on the Earth and on the Moon suggest that the crater production rate has been constant to within a factor of 2 to 4 over the last 3 Gy. The surface of the Moon has well recorded the earlier bombardment. The impact flux during the last 3 Gy has saturated the surface. In parallel, the impact history is poorly constrained on Earth because the surface has been modified through time by many active processes (erosion, tectonic, sedimentation...). The surface of Mars has not known very active processes like on the Earth during the last 3 Gy and so offers a remarkable surface to study the impact flux during this period. The ideal Martian geological process to study the impact flux would produce surfaces of different ages with a known occurrence during the last 3 Gy. The ages of the landslides of Valles Marineris canyons, the equatorial through system of Mars, range from 3 Gy up to the last 100 My. We then propose to study the crater population of the Valles Marineris landslides. First, the method of determination of the absolute ages of these landslides will be presented. Then, the temporal distribution of Martian landslides and the implications on impact rate of the last 3 Gy will be exposed.
Author
Tectonics; Sediments; Planetary Geology; Mars Surface; Landslides; Geology; Erosion; Craters

14
GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and test chambers and simulators. Also includes extraterrestrial bases and supporting equipment. For related information see also *09 Research and Support Facilities (Air)*.

20040068085 NASA Stennis Space Center, Bay Saint Louis, MS, USA
A Future Vision of a Data Acquisition: Distributed Sensing, Processing, and Health Monitoring
Figueroa, Fernando; Solano, Wanda; Thurman, Charles; Schmalzel, John; October 02, 2000; 7 pp.; In English; IEEE Instrument and Measurement Technology Conference, 21-23 May 2001, Budapest, Hungary
Report No.(s): SE-2000-10-00011-SSC; Copyright; Avail: CASI; A02, Hardcopy

This paper presents a vision fo a highly enhanced data acquisition and health monitoring system at NASA Stennis Space Center (SSC) rocket engine test facility. This vision includes the use of advanced processing capabilities in conjunction with highly autonomous distributed sensing and intelligence, to monitor and evaluate the health of data in the context of it's associated process. This method is expected to significantly reduce data acquisitions costs and improve system reliability. A Universal Signal Conditioning Amplifier (USCA) based system, under development at Kennedy Space Center, is being evaluated for adaptation to the SSC testing infrastructure. Kennedy's USCA architecture offers many advantages including flexible and auto-configuring data acquisition with improved calibration and verifiability. Possible enhancements at SSC may include multiplexing the distributed USCAs to reduce per channel cost, and the use of IEEE-485 to Allen-Bradley Control Net Gateways for interfacing with the resident control systems.
Author
Data Acquisition; Data Processing; Systems Engineering

20040068117 NASA Stennis Space Center, Bay Saint Louis, MS, USA
NASA Stennis Space Center Test Technology Branch Activities
Solano, Wanda M.; November 07, 2000; 15 pp.; In English; 3rd International Hydrogen Peroxide Propulsion Conference, 13-15 Nov. 2000
Report No.(s): SE-2000-11-00021-SSC; No Copyright; Avail: CASI; A03, Hardcopy

This paper provides a short history of NASA Stennis Space Center's Test Technology Laboratory and briefly describes the variety of engine test technology activities and developmental project initiatives. Theoretical rocket exhaust plume modeling, acoustic monitoring and analysis, hand held fire imaging, heat flux radiometry, thermal imaging and exhaust plume spectroscopy are all examples of current and past test activities that are briefly described. In addition, recent efforts and visions focused on accomodating second, third, and fourth generation flight vehicle engine test requirements are discussed.
Author
Test Facilities; Engine Tests; Rocket Engines

16
SPACE TRANSPORTATION AND SAFETY

Includes passenger and cargo space transportation, e.g., shuttle operations; and space rescue techniques. For related information see also *03 Air Transportation and Safety; 15 Launch Vehicles and Launch Operations*; and *18 Spacecraft Design, Testing and Performance*. For space suits see *54 Man/System Technology and Life Support*.

20040065981 NASA Marshall Space Flight Center, Huntsville, AL, USA
Automated Rendezvous and Capture System Development and Simulation for NASA
Roe, Fred D.; Howard, Richard T.; Murphy, Leslie; 2004; 1 pp.; In English; SPIE Defense and Security Symposium, 12-16 Apr. 2004, Orlando, FL, USA; No Copyright; Avail: Other Sources; Abstract Only

The USA does not have an Automated Rendezvous and Capture/Docking (AR and C) capability and is reliant on manned control for rendezvous and docking of orbiting spacecraft. This reliance on the labor intensive manned interface for control of rendezvous and docking vehicles has a significant impact on the cost of the operation of the International Space Station (ISS) and precludes the use of any U.S. expendable launch capabilities for Space Station resupply. The Soviets have the capability to autonomously dock in space, but their system produces a hard docking with excessive force and contact velocity. Automated Rendezvous and Capture/Docking has been identified as a key enabling technology for the Space Launch Initiative (SLI) Program, DARPA Orbital Express and other DOD Programs. The development and implementation of an AR&C

capability can significantly enhance system flexibility, improve safety, and lower the cost of maintaining, supplying, and operating the International Space Station. The Marshall Space Flight Center (MSFC) has conducted pioneering research in the development of an automated rendezvous and capture (or docking) (AR and C) system for U.S. space vehicles. This AR&C system was tested extensively using hardware-in-the-loop simulations in the Flight Robotics Laboratory, and a rendezvous sensor, the Video Guidance Sensor was developed and successfully flown on the Space Shuttle on flights STS-87 and STS-95, proving the concept of a video- based sensor. Further developments in sensor technology and vehicle and target configuration have lead to continued improvements and changes in AR&C system development and simulation. A new Advanced Video Guidance Sensor (AVGS) with target will be utilized on the Demonstration of Autonomous Rendezvous Technologies (DART) flight experiment in 2004.
Author
Simulation; Systems Engineering; Autonomy; International Space Station; Space Transportation System Flights; Spacecraft Docking

17
SPACE COMMUNICATIONS, SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes space systems telemetry; space communications networks; astronavigation and guidance; and spacecraft radio blackout. For related information see also *04 Aircraft Communications and Navigation*; and *32 Communications and Radar*.

20040066071 University of South Florida, Tampa, FL, USA
The Case for Deep Space Telecommunications Relay Stations
Chandler, Charles W.; Miranda, Felix A., Technical Monitor; April 2004; 22 pp.; In English
Contract(s)/Grant(s): NGT3-52395; WBS-22-322-20-06
Report No.(s): NASA/CR-2004-213053; E-14489; No Copyright; Avail: CASI; A03, Hardcopy

Each future mission to Jupiter and beyond must carry the traditional suite of telecommunications systems for command and control and for mission data transmission to earth. The telecommunications hardware includes the large antenna and the high-power transmitters that enable the communications link. Yet future spacecraft will be scaled down from the hallmark missions of Galileo and Cassini to Jupiter and Saturn, respectively. This implies that a higher percentage of the spacecraft weight and power must be dedicated to telecommunications system. The following analysis quantifies this impact to future missions and then explores the merits of an alternative approach using deep space relay stations for the link back to earth. It will be demonstrated that a telecommunications relay satellite would reduce S/C telecommunications weight and power sufficiently to add one to two more instruments.
Author
Deep Space; Large Space Structures; Relay Satellites; Telecommunication; Space Missions

18
SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes satellites; space platforms; space stations; spacecraft systems and components such as thermal and environmental controls; and spacecraft control and stability characteristics. For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance; 39 Structural Mechanics*; and *16 Space Transportation and Safety*.

20040068076 Orbital Sciences Corp., Dulles, VA, USA
Video-Guidance Design for the DART Rendezvous Mission
Ruth, Michael; Tracy, Chisholm; [2004]; 15 pp.; In English; SPIE Defense/Security Symposium, 12-16 Apr. 2004, Orlando, FL, USA
Contract(s)/Grant(s): NAS8-01102; No Copyright; Avail: CASI; A03, Hardcopy

NASA's Demonstration of Autonomous Rendezvous Technology (DART) mission will validate a number of different guidance technologies, including state-differenced GPS transfers and close-approach video guidance. The video guidance for DART will employ NASA/Marshall s Advanced Video Guidance Sensor (AVGS). This paper focuses on the terminal phase of the DART mission that includes close-approach maneuvers under AVGS guidance. The closed-loop video guidance design for DART is driven by a number of competing requirements, including a need for maximizing tracking bandwidths while coping with measurement noise and the need to minimize RCS firings. A range of different strategies for attitude control and docking guidance have been considered for the DART mission, and design decisions are driven by a goal of minimizing both

the design complexity and the effects of video guidance lags. The DART design employs an indirect docking approach, in which the guidance position targets are defined using relative attitude information. Flight simulation results have proven the effectiveness of the video guidance design.
Author
Guidance Sensors; Global Positioning System; Flight Simulation; Feedback Control; Attitude Control; Bandwidth

20040068078 NASA Marshall Space Flight Center, Huntsville, AL, USA
Tethers as Debris: Simulating Impacts of Tether Fragments on Shuttle Tiles
Evans, Steven W.; 2004; 11 pp.; In English; 45th AIAA/ASME/ASCE/AHS Structures, Structural Dynamics, and Materials Conference, 19-24 Apr. 2004, Palm Springs, CA, USA; No Copyright; Avail: CASI; A03, Hardcopy

The SPHC hydrodynamic code was used to simulate impacts of Kevlar and aluminum projectiles on a model of the LI-900 type insulating tiles used on Space Shuffle Orbiters The intent was to examine likely damage that such tiles might experience if impacted by orbital debris consisting of tether fragments. Projectile speeds ranged from 300 meters per second to 10 kilometers per second. Damage is characterized by penetration depth, tile surface-hole diameter, tile body-cavity diameter, coating fracture diameter, tether and cavity wall material phases, and deformation of the aluminum backwall.
Author
Fragments; Tethering; Tiles; Space Shuttle Orbiters; Hydrodynamics; Computerized Simulation; Space Debris

20040068088 American Inst. of Aeronautics and Astronautics, Reston, VA, USA
Will the ATV Deliver?
Iannotta, Ben; Aerospace America; July 2003; ISSN 0740-722X; 4 pp.; In English; Copyright; Avail: Other Sources

he European Space Agency's work on a fleet of expendable cargo spacecraft for the International Space Station (ISS) has long been viewed as a form of payment-in-kind by European space leaders for the right to attach their Columbus laboratory to the station starting in October 2004. With the grounding of the U S space shuttle fleet, timely development of the Automated Transfer Vehicle (ATV) has acquired new importance for the partners of the ISS.The ATV is the most technically challenging spacecraft Europe has ever designed, because of its automated navigation capabilities and multiple duties. Each ATV will dock automatically at the station s Russian-built Zvezda service module and will remain there for up to six months.
Derived from text
Automated Transfer Vehicle; Planning

20040068123 NASA Langley Research Center, Hampton, VA, USA
Photogrammetry and Videogrammetry Methods for Solar Sails and Other Gossamer Structures
Black, Jonathan T.; Pappa, Richard S.; [2004]; 11 pp.; In English; 45th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference, 19-22 Apr. 2004, Palm Springs, CA, USA
Contract(s)/Grant(s): 23-755-06-00
Report No.(s): AIAA Paper 2004-1662; No Copyright; Avail: CASI; A03, Hardcopy

Ultra-lightweight and inflatable gossamer space structures are designed to be tightly packaged for launch, then deploy or inflate once in space. These properties will allow for in-space construction of very large structures 10 to 1000 meters in size such as solar sails, inflatable antennae, and space solar power stations using a single launch. Solar sails are of particular interest because of their potential for propellantless propulsion. Gossamer structures do, however, have significant complications. Their low mass and high flexibility make them very difficult to test on the ground. The added mass and stiffness of attached measurement devices can significantly alter the static and dynamic properties of the structure. This complication necessitates an alternative approach for characterization. This paper discusses the development and application of photogrammetry and videogrammetry methods for the static and dynamic characterization of gossamer structures, as four specific solar sail applications demonstrate. The applications prove that high-resolution, full-field, non-contact static measurements of solar sails using dot projection photogrammetry are possible as well as full-field, noncontact, dynamic characterization using dot projection videogrammetry.
Author
Photogrammetry; Solar Sails; Inflatable Space Structures

19
SPACECRAFT INSTRUMENTATION AND ASTRIONICS

Includes the design, manufacture, or use of devices for the purpose of measuring, detecting, controlling, computing, recording, or processing data related to the operation of space vehicles or platforms. For related information see also *06 Avionics and Aircraft Instrumentation*; for spaceborne instruments not integral to the vehicle itself see *35 Instrumentation and Photography*; for spaceborne telescopes and other astronomical instruments see *89 Astronomy*.

20040062505 European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands
A New Celestial Navigation Method for Mars Landers
Trautner, R.; BelloMora, M.; Hechler, M.; Koschny, D.; Lunar and Planetary Science XXXV: Missions and Instruments: Hopes and Hope Fulfilled; 2004; 2 pp.; In English; See also 20040062499; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The accurate determination of the position of a scientific planetary lander after its touch-down is an important issue for a number of scientific and technical reasons. Previous Mars missions have relied predominantly on position determination via a direct lander-earth radio link in combination with the correlation of topographic features on lander panorama images. For the Viking 2 lander, the position was not undisputedly established due to the lack of horizon features. Planetary landers without direct earth radio links such as the European Beagle 2 lander need to apply different navigation methods for the restriction of the search area within the entry, descent and landing error ellipses. In the following sections, the celestial navigation method developed and implemented for Beagle 2 will be described. The achievable accuracy is presented, and a software implementation of the method is introduced.
Author
Celestial Navigation; Mars Missions; Mars Landing; Spacecraft Position Indicators

20040062533 NASA Kennedy Space Center, Cocoa Beach, FL, USA
Electrodynamic Dust Shield for Solar Panels on Mars
Calle, C. I.; Buhler, C. R.; Mantovani, J. G.; Clements, S.; Chen, A.; Mazumder, M. K.; Biris, A. S.; Nowicki, A. W.; Lunar and Planetary Science XXXV: Missions and Instruments: Hopes and Hope Fulfilled; 2004; 2 pp.; In English; See also 20040062499; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Materials Adherence Experiment on the Mars Pathfinder mission measured an obscuration of the solar arrays due to dust deposition at a rate of about 0.28% per day. It was estimated that settling dust may cause degradation in performance of a solar panel of between 22% and 89% over the course of two years. These results were obtained without the presence of a global dust storm. Several types of adherence forces keep dust particles attached to surfaces. The most widely discussed adherence force is the electrostatic force. Laboratory experiments as well as indirect evidence from the Wheel Abrasion Experiment on Pathfinder indicate that it is very likely that the particles suspended in the Martian atmosphere are electrostatically charged.
Author
Electrodynamics; Dust; Shielding; Solar Cells; Mars Surface; Electrostatic Charge; Deposition

20
SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources. For related information see also *07 Aircraft Propulsion and Power, 28 Propellants and Fuels, 15 Launch Vehicles and Launch Operations*, and *44 Energy Production and Conversion*.

20040062457 Swedish Defence Research Establishment, Tumba
Lifetime Expectancy Test of RB 77 Rocket Engine
Jun. 2003; In English
Report No.(s): PB2004-104144; FOI-R-0890-SE; No Copyright; Avail: National Technical Information Service (NTIS)

A lifetime expectancy test is reported for an engine belonging to RB77 HAWK that at the time of the test had reached an age of 24 years. The test included measurements of glass transition temperature, thermal stability, complex shear modulus and hardness. Furthermore, optical and radio graphical investigations have been performed to ensure the integrity of the engine that prior to its arrival at FOI had been dropped. Finally, the engine was test fired at a temperature of 15degC during which

the thrust and the specific impulse were measured. All test and measurement results can be considered within normal ranges with respect to the engine's age.
NTIS
Rocket Engines; Engine Tests; Life (Durability)

20040065827 Louisiana Tech Univ., Ruston, LA, USA
Particle Characterization in Rocket Exhaust Plumes
Callen, E. Eugene, Jr.; Fisher, J. Scott; July 1997; 150 pp.; In English
Contract(s)/Grant(s): NAS13-580
Report No.(s): SE-1998-01-00002-SSC; No Copyright; Avail: CASI; A07, Hardcopy

A method to characterize particles in rocket exhaust plumes is developed. The particle velocity, size, and material composition are determined from crater characteristics resulting from impacts into aluminum and copper targets passed through the plume. The targets are mounted on a steel arm approximately 21 inches (53 cm) long which is rotated through the plume at sufficient velocity to prevent material failure resulting from thermal effects. A Scanning Electron Microscope (SEM) with secondary x-ray detectors is used to determine the particle material, and a standard optical measurement microscope is used to determine the crater diameter and depth. The crater diameter and depth are used in turn, as inputs to a ballistics computer code to estimate the velocity and size of the particle. The target has a safe residence time in the plume of approximately 50 ms before reaching an unacceptably high temperature. The = must mach a velocity of 104 ft/s (32 m/s) before entering the plume to produce the design residence time of 20 ms. The arm is actuated by a torsion spring with a 5-inch (13 cm) outer diameter, 0.625-inch (16 mm wire diameter, and 11 coils. A prototype of the entire rocket exhaust particle impact characterization system (PICS) was constructed and statically tested.
Author
Exhaust Gases; Rocket Exhaust; Particle Size Distribution; Plumes

20040065849 Rice Univ., Houston, TX, USA
Summer Work Experience: Determining Methane Combustion Mechanisms and Sub-Scale Diffuser Properties for Space Transporation System Engine Testing
Williams, Powtawche N.; July 1998; 9 pp.; In English; 2nd Annual GEM Summer Institute, July 1998, Fort Lauderdale, FL, USA
Report No.(s): SE-1998-06-00006-SSC; No Copyright; Avail: CASI; A02, Hardcopy

To assess engine performance during the testing of Space Shuttle Main Engines (SSMEs), the design of an optimal altitude diffuser is studied for future Space Transportation Systems (STS). For other Space Transportation Systems, rocket propellant using kerosene is also studied. Methane and dodecane have similar reaction schemes as kerosene, and are used to simulate kerosene combustion processes at various temperatures. The equations for the methane combustion mechanism at high temperature are given, and engine combustion is simulated on the General Aerodynamic Simulation Program (GASP). The successful design of an altitude diffuser depends on the study of a sub-scaled diffuser model tested through two-dimensional (2-D) flow-techniques. Subroutines given calculate the static temperature and pressure at each Mach number within the diffuser flow. Implementing these subroutines into program code for the properties of 2-D compressible fluid flow determines all fluid characteristics, and will be used in the development of an optimal diffuser design.
Author
Space Shuttle Main Engine; Methane; Combustion Physics; Diffusers

20040066097 Virginia Univ., Charlottesville, VA, USA
Analysis of Factors Affecting the Performance of RLV Thrust Cell Liners
Arnold, Steven M., Technical Monitor; Butler, Daniel T., Jr.; Pinders, Marek-Jerzy; [2004]; 88 pp.; In English
Contract(s)/Grant(s): NAG3-2359; No Copyright; Avail: CASI; A05, Hardcopy

The reusable launch vehicle (RLV) thrust cell liner, or thrust chamber, is a critical component of the Space Shuttle Main Engine (SSME). It is designed to operate in some of the most severe conditions seen in engineering practice. This requirement, in conjunction with experimentally observed 'dog-house' failure modes characterized by bulging and thinning of the cooling channel wall, provides the motivation to study the factors that influence RLV thrust cell liner performance. Factors or parameters believed to be directly related to the observed characteristic deformation modes leading to failure under in-service loading conditions are identified, and subsequently investigated using the cylindrical version of the higher-order theory for functionally graded materials in conjunction with the Robinson's unified viscoplasticity theory and the power-law creep model

for modeling the response of the liner s constituents. Configurations are analyzed in which specific modifications in cooling channel wall thickness or constituent materials are made to determine the influence of these parameters on the deformations resulting in the observed failure modes in the outer walls of the cooling channel. The application of thermal barrier coatings and functional grading are also investigated within this context. Comparison of the higher-order theory results based on the Robinson and power-law creep model predictions has demonstrated that, using the available material parameters, the power-law creep model predicts more precisely the experimentally observed deformation leading to the 'dog-house' failure mode for multiple short cycles, while also providing much improved computational efficiency. However, for a single long cycle, both models predict virtually identical deformations. Increasing the power-law creep model coefficients produces appreciable deformations after just one long cycle that would normally be obtained after multiple cycles, thereby enhancing the efficiency of the analysis. This provides a basis for the development of an accelerated modeling procedure to further characterize dog-house deformation modes in RLV thrust cell liners. Additionally, the results presented herein have demonstrated that the mechanism responsible for deformation leading to 'dog-house' failure modes is driven by pressure, creep/relaxation and geometric effects.
Author (revised)
Reusable Launch Vehicles; Rocket Linings; Design Analysis; Thrust Chambers

20040067847 Southwest Research Inst., San Antonio, TX
Fuel and Fuel Additive Registration Testing of Ethanol-Diesel Blend for O2Diesel, Inc
Fanick, E. R.; Feb. 2004; 48 pp.; In English
Report No.(s): DE2004-15006750; No Copyright; Avail: Department of Energy Information Bridge

O2 Diesel Inc. (formerly AAE Technologies Inc.) tested a heavy duty engine with O2Diesel (diesel fuel with 7. 7% ethanol and additives) for regulated emissions and speciation of vapor-phase and semi-volatile hydrocarbon compounds. This testing was performed in support of EPA requirements for registering designated fuels and fuel additives as stipulated by sections 211(b) and 211(e) of the Clean Air Act.
NTIS
Vapor Phases; Ethyl Alcohol

20040068072 Purdue Univ., West Lafayette, IN, USA
Spray Characteristics of a Hybrid Twin-Fluid Pressure-Swirl Atomizer
Durham, M. J.; Sojka, P. E.; Ashmore, C. B.; [2004]; 7 pp.; In English; AIAA Regional Student Conference (Region III), 22-24 Apr. 2004, West Lafayette, IN, USA
Contract(s)/Grant(s): NAG8-1894; No Copyright; Avail: CASI; A02, Hardcopy

The spray performance of a fuel injection system applicable for use in main combustion chamber of an oxidizer-rich staged combustion (ORSC) cycles is presented. The experimental data reported here include mean drop size and drop size distribution, spray cone half-angle, and momentum rate (directly related to spray penetration). The maximum entropy formalism, MEF, method to predict drop size distribution is applied and compared to the experimental data. Geometric variables considered include the radius of the injector inlet orifice plate through which oxidizer flows (&) and the exposed length from the fuel inlet to the injector exit plane (L2). Operating conditions that were varied include the liquid mass flow rate and air mass flow rate. For orifices B and C there is a significant dependence of D3Z on both the air and liquid mass flow rates, as well as on L2. For the A orifice, the momentum rate of the air flow appears to exceed a threshold value above which a constant D32 is obtained. Using the MEF method, a semi-analytical process was developed to model the spray distribution using two input parameters (q = 0.4 and Dso). The momentum rate of the spray is directly related to the air and liquid mass flow rates. The cone half angle of the spray ranges from 25 to 17 degrees. The data resulting from this project will eventually be used to develop advanced rocket systems.
Author
Atomizers; Sprayers; Spray Characteristics; Fuel Injection; Combustion Chambers; Fluid Pressure; Mass Flow Rate; Air Flow

20040068079 Spectra Research Systems, Inc., Huntsville, AL, USA
Grid Sphere Electrodes used for Current Collection at the Positive Pole of Electrodynamic Tethers
Stone, N. H.; Moore, J. D.; April 2004; 7 pp.; In English; 5th AIAA Gossamer Spacecraft Forum, 19-22 Apr. 2004, Palm Springs, CA, USA
Contract(s)/Grant(s): NAS8-03014; NNM04AAS11C; No Copyright; Avail: CASI; A02, Hardcopy

The generation of either electrical power or propulsive thrust with an electrodynamic tether system necessarily depends on driving a return current through the system's ambient space plasma environment. An electrical connection is, therefore, required between the plasma and each end of the tether. The voltage required to drive current through the system is derived either from the orbital motion of the conducting tether through the magnetic field of the Earth, or from a high-voltage power supply that taps into an external energy source (e.g., the sun). In either case, one end of the tether will receive a positive bias. This positive bias, between the tether and the ambient plasma, allows electrons to be collected effectively with a simple, passive electrode. Passive electrode contactors offer several important advantages, including simplification of the upper end-body design and operations, minimization of system mass, and an increase of system reliability and robustness. A preliminary analysis of an inflatable Grid-Sphere end-body concept is presented that is interesting because of the potential for collecting arbitrarily large currents independent of tether length, while the device has the physical characteristics of a high area-to-mass ratio, a low drag coefficient, and simplicity. In particular, we will discuss the physics of current collection by a biased Grid-Sphere and the present state-of-the-art of materials, attainable area-to-mass ratios, and deployment techniques.
Author
Electrodes; Tetherlines; Spacecraft Propulsion; Inflatable Space Structures; Thin Films

20040068083 NASA Langley Research Center, Hampton, VA, USA
Demonstration of a 10-m Solar Sail System
Murphy, David M.; Macy, Brian D.; Gaspar, James L.; [2004]; 11 pp.; In English; 45th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dyamics and Materials Conference, 19-22 Apr. 2004, Palm Springs, CA, USA
Contract(s)/Grant(s): NAS8-03043; 23-755-06-00
Report No.(s): AIAA Paper 2004-1576; No Copyright; Avail: CASI; A03, Hardcopy

The NASA In-Space Propulsion (ISP) program has been sponsoring system design development and hardware demonstration activities of solar sail technology over the past 16 months. Efforts to validate by test a moderate-scale (10-m) 1/4 symmetry ground demonstration sail system are nearly complete. Results of testing and analytical model validation of component and assembly functional, strength, stiffness, shape, and dynamic behavior are discussed.
Author
Solar Sails; Design Analysis; Systems Engineering

23
CHEMISTRY AND MATERIALS (GENERAL)

Includes general research topics related to the composition, properties, structure, and use of chemical compounds and materials as they relate to aircraft, launch vehicles, and spacecraft. For specific topics in chemistry and materials see *categories 25 through 29*. For astrochemistry see category *90 Astrophysics*.

20040062447 Lawrence Livermore National Lab., Livermore, CA
Functionalized Silicon Membranes for Selective Bio-Organisms Capture
Letant, S. E.; Hart, B. R.; van Buuren, A. W.; Terminello, L. T.; Jan. 09, 2003; 20 pp.; In English
Report No.(s): DE2004-15006521; UCRL-JC-150806; No Copyright; Avail: Department of Energy Information Bridge

Membranes with various pore size, length, morphology and density have been synthesized out of diverse materials for size exclusion-based separation. An example of application is the sterilization of intravenous lines by exclusion of bacteria and viruses using Polyvinylidene Fluoride membranes with 0.1 pm diameter pores. The need for chemically specific filtration has recently been addressed, but for small molecules only. An important problem remaining to be solved is the selective capture of large bio-organisms for decontamination or analysis of air and liquids such as drinking water and body fluids. To achieve this goal, materials with controlled pore diameter, length and surface chemistry are required. In this letter, we present the first functionalized silicon membranes and demonstrate their ability to selectively capture simulated bio-organisms. These extremely versatile and rigid devices open the door on a new class of materials able to recognize the external fingerprints of bio-organisms such as size and outer membrane proteins for specific capture and detection applications.
NTIS
Silicon; Membranes

20040062459 Oklahoma Dept. of Transportation, Oklahoma City, OK, USA
Experimental Products Evaluation Program: Annual Report, February 2004
Williams, G.; Feb. 2004; 30 pp.; In English
Report No.(s): PB2004-104602; No Copyright; Avail: CASI; A03, Hardcopy

This publication consists of a listing of experimental products that are being or have been evaluated by The Oklahoma Department of Transportation (ODOT), or other transportation agencies. This listing is continuously updated as new information is received. A status of the evaluation is given for each item, showing the progress or result of the evaluation.
NTIS
Transportation; Highways; Products

20040062463 National Inst. for Occupational Safety and Health, Cincinnati, OH, USA
NIOSH Health Hazard Evaluation Report: HETA No. 2001-0303-2893, TRW Automotive, Mt. Vernon, Ohio
Oct. 2002; 48 pp.; In English
Report No.(s): PB2004-104736; HETA-2001-0303-2893; No Copyright; Avail: CASI; A03, Hardcopy
This Health Hazard Evaluation was requested by the union and management at Mt. Vernon to try to find ways to stop illnesses from occurring among employees in the machining areas.
NTIS
Metal Working; Health; Hazards

20040065765 Academy of Sciences (Russia), Moscow, Russia
Anhydrite EOS and Phase Diagram in Relation to Shock Decomposition
Ivanov, B. A.; Langenhorst, F.; Deutsch, A.; Hornemann, U.; Lunar and Planetary Science XXXV: Impacts: Modeling and Observations; 2004; 2 pp.; In English; See also 20040065753
Contract(s)/Grant(s): DFG-De-401/15; DFG-La-830/4; DFG-Ho-1446/3; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document
In the context of the Chicxulub impact, it became recently obvious that experimental and theoretical research on the shock behavior of sulfates is essential for an assessment of the role of shock-released gases in the K/T mass extinction. The Chicxulub crater is the most important large impact structure where the bolide penetrated a sedimentary layer with large amounts of interbedded anhydrite (Haughton has also significant anhydrite in the target). The sulfuric gas production by shock compression/decompression of anhydrite is an important issue, even if the size of Chicxulub crater is only half of the so far assumed size. The comparison of experimental data for anhydrite, shocked with different techniques at various laboratories, reveals large differences in the threshold pressures for melting and decomposition. To gain insight into this issue, we have made a theoretical investigation of the thermodynamic properties of anhydrite. The project includes the review of data published in the last 40 years - reasons to study anhydrite cover a wide field of interests: from industrial problems of cement and ceramic production to the analysis of nuclear underground explosions in salt domes, conducted in the USA and USSR in the 1970th.
Author
Anhydrides; Earth Observing System (Eos); Phase Diagrams; Shock Loads; Decomposition; Sulfates

20040066088 National Center for Microgravity Research on Fluids and Combusiton, Cleveland, OH, USA
Single-Walled Carbon Nanotubes, Carbon Nanofibers and Laser-Induced Incandescence
Schubert, Kathy, Technical Monitor; VanderWal, Randy L.; Ticich, Thomas M.; Berger, Gordon M.; Patel, Premal D.; April 2004; 14 pp.; In English; Carbon 2004, 11-16 Jul. 2004, Providence, RI, USA
Contract(s)/Grant(s): NRA-97-HEDS-01; NCC3-975; WBS 22-101-12-15
Report No.(s): NASA/CR-2004-212977; E-14453; No Copyright; Avail: CASI; A03, Hardcopy
Laser induced incandescence applied to a heterogeneous, multi-element reacting flows is characterized by a) temporally resolved emission spectra, time-resolved emission at selected detection wavelengths and fluence dependence. Laser fluences above 0.6 Joules per square centimeter at 1064 nm initiate laser-induced vaporization, yielding a lower incandescence intensity, as found through fluence dependence measurements. Spectrally derived temperatures show that values of excitation laser fluence beyond this value lead to a super-heated plasma, well above the vaporization of temperature of carbon. The temporal evolution of the emission signal at these fluences is consistent with plasma dissipation processes, not incandescence from solid-like structures.
Author
Carbon Nanotubes; Incandescence; Nanoparticles; Reacting Flow; Laser Applications

20040067848 Lawrence Livermore National Lab., Livermore, CA
Study of Plasma Detachment in a Simplified 2D Geometry using UEDGE
Groth, M.; Mahdavi, A. M.; Porter, G. D.; Rognlien, T. D.; Aug. 31, 2001; 14 pp.; In English
Report No.(s): DE2004-15006843; UCRL-JC-143963; No Copyright; Avail: Department of Energy Information Bridge

The location of the ionization front in a generic, detached plasma has been studied in a two-dimensional slab geometry by varying the core plasma density and input heating power. The ratio of the recombination to ionization current and the momentum losses in the computational domain have been used to quantify the degree of detachment. Contours of constant ratio of these parameter in the core plasma density--heating power parameter space show that at high input power higher momentum losses can be achieved even at low density. High fraction of recombination, however, require high core densities to sufficiently separate the plasma from the target plate.
NTIS
Plasmas (Physics); Detachment; Slabs

20040067880 Franklin Associates, Prairie Village, KS, USA
U.S. LCI Database Project-Review Panel Report on Developmental Guidelines
Jan. 2004; 18 pp.; In English
Report No.(s): DE2004-15004560; No Copyright; Avail: Department of Energy Information Bridge
This is a report from the review panel that reviewed the development guidelines of the LCI Database project. The ultimate goal of the project is to develop publicly available LCI Data modules for commonly used materials, products, and processes.
NTIS
Data Bases; Modules

20040067914 Savannah River Ecology Lab., Aiken, SC, USA
Substitution of Oxides of Nitrogen for Sodium Nitrate
Yeager, C. J.; Aug. 1983; 12 pp.; In English
Report No.(s): DE2004-785211; No Copyright; Avail: Department of Energy Information Bridge
The purpose of this report is to discuss the chemistry of nitrous acid, the Savannah River Plant application of nitrogen, environmental effects, and outline a development program for nitrogen replacement of sodium nitrite.
NTIS
Sodium Nitrates; Environment Effects; Nitrogen Oxides

20040067960 National Inst. of Standards and Technology, Gaithersburg, MD, USA
Materials Science and Engineering Laboratory. FY 2003 Programs and Accomplishments, Materials Reliability Division
St. Pierre, J.; Siewert, T. A.; Sep. 2003; In English
Report No.(s): PB2004-103737; NISTIR-7015; No Copyright; Avail: National Technical Information Service (NTIS)
The Materials Reliability Division's mission is to develop and disseminate measurement methods and standards enhancing the quality and reliability of materials for industry. Our portfolio of research projects has changed again this past year, as we continue to discover and address critical technology gaps that limit the reliable use of materials. For FY03, we organized our research into the following focus areas: Materials for Micro- and Optoelectronics - The U. S. microelectronics and related industries continue to face fierce international competition. The International Technology Roadmap for Semiconductors (ITRS) has long recognized the importance of metrology to the advancement of the industry by devoting an entire chapter to the subject. Nanocharacterization- The overarching goal of our nine nanocharacterization projects is to develop reliable and accurate measurement techniques for a broad range of materials and material properties at the nanoscale. Infrastructure - The projects in this group are designed to develop measurement technology for determining a material's characteristics or for characterizing a measurement system. Biomaterials Metrology- Our ongoing biomaterials projects are aimed at improving health care.
NTIS
Materials Science; Reliability; Research Management

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COMPOSITE MATERIALS

Includes physical, chemical, and mechanical properties of laminates and other composite materials.

20040062455 Federal Highway Administration, Columbus, OH, USA
Material Properties for Implementation of Mechanistic-Empirical (M-E) Pavement Design Procedures. Final Report
Feb. 2004; 310 pp.; In English
Report No.(s): PB2004-101013; FHWA/OH-2003/021; No Copyright; Avail: CASI; A14, Hardcopy

The highway engineering community is currently in the process of transition from the traditional empirical design procedures to the mechanistic design procedures. This transition is necessitated by the fact that the largely empirical AASHTO pavement design procedures have become outdated by the introductions of new pavement materials and truck types as well as the continuing increase in traffic volumes, truck weights, and tire pressures. By nature, the empirical procedures are valid only under the conditions addressed in the original study. The empirical procedures have a tendency to introduce a level of uncertainty when the conditions change and extrapolations are needed beyond the bounds. ODOT is one of many state highway agencies gearing up to implement the M-E procedures. There is some preparatory work that each of these agencies must make prior to the implementation of the mechanistic-empirical (M-E) design procedures. It is speculated that a significant portion of the preparation would be spent on obtaining mechanistic properties of various engineering materials encountered in the multi-layer pavement structure. A comprehensive study was conducted to compile mechanistic property data for pavement materials specified and utilized in Ohio. The end result of the project was a collection of recommended hierarchical material property values and prediction methods for both rigid and flexible pavements to aid highway engineers and researchers in Ohio to implement the M-E procedures.
NTIS
Pavements; Prediction Analysis Techniques

20040062460 Lawrence Livermore National Lab., Livermore, CA
Experimental Results in Support of Simulating Progressive Crush in Carbon-Fiber Textile Composites
DeTeresa, S. J.; Allison, L. M.; Cunningham, B. J.; Freeman, D. C.; Scaulla, M. D.; Apr. 02, 2001; 118 pp.; In English
Report No.(s): DE2004-15005998; UCRL-ID-143287; No Copyright; Avail: Department of Energy Information Bridge
This report summarizes the findings of an experimental program conducted to support the modeling of the crush behavior of triaxial braid carbon fiber composites. The matrix material as well as braided panels and tubes were characterized in order to determine material properties, to assess failure modes, and to provide a test bed for new analytical and numerical tools developed specifically for braided composites. The matrix material selected by the ACC was an epoxy vinyl ester. Tensile tests were used to compare two formulations-one used by the ACC and one recommended by the resin supplier. The latter was a faster reacting system and gelled in one-third the time of the ACC formulation.
NTIS
Matrix Materials; Tensile Tests; Braided Composites

20040062490 Federal Highway Administration, Columbus, OH, USA
Material Properties for Implementation of Mechanistic-Empirical (M-E) Pavement Design Procedures (Raw Data on CD-ROM)
Feb. 2004; In English
Report No.(s): PB2004-500127; FHWA/OH-2003/021-CD; No Copyright; Avail: National Technical Information Service (NTIS)
A comprehensive study was conducted to compile mechanistic property data for pavement materials specified and utilized in Ohio. This product includes a CD-ROM consisting of three major components accompanied by a User's Guide. In the first component, background information on the new mechnistic-empirical (M-E) pavement design/analysis procedures was researched and presented. In the second component, each of the twenty-eight pavement-related research projects conducted for the ODOT within the last two decades was summarized with emphases placed on pavement material properties measured and pavement distress data recorded. In the third component reliability of the Asphalt Institute's Witczak equation was evaluated for asphalt concrete mixtures used in Ohio in light of the latest laboratory dynamic modulus test data collected by the authors. The end result of the project was a collection of recommended hierarchical material property values and prediction methods for both rigid and flexible pavements to aid highway engineers and researchers in Ohio to implement the M-E procedures.
NTIS
Prediction Analysis Techniques; Design Analysis

20040065975 NASA Langley Research Center, Hampton, VA, USA
Polyimide/Carbon Nanotube Composite Films for Electrostatic Charge Mitigation
Smith, Joseph G., Jr.; Delozier, Donavon M.; Connell, John W.; Watson, Kent A.; March 25, 2004; 8 pp.; In English; 41st Space Congress, 27-30 Apr. 2004, Cape Canaveral, FL, USA; No Copyright; Avail: CASI; A02, Hardcopy
Low color, space environmentally durable polymeric films with sufficient electrical conductivity to mitigate electrostatic

charge (ESC) build-up have potential applications on large, deployable, ultra-light weight Gossamer spacecraft as thin film membranes on antennas, solar sails, thermal/optical coatings, multi-layer insulation blankets, etc.. The challenge has been to develop a method to impart robust electrical conductivity into these materials without increasing solar absorptivity (alpha) or decreasing optical transparency or film flexibility. Since these spacecraft will require significant compaction prior to launch, the film portion of the spacecraft will require folding. The state-of-the-art clear, conductive coating (e.g. indium-tin-oxide, ITO) is brittle and cannot tolerate folding. In this report, doping a polymer with single-walled carbon nanotubes (SWNTs) using two different methods afforded materials with good flexibility and surface conductivities in the range sufficient for ESC mitigation. A coating method afforded materials with minimal effects on the mechanical, optical, and thermo-optical properties as compared to dispersal of SWNTs in the matrix. The chemistry and physical properties of these nanocomposites are discussed.
Author
Coating; Electrostatic Charge; Polyimides; Polymeric Films; Thin Films; Carbon Nanotubes; Absorptivity

25
INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY

Includes the analysis, synthesis, and use of inorganic and organic compounds; combustion theory; electrochemistry; and photochemistry. For related information see category *34 Fluid Dynamics and Thermodynamics*. For astrochemistry see category *90 Astrophysics*.

20040062453 Du Pont de Nemours (E. I.) and Co., Aiken, SC, USA
Quantitative Analysis of Radionuclides in Process and Environmental Samples
Boni, A. L.; Jun. 1959; 34 pp.; In English
Report No.(s): DE2004-808275; DPSP-59-11-15; No Copyright; Avail: Department of Energy Information Bridge
An analytical method was developed for the radiochemical separation and quantitative recovery of ruthenium, zirconium, niobium, neptunium, cobalt, iron, zinc, strontium, rare earths, chromium and cesium from a wide variety of natural materials. This paper discusses this analytical method, based on the anion exchange properties of the various radionuclides, although both ion exchange and precipitation techniques are incorporated.
NTIS
Radioactive Isotopes; Radiochemical Separation

20040062454 Lockheed Martin Corp., Schenectady, NY, USA
Immiscibility in Fe(sub 3)O(sub 4)-FeCr(sub 2)O(sub 4) Spinel Binary
Ziemniak, S. E.; Castelli, R. A.; Mar. 20, 2003; 42 pp.; In English
Report No.(s): DE2004-821371; LM-03K029; No Copyright; Avail: Department of Energy Information Bridge
A recent thermodynamic model of mixing in spinel binaries, based on changes in cation disordering (x) between tetrahedral and octahedral sites, is investigated for applicability to the Fe(sub 3)O(sub 4)-FeCr(sub 2)O(sub 4) system under conditions where incomplete mixing occurs.
NTIS
Spinel; Thermodynamics; Solubility

20040062456 Dynamac Corp., Rockville, MD, USA, Powell and Associates Science Services, Las Vegas, NV, USA
Economic Analysis of the Implementation of Permeable Reactive Barriers for Remediation of Contaminated Ground Water
Powell, R. M.; Powell, R. D.; Puls, R. W.; Jun. 2002; In English
Report No.(s): PB2004-102969; No Copyright; Avail: National Technical Information Service (NTIS)
This report presents an analysis of the cost of using permeable reactive barriers to remediate contaminated ground water. When possible, these costs are compared with the cost of pump-and-treat technology for similar situations. Permeable reactive barriers are no longer perceived as an innovative remediation technology but are rapidly maturing and may be considered as a standard remediation technology, similar to pump-and-treat. PRB cost information was obtained from a variety of sources, including reports, surveys, and interviews. Costs were broken out into four general categories: site characterization, design, construction, and operation and maintenance. Subcategories within these four further detailed the costs.
NTIS
Ground Water; Contamination; Water Quality

20040062484 Lawrence Livermore National Lab., Livermore, CA
Review of Corrosion Modes for Alloy 22 Regarding Lifetime Expectancy of Nuclear Waste Containers
Rebak, R. B.; Estill, J. C.; Nov. 15, 2002; 14 pp.; In English
Report No.(s): DE2004-15006487; UCRL-JC-148826; No Copyright; Avail: Department of Energy Information Bridge

Alloy 22 (UNS N06022) was selected to fabricate the corrosion resistant outer barrier of a two-layer waste package container for nuclear waste at the designated repository site in Yucca Mountain in Nevada (USA). A testing program is underway to characterize and quantify three main modes of corrosion that may occur at the site. Current results show that the containers would perform well under general corrosion, localized corrosion and environmentally assisted cracking (EAC). For example, the general corrosion rate is expected to be below 100 nm/year and the container is predicted to be outside the range of potential for localized corrosion and environmentally assisted cracking.
NTIS
Corrosion; Alloys

20040066096 Lawrence Livermore National Lab., Livermore, CA
Mass and Density, Criticality Relationships
Cullen, D. E.; Apr. 10, 2001; 12 pp.; In English
Report No.(s): DE2004-15006864; UCRL-ID-143496; No Copyright; Avail: Department of Energy Information Bridge

Here I present some well known relationships that allow the variation in critical mass versus density to be written in a simple analytical form; these relationships have appeared extensively in the open literature for over 50 years, but seem to be periodically forgotten. These relationships are exact for bare, homogeneous systems, and approximate (but reasonably accurate) for reflected systems. With these relationships anyone can quickly estimate the critical mass corresponding to any given density, using nothing more complicated than a hand calculator.
NTIS
Critical Mass; Density

20040067939 Rhode Island Univ., Kingston, RI, USA
Beneficial Uses of Dredge Material from the QPD Intermodal Port Terminal
Silva, A. J.; Baxter, C. D. P.; Calabretta, V.; May 2003; In English
Report No.(s): PB2004-104004; No Copyright; Avail: National Technical Information Service (NTIS)

Over the past few years the University of Rhode Island (URI), Marine Geomechanics Laboratory and the Maguire Group Inc., (MGI) have gathered significant data and conducted tests relative to beneficial use of dredge materials from the Quonset Point/Davisville port in Rhode Island. The objective was to determine possible beneficial use options for the various sediment types that will be encountered. The sources of data consist of earlier subsurface investigations, conducted by MGI, and a joint URI/MGI research project sponsored by the URI Transportation Center in 2000 and 2001. In the recent research project, cores were obtained using a Large-diameter Gravity Corer and a vibracorer. Sediments were characterized using a Multi-Sensor Core Logger for bulk density profiles and then classified in a laboratory/testing program that included Atterberg Limits, grain-size analyses, and organic and chemical testing. The sediments consisted of organic and inorganic silts and silty fine to medium sands. Based on the sediment types, bench scale tests were conducted to determine possible beneficial use alternatives. These alternatives included: direct use for landfill and construction applications, brownfield encapsulation with the low permeability sediments, cement enhancement, lime stabilization, and blending with coarser materials such as crushed demolition debris for use as common borrow. Bench-scale testing included compaction tests, strength tests with the additives, permeability experiments and chemical analyses. The results of unconfined compression strength testing for the cement-enhanced samples achieved strengths commensurate with potential construction materials and flowable fill. Lime stabilization with lime contents ranging from 3% to 7% by weight effectively increased the strength of the inorganic silts. Blending of the fine silty sands with construction debris for use as common borrow fill did not result in practical beneficial use opportunities. Permeability test results indicated that the inorganic silts can be used as a low permeability liner or cover for landfills and for brownsfield remediation. For each of these options, however, more research is needed in terms of their economic viability and the effects of salt and dewatering on the measured properties. The results of this research were oriented toward proposed dredging activities at the Quonset/Davisville Port Facilities, but the methodology is applicable to other similar locations.
NTIS
Dredging; Technology Utilization; Ports

20040068006 Karpinsky Geological Research Inst., Saint Petersburg, USSR

A Thermodynamic Regularities of Evaporation Processes of CMAS Compounds

Shornikov, S. I.; Lunar and Planetary Science XXXV: Planetary Formation and Early Evolution; 2004; 2 pp.; In English; See also 20040068004; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The chemical evolution of protoplanet substances and the problems relating to the condensation and the cooling of substance in the solar nebula have attracted considerable interest of scientists for a long time. This interest derives from the importance of the process of successive condensation of incandescent gases at forming space objects as physico-chemical systems. Firstly the condensation of the hot gas of solar composition was investigated quantitatively by Larimer and then by him together with Grossman. It's necessary to notice that the results of further theoretical investigation didn't give rise to any substantial review of their important conclusions about the sequence of protoplanet substance condensation. At the same time the theoretical calculations require of experimental confirmation. The oxide system under study, CaO-MgO-Al2O3-SiO2 (CMAS) is a part of the system CaO-FeO-MgO-Al2O3-SiO2 (CFMAS) which is one of the most important ones to understand the above-mentioned cosmochemical problem. More than 30 compounds were found to exist in the CMAS system. However the information about the evaporation processes and thermodynamic properties of CMAS compounds and their melts at high temperatures (more than 1800 K) is poor and contradictory in comparison with the one for oxides. In this connection the information obtained by the high-temperature Knudsen effusion method is of great interest. This method combines the data about the equilibrium constants of the reactions in the gas phase and the activity of oxides in compounds. It should be pointed out that such data haven't been used earlier for the thermodynamic calculations. The study of the evaporation of CMAS compounds from molybdenum effusion cells was carried out using MI 1201 mass spectrometer with the ion source modified for the high-temperature investigations. One of the unique characteristics of this source is the possibility of heating of the effusion cell up to 3000 K at the background pressure less than 10(exp -10) atm.

Derived from text

Thermodynamics; Evaporation; Cosmochemistry; Calcium Oxides; Magnesium Oxides; Aluminum Oxides; Silicon Oxides

20040068064 NASA Marshall Space Flight Center, Huntsville, AL, USA

The Thiamine-Pyrophosphate-Motif

Ciszak, Ewa; Dominiak, Paulina; [2004]; 1 pp.; In English; Keystone Symposium, 13-15 Apr. 2004, Snowbird, UT, USA

Contract(s)/Grant(s): NAG8-1924; No Copyright; Avail: Other Sources; Abstract Only

Thiamin pyrophosphate (TPP), a derivative of vitamin B1, is a cofactor for enzymes performing catalysis in pathways of energy production including the well known decarboxylation of a-keto acid dehydrogenases followed by transketolation. TPP-dependent enzymes constitute a structurally and functionally diverse group exhibiting multimeric subunit organization, multiple domains and two chemically equivalent catalytic centers. Annotation of functional TPP-dependcnt enzymes, therefore, has not been trivial due to low sequence similarity related to this complex organization. Our approach to analysis of structures of known TPP-dependent enzymes reveals for the first time features common to this group, which we have termed the TPP-motif. The TPP-motif consists of specific spatial arrangements of structural elements and their specific contacts to provide for a flip-flop, or alternate site, enzymatic mechanism of action. Analysis of structural elements entrained in the flip-flop action displayed by TPP-dependent enzymes reveals a novel definition of the common amino acid sequences. These sequences allow for annotation of TPP-dependent enzymes, thus advancing functional proteomics. Further details of three-dimensional structures of TPP-dependent enzymes will be discussed.

Author

Thiamine; Vitamins; Enzymes; Molecular Structure; Phosphates

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METALS AND METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals and metallic materials; and metallurgy.

20040062475 Lawrence Livermore National Lab., Livermore, CA

Three-Dimensional Analysis of Voids in AM60B Magnesium Tensile Bars Using Computed Tomography Imagery

Waters, A. M.; May 01, 2001; 270 pp.; In English

Report No.(s): DE2004-15006000; UCRL-LR-144841; No Copyright; Avail: Department of Energy Information Bridge

This report summarizes the findings of an experimental program conducted to support the modeling of the crush behavior of triaxial braid carbon fiber composites. The matrix material as well as braided panels and tubes were characterized in order

to determine material properties, to assess failure modes, and to provide a test bed for new analytical and numerical tools developed specifically for braided composites. The matrix material selected by the ACC was an epoxy vinyl ester (Ashland Hetron 922). Tensile tests were used to compare two formulations-one used by the ACC and one recommended by the resin supplier. The latter was a faster reacting system and gelled in one-third the time of the ACC formulation.
NTIS
Braided Composites; Tensile Tests; Fiber Composites; Failure Modes

20040065824 Tokyo Univ., Hongo, Japan
Condensation Kinetics of Metallic Iron: An Experimental Study
Tatsumi, K.; Nagahara, H.; Ozawa, K.; Tachibana, S.; Lunar and Planetary Science XXXV: Dust: Theory and Experiments; 2004; 2 pp.; In English; See also 20040065816; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Metallic elements in gaseous state in a hot interstellar environment condense into dusts during cooling of the gas. In recent IR surveys, existence of magnesium silicates around either evolved stars or young stars have come to evident. Although there has been no observation so far clearly indicating the presence of crystalline Fe, one of the most abundant metallic element in the solar composition next to magnesium and silicon, it is expected to be present as dusts because of its abundance. We have studied condensation kinetics of Fe for the better understanding of condensation processes in the circumstellar environment, such as time scale of condensation, by taking the advantage of its simple crystalline structure and chemistry. It is unclear how much atoms once collided the already condensed solid surface stick there as new part of solid. The ratio of atoms that incorporate into the crystalline structure to incoming atoms is called a condensation coefficient that is critical to determine the growth rate of solid when considering the gas to solid condensation. In some models which calculated the growth rate of condensate, this value was treated as unity. However, if this coefficient is significantly smaller, result of calculation of the growth rate becomes much lower and the time scale of condensation becomes much longer than before. In this study, the condensation coefficient of metallic iron is directly estimated experimentally by the measurement of weight loss of evaporation source and weight gain of a target due to condensation. Note that the first step of condensation is nucleation. To nucleate from gas, high supersaturation state should be achieved to acquire the steady growth state as solid particle. Therefore, the difficulty that an atom can stay on the solid surface once stuck is different in the case of growth state from nucleation state. In this study, growth state is mainly considered.
Author
Iron; Condensing; Kinetics

20040067916 National Inst. of Standards and Technology, Gaithersburg, MD
Materials Science and Engineering Laboratory. FY 2003 Programs and Accomplishments, Metallurgy Division
Handwerker, C. A.; Gayle, F. W.; Sep. 2003; In English
Report No.(s): PB2004-103736; NISTIR-7017; No Copyright; Avail: National Technical Information Service (NTIS)

This Annual Report describes the major technical activities, accomplishments, and areas of scientific expertise in the Metallurgy Division of NIST Materials Science and Engineering Laboratory for FY2003 (October 2002 through September 2003). The 2003 research portfolio focuses on fulfilling specific measurement needs of the industrial sectors: the magnetic data storage, microelectronics/ optoelectronics, automotive, aerospace, and defense industries, and on developing the materials data need for the World Trade Center failure investigation. Output consists of a variety of forms, from a fundamental understanding of materials behavior to measurement techniques conveyed through the scientific literature and oral presentations, standard reference materials, evaluated data and online databases, software tools, and sensors for on-line process control. Examples of 2003 outputs in a few of these areas are: (1)Magnetic Data Storage: In 2003, NIST shifted emphasis from Giant Magnetoresistance (GMR) in Thin Films to understanding artifacts in Ballistic Magnetoresistance (BMR). In the past year, advances in the Ballistic Magnetoresistance (BMR) effect appeared to provide an enormous increase in the sensitivity of nanoscale devices. (2)Microelectronics Packaging: In the MSEL Program on Materials for Microelectronics, we continue to provide tools for producing improved metal interconnects, from copper on-chip interconnects at the nanometer scale to lead-free solder joints on printed wiring boards. (3)Infrastructure Materials: NIST has developed a unique testing facility for measuring high-strain rate mechanical properties of materials at high heating rates.
NTIS
Metallurgy; Research and Development; Test Facilities

20040067942 Helsinki Univ. of Technology, Espoo, Finland
Advanced Steel Structures. (1) Structural Fire Design. (2) Fatigue Design
Lu, W.; Makelainen, P.; 2003; In English
Report No.(s): PB2004-104413; TKK-TER-29; Copyright; Avail: National Technical Information Service (NTIS)
Contents include the following: Preface; Structural fire design; Fatigue design and References.
NTIS
Fatigue (Materials); Structural Design; Steel Structures; Flame Retardants

20040068061 NASA Marshall Space Flight Center, Huntsville, AL, USA
Electrodeposition of High Quality Nickel Phosphorous Alloys for Pollution Reduction and Energy Conservation
Engelhaupt, Darell; Ramsey, Brian; 2004; 1 pp.; In English; American Electroplaters and Surface Finishers Society's Aerospace/Airline Plating and Metal Finishing Forum, 29 Mar - 1 Apr. 2004, Tulsa, OK, USA; No Copyright; Avail: Other Sources; Abstract Only
NASA and the University of Alabama in Huntsville have developed ecologically friendly, versatile nickel and nickel cobalt phosphorous electroplating processes. Solutions show excellent performance with high efficiency for vastly extended throughput. Properties include, clean, low temperature operation (40 - 60 C), high Faradaic efficiency, low stress and high hardness. A variety of alloy and plating speed options are easily achieved from the same chemistry using soluble anodes for metal replacement with only 25% of the phosphorous additions required for electroless nickel. Thick deposits are easily achieved unattended, for electroforming freestanding shapes without buildup of excess orthophosphate or stripping of equipment.
Author
Electrodeposition; Nickel Alloys; Pollution; Phosphorus; Energy Conservation

27
NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials. For composite materials see *24 Composite Materials*.

20040067915 National Inst. of Standards and Technology, Gaithersburg, MD, USA
Materials Science and Engineering Laboratory. FY 2003 Programs and Accomplishments, Ceramics Division
Kaiser, D. L.; Sep. 2003; In English
Report No.(s): PB2004-103735; NISTIR-7014; No Copyright; Avail: National Technical Information Service (NTIS)
Ceramic materials - inorganic nonmetals - have diverse functionality and chemical and mechanical robustness that makes them attractive candidates for integration in devices and components for high-end applications including electronics, telecommunications, and biotechnology. Once used predominantly in bulk, monolithic form, ceramic materials are now increasingly used in microscale or even nanoscale forms, such as multilayers, composites, particulates, fibers, and tubes. The NIST Ceramics Division in the Materials Science and Engineering Laboratory (MSEL) is increasingly focusing on the measurements, standards, and data needs for advanced applications of ceramics, particularly in the nanoscale realm. This report of the Ceramics Division's technical activities in FY 2003 (October 1, 2002-September 30, 2003) contains brief synopses of our projects related to six of the nine umbrella programs in MSEL - Combinatorial Methods, Data and Data Delivery, Materials for Micro- and Opto-Electronics, Materials Property Measurements, Materials Structure Characterization, and Nanocharacterization. Six particularly significant accomplishments are described in more detail in the Technical Highlights section of this report.
NTIS
Research and Development; Combinatorial Analysis; Particulates; Crystal Structure

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PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers; their storage and handling procedures; and aircraft fuels. For nuclear fuels see *73 Nuclear Physics*. For related information see also *07 Aircraft Propulsion and Power; 20 Spacecraft Propulsion and Power*, and *44 Energy Production and Conversion*.

20040065825 Air Force Research Lab., Edwards AFB, CA, USA
Fracture Mechanics and Service Life Prediction Research
Liu, C. T.; October 2002; 19 pp.; In English
Contract(s)/Grant(s): AF Proj. 2302
Report No.(s): AD-A410424; AFRL-PR-ED-VG-2001-190; No Copyright; Avail: CASI; A03, Hardcopy

The objectives were to gain an improvement in understanding of damage mechanisms and fracture behavior in solid propellants and insulator/linear/propellant bond systems and to develop methods to predict crack growth.
DTIC
Crack Propagation; Fracture Mechanics; Solid Propellants; Bonded Joints

20040065833 Defence Science and Technology Organisation, Edinburgh, Australia
Near-field Performance Evaluations of Alex Effect in Metallised Explosives
Lu, Jing Ping; Dorsett, Helen E.; Franson, Mark D.; Cliff, Matthew D.; December 2003; 38 pp.; In English
Report No.(s): DSTO-TR-1542; DODA-AR-013-013; Copyright; Avail: Other Sources

Aluminium, which commonly added performance. Such contributes to late energy releases in the detonation process, is to explosives to enhance both blast effects and underwater aluminium grades, typically 10-20 micron in diameter, react predominantly during the expa-ion of the- detonation products behind the reaction front, and behave largely as an inert material in the detonation front with little contribution of energy. However, Russian scientists [Reshetov et all9841 who worked with AZex for a number of years, claimed that Alex contained significant additional strain energy above that chemically available which enabled it to greatly enhance the performance of both explosive and propellant systems. WSD initiated research into AZex in 1997 to investigate these claims. A bilateral program with Canada at the Defence Research Establishment Valcartier (DREV) to further examine the potential of Alex was established to evaluate its influence upon both near and far-field performance of explosive formulations. This report will give a summary of new and previously reported measurements of near-field performance evaluations, i.e., detonation velocity and plate dent depth tests and critical diameter tests.
Author
Detonation; Aluminum; Trinitrotoluene; Propellants

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ENGINEERING (GENERAL)

Includes general research topics related to engineering and applied physics, and particular areas of vacuum technology, industrial engineering, cryogenics, and fire prevention. For specific topics in engineering see *categories 32 through 39*.

20040068122 National Taiwan Univ. of Science and Technology, Taipei, Taiwan, Province of China
Journal of the Chinese Institute of Engineers, Volume 27, No. 2
Chen, Shun-Tyan, Editor; Tsai, Hsien-Lung, Editor; Shiou, Fang-Jung, Editor; Lee, Liang-Sun, Editor; Young, Der-Liang, Editor; Pan, Ching-Tsai, Editor; Chen, Jean-Lien, Editor; Chung, Chung-Ping, Editor; Chao, Ching-Kong, Editor; Chang, Kai, Editor, et al.; March 2004; ISSN 0253-3839; 142 pp.; In English; Copyright; Avail: Other Sources

Full papers in this issue are: Reliability Analysis of Flip Chip Packages Using Contact Finite Element Method, An Optimization Model for Command Cycle Assignment of AS/RS Orders, Pulse Compression Technique Applied to Ultrasonic Nondestructive Testing of Concrete, Evolutionary-Based Virtual Training in Extracting Fuzzy Knowledge for Deburring Tasks, System Identification of Discrete Event Systems, Cogeneration Pricing Based on Avoided Costs of Power Generation and Transmission, An Analytical (Classical) Subthreshold Behavior Model for Symmetrical Fully-Depleted SOI Double-Gate MOSFET's, Effect of Non-Instantaneous Disposition on the General Measures of Distribution Kinetics in a Modified Mammillary Compartmental Model,The Influence of Process Parameters on the MoS2 Content of Ni-MoS2 Composite Coating by the Robust Design Method, Nonpoint Source Pollution Potential Index: A Case Study of the Feitsui Reservoir Watershed, Taiwan, Applications of Kramers-Kronig Transforms to Predict the Corrosion State of Existing Reinforced

Concrete Structures. Short papers presented in this issue are: Fast Converging Approach for Blind Constant Modulus Interference Suppression, New Results of Rational Inverse Z Transformation via Partial Fraction Expansion and Some Application, Lubrication Performance of Long Journal Bearings Considering Effects of Couple Stresses and Surface Roughness, An Evaluation of the Capacitance of Aluminum Electrolytic Capacitor Foils A.C. Etched in Hydrochloric Acid Electrolytes, The Kinematic Model for Granular Flow in a Two-Dimensional Symmetrical Louvered Moving Granular Filter Bed.
CASI
Finite Element Method; Lubrication; Nondestructive Tests; Reliability Analysis; Kramers-Kronig Formula; Journal Bearings; Metal Oxide Semiconductors; Optimization; System Identification; Ultrasonic Tests

32
COMMUNICATIONS AND RADAR

Includes radar; radio, wire, and optical communications; land and global communications; communications theory. For related information see also 04 Aircraft Communications and Navigation; and *17 Space Communications, Spacecraft Communications, Command and Tracking*; for search and rescue, see *03 Air Transportation and Safety*; and *16 Space Transportation and Safety*.

20040062529 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
The 2009 Mars Telecommunications Orbiter
Wilson, G. R.; DePaula, R.; Diehl, R. E.; Edwards, C. D.; Fitzgerald, R. J.; Franklin, S. F.; Kerridge, S. A.; Komarek, T. A.; Noreen, G. K.; Lunar and Planetary Science XXXV: Missions and Instruments: Hopes and Hope Fulfilled; 2004; 2 pp.; In English; See also 20040062499; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The first spacecraft with a primary function of providing communication links while orbiting a foreign planet has begun development for a launch in 2009. NASA's Mars Telecommunications Orbiter would use three radio bands to magnify the benefits of other future Mars missions and enable some types of missions otherwise impractical. It would serve as the Mars hub for a growing interplanetary Internet. And it would pioneer the use of planet-to-planet laser communications to demonstrate the possibility for even greater networking capabilities in the future. With Mars Telecommunications Orbiter overhead in the martian sky, the Mars Science Laboratory rover scheduled to follow the orbiter to Mars by about a month could send to Earth more than 100 times as much data per day as it could otherwise send. The orbiter will be designed for the capability of relaying up to 15 gigabits per day from the rover, equivalent to more than three full compact discs each day. The same benefits would accrue to other future major Mars missions from any nation.
Derived from text
Communication Networks; Mars (Planet); Optical Communication; Mars Missions

20040066094 Lawrence Livermore National Lab., Livermore, CA
Time Reversal Signal Processing in Communications: A Feasibility Study
Meyer, A. W.; Candy, J. V.; Poggio, A. J.; Jan. 30, 2002; 26 pp.; In English
Report No.(s): DE2004-15006881; UCRL-ID-147014; No Copyright; Avail: Department of Energy Information Bridge

A typical communications channel is subjected to a variety of signal distortions, including multipath, that corrupt the information being transmitted and reduce the effective channel capacity. The mitigation of the multipath interference component is an ongoing concern for communication systems operating in complex environments such as might be experienced inside buildings, urban environments, and hilly or heavily wooded areas. Communications between mobile units and distributed sensors, so important to national security, are dependent upon flawless conveyance of information in complex environments.
NTIS
Signal Processing; Telecommunication

20040067884 Lawrence Livermore National Lab., Livermore, CA
International Exchange of Emergency Phase Information and Assessment: An Aid to Inter/National Decision Makers
Sullivan, T. J.; Chino, M.; Ehrhardt, J.; Shershakov, V.; Sep. 01, 2003; In English
Report No.(s): DE2003-15005404; UCRL-ID-152535; No Copyright; Avail: National Technical Information Service (NTIS)

This paper discusses a collaborative project whose purpose is (1) to demonstrate the technical feasibility and mutual benefit of a system seeking early review or preview, in a 'quasi peer review' mode, of nuclear accident plume and dose

assessment predictions by four major international nuclear accident emergency response systems before release of their calculations to their respective national authorities followed by (2) sharing these results with responsible international authorities. The extreme sensitivity of the general public to any nuclear accident information has been a strong motivation to seek peer review prior to public release. Another intended objective of this work is (3) the development of an affordable/accessible system for distribution of prediction results to countries having no prediction capabilities and (4) utilization of the link for exercises and collaboration studies. The project exploits the Internet as a ubiquitous communications medium, browser technology as a simple, user friendly interface, and low-cost PC level hardware.
NTIS
Plumes; Emergencies

20040067919 Florida Univ., Gainesville, FL, USA
Feasibility Study for an Integrated Network of Data Sources
Dourage, K.; Li, I.; Hammer, J.; Ji, F.; Yu, Q.; Jan. 2004; In English
Report No.(s): PB2004-103538; UFTRC-880-1; No Copyright; Avail: National Technical Information Service (NTIS)

Florida's Statewide Intelligent Transportation Systems (ITS) Architecture contains a central data warehouse (CDW) component in its Statewide Concept of Operations. The principal function of a CDW is to collect and store statewide information from many data sources and make it available for use by different applications. The CDW will allow data from these separate and disparate data sources to be aggregated. Florida Department of Transportation Contract BC-354-61 was initiated to perform a feasibility study for a central data warehouse (CDW) for data generated and used by various ITS applications in Florida and to provide preliminary recommendations on the configuration and functionality of a CDW in preparation for a future project phase. The report contains (1) A Summary the sources available for the development of a central data warehouse for ITS applications; (2) A discussion of the common concepts and standards that apply to the design of a CDW; (3) Observations and recommendations that can be offered at this time, given the relatively coarse level of the investigations that have been done to this point; (4) A description of prototype for a CDW, designed to illustrate the concepts and recommendations contained in this report; and (5) A prospectus for a proof-of-concept study as a subsequent phase of the project.
NTIS
Information Systems; Transportation

20040067923 National Telecommunications and Information Administration, Washington, DC, USA
Gain Characterization of the RF Measurement Path
Allen, J. W.; Feb. 2004; 24 pp.; In English
Report No.(s): PB2004-105435; NTIA-TR-04-410; No Copyright; Avail: CASI; A03, Hardcopy

In radio frequency (RF) measurements the gain (or loss) of the signal path connecting the measurement equipment to the measurement reference plane must be accounted for. This tutorial paper discusses the various definitions of gain, and how to determine the gain using either a calibrated signal generator, noise source, or network analyzer.
NTIS
Calibrating; Frequency Measurement; Radio Frequencies; Signal Measurement

20040067924 Newcastle-upon-Tyne Univ., Newcastle
Efficient Reliable Broadcast Protocol for Mobile Ad-hoc Networks
Vollset, E.; Ezhilchelvan, P.; Dec. 2003; 24 pp.; In English
Report No.(s): PB2004-105457; CS-TR-822; Copyright; Avail: National Technical Information Service (NTIS)

This paper presents and studies a reliable broadcast protocol for a group of mobile nodes forming an ad-hoc wireless network. The protocol assumes what is seemingly the weakest restriction on node mobility. A node can remain detached from others for an arbitrary amount of time that is bounded by an unknown constant, and connects with an arbitrarily chosen node for a duration with a small and known lower bound. Under these conditions, node movements may make it hard to construct and maintain a viable routing structure. Consequently, our protocol does not attempt to construct such structures, nor does it attempt to sense or assume the likely pattern of topological changes. Instead it works by decentralising the task of packet dissemination among all nodes. In addition, its design places due emphasis on low packet overhead, adaptivity to perceived network conditions, and small broadcast latency. Simulations confirm these design objectives and correctness proofs validate the protocol.
NTIS
Broadcasting; Mobility; Protocol (Computers)

20040067933 Swedish Defence Research Establishment, Stockholm, Sweden
Free-Space Optical Communication with Underwater Systems using Modulated Retro-Reflectors
Kullander, F.; Olsson, A.; Sangfeldt, E.; Sjoeqvist, L.; Zyra, S.; Sep. 2003; In English
Report No.(s): PB2004-104153; FOI-R-0951-SE; No Copyright; Avail: National Technical Information Service (NTIS)

Future missions for underwater systems may require rapid communication utilizing high data transfer rates. Optical communication can provide this capability, being either based on optical fibers or transmission directly through the media. Both are highly covert, directional and do not require frequency allocation as radio transmitters. This report describes particularly a method for wireless optical communication using modulated retro-reflectors. This technology has the potential to provide data rates in the megabits per second range in the future. We describe in this report briefly the basic idea, the achievable performance potential applications of the technology, the current status and our recommendation for future work within this field.
NTIS
Free-Space Optical Communication; Wireless Communication; Underwater Communication; Reflectors; Technology Utilization

20040067934 Swedish Defence Research Establishment, Linkoeping, Sweden
Parabolic Equation Technique in Vegetation and Urban Environments
Holm, P.; Lundborg, B.; Waem, A.; Dec. 2003; In English
Report No.(s): PB2004-104154; FOI-R-1050-SE; No Copyright; Avail: National Technical Information Service (NTIS)

It is well known that the radio channel sets limits for present and future wireless communication systems. (Waern et al, 2003). This is true regardless of the nature of the propagation environment, be it a rural area or urban or indoor scenarios. One can use several different techniques to model the wave propagation and in this report we discuss wave propagation modeling by parabolic equation (PE) technique. FOI has developed a wave propagation model using the parabolic equation (PE) technique (Holm and Erikson, 2002). This model is intended for forest environment and the results so far are promising. The topic of the present work has been to study if this technique is useful also for urban environments. To start with, we review the propagation aspects in forest. Then we give a brief summary of the FOI model and show some results from calculations of the wave propagation in a forest environment. In chapter 3, we discuss the PE technique for urban areas. Finally, we conclude our report by a discussion leading to a suggestion for the next step in our studies on wave propagation modeling in urban environment.
NTIS
Wave Propagation; Radio Transmission; Vegetation; Cities

20040067941 National Inst. of Standards and Technology, Gaithersburg, MD, Maryland Univ., College Park, MD, USA
Deconvolving LADAR Images of Bar Codes for Construction Site Object Recognition
Gilsinn, D. E.; Cheok, G. S.; O'Leary, D. P.; 2003; In English
Report No.(s): PB2004-103897; NISTIR-7044; No Copyright; Avail: National Technical Information Service (NTIS)

Imaging sensors such as LADARs (laser distance and ranging devices) are used to rapidly acquire data of a scene to generate three dimensional (3D) models. The increased interest in this technology is due to the substantial growth in applications for real-time scene updates driven by the recent advances in imaging sensor software and hardware. Current applications include 3D modeling, site surveillance, map/terrain update/reconnaissance, bathymetry, indoor/outdoor visual inspection, autonomous control navigation, and collision avoidance.
NTIS
Three Dimensional Models; Pattern Recognition; Imaging Techniques; Laser Ranging; Optical Radar

20040067951 Swedish Defence Research Establishment, Stockholm, Sweden
Modelling of Echo Reduction by Alberich Anechoic Coatings
Ivansson, S.; Lund, L. F.; Dec. 2003; In English
Report No.(s): PB2004-104155; FOI-R-1039-SE; No Copyright; Avail: National Technical Information Service (NTIS)

The aim of the present report is to perform numerical modeling of echo reduction by Alberich anechoic coating with two different methods; the Riccati method and the finite difference (FD) method. Both methods model the sound scattering by the cavities explicitly. The Riccati method allows rapid computations for scatterers of simple shape, whereas complicated

scatterers can be handled by the FD method (which is actually related to the FEM method).
NTIS
Acoustic Scattering; Finite Difference Theory; Sound Propagation; Echo Suppressors; Coatings

33
ELECTRONICS AND ELECTRICAL ENGINEERING

Includes development, performance, and maintainability of electrical/electronic devices and components; related test equipment; and microelectronics and integrated circuitry. for related information see also *60 Computer Operations and Hardware*; and *76 Solid-State Physics*. For communications equipment and devices see *32 Communications and Radar*.

20040067854 ITN Energy Systems, Inc., Littleton, CO, USA
Trajectory Oriented and Fault Tolerant Based Intelligent Process Control for Flexible CIGS PV Module Manufacturing. Phase One Final Technical Report, March 2003
Simpson, L.; Feb. 2004; In English
Report No.(s): DE2004-15006748; NREL/SR-520-35146; No Copyright; Avail: National Technical Information Service (NTIS)

With the assistance of NREL's PV Manufacturing R&D program, ITN Energy Systems, Inc. and Global Solar Energy, Inc. continued the advancement of CIGS production technology by developing trajectory-oriented predictive/control models, fault-tolerance control, control-platform development, in-situ sensors, and process improvements. Modeling activities to date include developing physics-based and empirical models for CIGS and physics-based Mo deposition processing, implementing model-based control for CIGS processing, and applying predictive models to the construction of new evaporation sources.
NTIS
Solar Cells; Trajectories; Simulation

20040067952 Swedish Defence Research Establishment, Linkoeping, Sweden
Array Mapping for the SESAM System: Optimal Transformation Matrix Design
Hyberg, P.; Dec. 2003; In English
Report No.(s): PB2004-104157; FOI-R-0941-SE; No Copyright; Avail: National Technical Information Service (NTIS)

Mapping of the data output vector from an existing antenna array onto the data vector of an imaginary array of more suitable configuration is well known in array signal processing. By mapping onto an array manifold of lower dimension or uniform structure f. ex. , processing speed can be improved. Conditions for the retaining of DOA estimate variance under such mapping have been formulated by several authors by the equally important systematic mapping errors, the bias, has been less treated to date. This paper uses a geometrical interpretation of a Taylor expansion of the DOA estimator cost function to derive an alternative design of the mapping matrix that almost completely removes the bias. The key feature of the proposed design is that it takes the orthogonality between the manifold mapping errors and certain gradients of the estimator cost function into account.
NTIS
Antenna Arrays; Transformations (Mathematics); Matrices (Mathematics)

20040068065 NASA Marshall Space Flight Center, Huntsville, AL, USA
Advanced Video Guidance Sensor Development Testing
Howard, Richard T.; Bryan, Thomas C.; Book, Michael L.; Johnston, Albert S.; [2004]; 1 pp.; In English; SPIE Defense and Security Symposium, 12-16 Apr. 2004, Orlando, FL, USA; No Copyright; Avail: Other Sources; Abstract Only

NASA's Marshall Space Flight Center was the driving force behind the development of the Advanced Video Guidance Sensor, an active sensor system that provides near-range sensor data as part of an automatic rendezvous and docking system. The sensor determines the relative positions and attitudes between the active sensor and the passive target at ranges up to 300 meters. The VGS uses laser diodes to illuminate retro-reflectors in the target, a solid-state camera to detect the return from the target, and image capture electronics and a digital signal processor to convert the video information into the relative positions and attitudes. This development effort has required a great deal of testing of various sorts at every phase of development, and some of the test efforts, predictions, and results will be laid out in this paper.
Author
Guidance Sensors; Video Communication; Autonomy; Systems Engineering

20040068081 NASA Langley Research Center, Hampton, VA, USA

Anisotropic Piezocomposite Actuator Incorporating Machined PMN-PT Single Crystal Fibers

Wilkie, W. Keats; Inman, Daniel J.; Lloyd, Justin M.; High, James W.; [2004]; 17 pp.; In English; 45th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference, 19-22 Apr. 2004, Palm Springs, CA, USA

Contract(s)/Grant(s): 23-755-06-00

Report No.(s): AIAA Paper 2004-1889; No Copyright; Avail: CASI; A03, Hardcopy

The design, fabrication, and testing of a flexible, planar, anisotropic piezoelectric composite actuator utilizing machined PMN-32%PT single crystal fibers is presented. The device consists of a layer of rectangular single crystal piezoelectric fibers in an epoxy matrix, packaged between interdigitated electrode polyimide films. Quasistatic free-strain measurements of the single crystal device are compared with measurements from geometrically identical specimens incorporating polycrystalline PZT-5A and PZT-5H piezoceramic fibers. Free-strain actuation of the single crystal actuator at low bipolar electric fields (+/-250 V/mm) is approximately 400% greater than that of the baseline PZT-5A piezoceramic device, and 200% greater than that of the PZT-5H device. Free-strain actuation under high unipolar electric fields (0-4kV/mm) is approximately 200% of the PZT-5A baseline device, and 150% of the PZT-5H alternate piezoceramic device. Performance increases at low field are qualitatively consistent with predicted increases based on scaling the low-field d(sub 33) piezoelectric constants of the respective piezoelectric materials. High-field increases are much less than scaled d(sub 33) estimates, but appear consistent with high-field freestrain measurements reported for similar bulk single-crystal and piezoceramic compositions. Measurements of single crystal actuator capacitance and coupling coefficient are also provided. These properties were poorly predicted using scaled bulk material dielectric and coupling coefficient data. Rules-of-mixtures calculations of the effective elastic properties of the single crystal device and estimated actuation work energy densities are also presented. Results indicate longitudinal stiffnesses significantly lower (50% less) than either piezoceramic device. This suggests that single-crystal piezocomposite actuators will be best suited to low induced-stress, high strain and deflection applications.

Author

Fabrication; Piezoelectric Ceramics; Piezoelectricity; Single Crystals; Piezoelectric Actuators; Ceramic Fibers

20040068090 NASA Marshall Space Flight Center, Huntsville, AL, USA

Solar Arrays for Direct-Drive Electric Propulsion: Arcing at High Voltages

Schneider, Todd A.; Mikellides, I. G.; Jongeward, G. A.; Peterson, T.; Kerslake, T. W.; Snyder, D.; Ferguson, D.; March 30, 2004; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

The results from an experimental investigation to assess arcing during operation of high voltage solar arrays in a plasma environment are presented. The experiments were part of an effort to develop systems that would allow safe operation of Hall-Effect Thrustefls) in direct-drive mode. Arc discharges are generated when the array is biased negative with respect to the plasma. If sustained for long periods of time between adjacent solar cells, arcs may severely damage a solar array, thus significantly shortening its lifetime. Most often sustained arcs are triggered by plasma produced during short-duration discharge arcs (approximately 20 microseconds). These trigger arcs are sparked between the semiconducting cell and the covering dielectric. Both trigger and sustained (greater than 1 millisecond) arcs have been captured during the tests. Current and voltage waveforms associated with the different arc events are presented. The test results have defined operational limits (thresholds) for the various array concepts studied that minimize the likelihood of damage from sustained arcs. Experimental trends regarding the effect of the solar array substrate on arc duration are also presented.

Author

High Voltages; Solar Arrays; Electric Propulsion; Plasmas (Physics); Arc Discharges

34
FLUID MECHANICS AND THERMODYNAMICS

Includes fluid dynamics and kinematics and all forms of heat transfer; boundary layer flow; hydrodynamics; hydraulics; fluidics; mass transfer and ablation cooling. For related information see also *02 Aerodynamics*.

20040062450 Lawrence Livermore National Lab., Livermore, CA

Passive Wake Vortex Control

Ortega, J. M.; Oct. 18, 2001; 24 pp.; In English

Report No.(s): DE2004-15006847; UCRL-ID-146320; No Copyright; Avail: Department of Energy Information Bridge

The collapse of the Soviet Union and ending of the Cold War brought about many significant changes in military submarine operations. The enemies that the US Navy faces today and in the future will not likely be superpowers armed with

nuclear submarines, but rather smaller, rogue nations employing cheaper diesel/electric submarines with advanced air-independent propulsion systems. Unlike Cold War submarine operations, which occurred in deep-water environments, future submarine conflicts are anticipated to occur in shallow, littoral regions that are complex and noisy. Consequently, non-acoustic signatures will become increasingly important and the submarine stealth technology designed for deep-water operations may not be effective in these environments. One such non-acoustic signature is the surface detection of a submarine's trailing vortex wake.
NTIS
Vortices; Wakes; Submarines

20040066085 NASA Ames Research Center, Moffett Field, CA, USA
High Energy Boundary Conditions for a Cartesian Mesh Euler Solver
Pandya, Shishir A.; Murman, Scott M.; Aftosmis, Michael J.; January 09, 2004; 12 pp.; In English; 22nd AIAA Applied Aerodynamics Conference and Exhibit, 16-19 Aug. 2004, Providence, RI, USA; No Copyright; Avail: CASI; A03, Hardcopy

Inlets and exhaust nozzles are often omitted or fared over in aerodynamic simulations of aircraft due to the complexities involving in the modeling of engine details such as complex geometry and flow physics. However, the assumption is often improper as inlet or plume flows have a substantial effect on vehicle aerodynamics. A tool for specifying inlet and exhaust plume conditions through the use of high-energy boundary conditions in an established inviscid flow solver is presented. The effects of the plume on the flow fields near the inlet and plume are discussed.
Author
Boundary Conditions; Aerodynamics; Exhaust Nozzles; Fluid Dynamics; Inlet Nozzles

20040066099 NASA Ames Research Center, Moffett Field, CA, USA
Implementation of Premixed Equilibrium Chemistry Capability in OVERFLOW
Olsen, Mike E.; Liu, Yen; Vinokur, M.; Olsen, Tom; January 2004; 10 pp.; In English; 42nd AIAA Aerospace Sciences Meeting and Exhibit, 5-8 Jan. 2004, Reno, NV, USA
Report No.(s): AIAA Paper 2004-1273; No Copyright; Avail: CASI; A02, Hardcopy

An implementation of premixed equilibrium chemistry has been completed for the OVERFLOW code, a chimera capable, complex geometry flow code widely used to predict transonic flowfields. The implementation builds on the computational efficiency and geometric generality of the solver.
Author
Chemical Equilibrium; Approximation; Computer Programs; Thermodynamics; Premixing; Flow Distribution

20040067947 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
AMR for Low Mach Number Reacting Flow
Bell, J.; 2003; In English
Report No.(s): DE2004-821336; No Copyright; Avail: National Technical Information Service (NTIS)

We present a summary of recent progress on the development and application of adaptive mesh refinement algorithms for low Mach number reacting flows. Our approach uses a form of the low Mach number equations based on a general equation of state that discretely conserves both mass and energy. The discretization methodology is based on a robust projection formulation that accommodates large density contrasts. The algorithm supports modeling of multicomponent systems and incorporates an operator-split treatment of stiff reaction terms. The basic computational approach is embedded in an adaptive projection framework that uses structured hierarchical grids with subcycling in time that preserves the discrete conservation properties of the underlying single-grid algorithm. We present numerical examples illustrating the application of the methodology to turbulent premixed combustion and nuclear flames in type Ia supernovae.
NTIS
Reacting Flow; Grid Refinement (Mathematics); Structured Grids (Mathematics)

20040068082 Syracuse Univ., NY, USA
Measurement of Turbulent Pressure and Temperature Fluctuations in a Gas Turbine Combustor
Povinelli, Louis, Technical Monitor; LaGraff, John E.; Bramanti, Cristina; Pldfield, Martin; Passaro, Andrea; Biagioni, Leonardo; March 13, 2004; 20 pp.; In English
Contract(s)/Grant(s): NAG3-2419; No Copyright; Avail: CASI; A03, Hardcopy

The report summarizes the results of the redesign efforts directed towards the gas-turbine combustor rapid-injector flow

diagnostic probe developed under sponsorship of NASA-GRC and earlier reported in NASA-CR-2003-212540. Lessons learned during the theoretical development, developmental testing and field-testing in the previous phase of this research were applied to redesign of both the probe sensing elements and of the rapid injection device. This redesigned probe (referred to herein as Turboprobe) has been fabricated and is ready, along with the new rapid injector, for field-testing. The probe is now designed to capture both time-resolved and mean total temperatures, total pressures and, indirectly, one component of turbulent fluctuations.
Author
Gas Turbines; Pressure Measurement; Temperature Measurement; Measuring Instruments; Turbulence Effects

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INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography. For aerial photography see *43 Earth Resources and Remote Sensing*. For related information see also *06 Avionics and Aircraft Instrumentation*; and *19 Spacecraft Instrumentation and Astrionics*.

20040061970 Arkansas State Univ., State University, AR, USA
Discrimination of Heavy Charged Particles in a Mixed Irradiation Using Optically Stimulated Luminescence Methods
Yount, B.; Yukihara, E.; McKeever, S. W. S.; Lunar and Planetary Science XXXV: Human Occupation of Space: Radiation, Risk, and Refuse; 2004; 2 pp.; In English; See also 20040061967; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Astronauts are subjected to many different types of radiation. In an effort to keep track of the dose an astronaut receives, they wear dosimeters that can be read by different means. The newest method, termed Optically Stimulated Luminescence, entails using a known wavelength of light to stimulate the dosimeter material causing it to emit light of a different wavelength. By measuring the amount of light emitted, we can infer the dose received. The material we used for OSL dosimetry is aluminum oxide, Al2O3. In this study, we investigated the potential of Al2O3 for discrimination of different types of radiation (alpha and beta in this study).
Derived from text
Charged Particles; Dosage; Dosimeters

20040062501 Weber State Coll., Ogden, UT, USA
The Compact Microimaging Spectrometer (CMIS): A New Tool for In-Situ Planetary Science
Armstrong, J. C.; Sellar, R. G.; Lunar and Planetary Science XXXV: Missions and Instruments: Hopes and Hope Fulfilled; 2004; 2 pp.; In English; See also 20040062499; Original contains color illustrations
Contract(s)/Grant(s): NAG5-10730; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In-situ identification of trace minerals, ices, or organics in planetary samples may be difficult with panchromatic microscopic imagery and spot spectroscopy. The panchromatic imagery acquired by a microscopic imager provides morphological information and albedo, but these are generally insufficient for unambiguous identification. The spatially-averaged spectra acquired by a nonimaging (point- or spot-) spectrometer may enable identification of the major components but identification of unknown trace components is difficult at best. With our Compact Micro-Imaging Spectrometer (CMIS), however, we acquire spectroscopic data in an imaging format at microscopic scales. The distinct spectra of individual grains, provided by our approach, make detection and identification possible even for trace components in regolith or heterogeneous samples.
Derived from text
Imaging Spectrometers; Imaging Techniques; Spectrometers; Spectroscopy; Planetary Composition; Microinstrumentation

20040062502 Bern Univ., Bern, Switzerland
The Beagle 2 Microscope
Luethi, B. S.; Thomas, N.; Hviid, S. F.; Keller, H. U.; Markiewicz, W. J.; Bluemchen, T.; Smith, P. H.; Tanner, R.; Oquest, C.; Reynolds, R., et al.; Lunar and Planetary Science XXXV: Missions and Instruments: Hopes and Hope Fulfilled; 2004; 2 pp.; In English; See also 20040062499; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The microscope for the Beagle 2 lander, which was launched as part of the European Space Agency's Mars Express

mission on 2 June 2003, is able to provide images of the Martian surface at around 6 microns resolution. It provides optical images of the surface of Mars at a resolution 5 times higher than any other experiment currently planned. The device has a working distance of 12 mm and uses a set of 12 light-emitting diodes which surround the optical aperture to illuminate the sample in 4 colors. The target is brought into focus using a translation stage. We describe the scientific objectives and present measurements of terrestrial samples for illustration. We also give a brief summary of the design of the microscope.
Author
Mars Express; Spacecraft Instruments; Microscopes

20040062510 Cornell Univ., Ithaca, NY, USA
Mars Odyssey THEMIS-VIS Calibration
McConnochie, T. H.; Bell, J. F., III; Christensen, P. R.; Malin, M.; Caplinger, M.; Ravine, M.; Mehall, G. L.; Silverman, S. H.; Hayes, A. G.; Dobrea, E. Z. Noe; Savransky, D., et al.; Lunar and Planetary Science XXXV: Missions and Instruments: Hopes and Hope Fulfilled; 2004; 2 pp.; In English; See also 20040062499; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Visible Imaging Subsystem (VIS) on the NASA Mars Odyssey spacecraft's THEMIS instrument has been obtaining high spatial resolution images of Mars since mapping began in February 2002. VIS is a 1024 x 1024 interline transfer CCD camera. It acquires multispectral or monochrome images using any combination of 5 narrowband (approx. 50 nm FWHM) interference filters that are centered at 425, 540, 654, 749, and 860 nm. These filters are bonded directly to the CCD, each covering approximately 200 CCD pixels along the orbit track and spanning the entire detector in the cross-track direction. VIS images are contaminated by a significant amount of light leaking around the edges of the filters. This light accumulates both in the photosites during the nominal exposure period, and in the interline registers during the readout process. Here, we summarize the process of calibrating VIS images to remove these light leakage effects and to produce estimates of absolute radiance, focusing on the limitations of the procedure that must be taken into account when interpreting the data. Detailed documentation of the calibration process can be found at http://pdsimg.jpl.nasa.gov/Atlas/DocLinks.html#2001_MARS_ODYSSEY.
Author
2001 Mars Odyssey; Spacecraft Instruments; Calibrating; CCD Cameras

20040062524 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Electron-induced Luminescence and X-Ray Spectrometer (ELXS) System Development
Wilcox, J. Z.; Urgiles, E.; Douglas, S.; George, T.; Lunar and Planetary Science XXXV: Missions and Instruments: Hopes and Hope Fulfilled; 2004; 2 pp.; In English; See also 20040062499; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The ELXS concept is a novel, portable, micro-instrument targeted for rapid, non-contact detection of chemical-elemental composition and mineralogic signatures of past and extinct life on the surface of planetary bodies such as Mars. The ELXS builds on the JPL-pioneered concept of electron-induced x-ray fluorescence (XRF) analysis to determine chemical-elemental composition of samples in situ in ambient atmosphere. The analysis is performed in a manner similar to a laboratory electron microprobe; however, since they do not need to be drawn into the vacuum of the electron source, the inspected samples are in their pristine state. The enabling technology for in situ operation is a microfabricated electron transmissive membrane that isolates the source vacuum from the planetary atmosphere. An electron beam generated in the slectron source is transmitted through the membrane and excites characteristic XRF from surfaces of irradiated samples. In comparison to other in situ XRF techniques (such as the Alpha Proton X-ray Spectrometry and X-Ray Induced Fluorescence) ELXS offers short (minute-scale) spectrum acquisition time and (consequently) low energy (approx. 50 J) consumption per acquired spectrum, and a much higher spatial resolution (irradiated spot size less than 1 mm). If implemented as a complementary instrument to those techniques, AEXS would extend their spatial resolution from the cm to the sub-mm scale. In addition, by varying the working (membrane-sample) distance from a mm to several cm, the size of the irradiated spot can be varied from several hundred micrometers to about one cm, allowing scientists to perform observations on a series of reducing scales.
Derived from text
Chemical Composition; Microinstrumentation; Signatures; Systems Engineering; X Ray Spectrometers; Electroluminescence; Planetary Composition

20040062532 NASA Kennedy Space Center, Cocoa Beach, FL, USA

Preliminary Results of a New Type of Surface Property Measurement Ideal for a Future Mars Rover Mission

Buhler, C. R.; Calle, C. I.; Mantovani, J. G.; Buehler, M. G.; Nowicki, A. W.; Ritz, M.; Lunar and Planetary Science XXXV: Missions and Instruments: Hopes and Hope Fulfilled; 2004; 2 pp.; In English; See also 20040062499; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The success of the recent rover missions to Mars has stressed the importance of acquiring the maximum amount of geological information with the least amount of data possible. We have designed, tested and implemented special sensors mounted on a rover s wheel capable of detecting minute changes in surface topology thus eliminating the need for specially-made science platforms. These sensors, based on the previously designed, flight qualified Mars Environmental Compatibility Assessment (MECA) Electrometer, measure the static electricity (triboelectricity) generated between polymer materials and the Martian regolith during rover transverses. The sensors are capable of detecting physical changes in the soil that may not be detectable by other means, such as texture, size and moisture content. Although triboelectricity is a surface phenomenon, the weight of a rover will undoubtedly protrude the sensors below the dust covered layers, exposing underlying regolith whose properties may not be detectable through other means.

Author

Wheels; Topology; Surface Properties; Roving Vehicles; Planetary Geology; Mars Surface

20040065774 NASA Langley Research Center, Hampton, VA, USA

Pressure and Temperature Sensitive Paint Field System

Sprinkle, Danny R.; Obara, Clifford J.; Amer, Tahani R.; Faulcon, Nettie D.; Carmine, Michael T.; Burkett, Cecil G.; Pritchard, Daniel W.; Oglesby, Donald M.; April 2004; 39 pp.; In English

Report No.(s): NASA/TM-2004-213020; L-183774; No Copyright; Avail: CASI; A03, Hardcopy

This report documents the Pressure and Temperature Sensitive Paint Field System that is used to provide global surface pressure and temperature measurements on models tested in Langley wind tunnels. The system was developed and is maintained by Global Surface Measurements Team personnel of the Data Acquisition and Information Management Branch in the Research Facilities Services Competency. Descriptions of the system hardware and software are presented and operational procedures are detailed.

Author

Pressure Sensitive Paints; Temperature Sensitive Paints; Wind Tunnels; Electronic Equipment; Photometry; Spectrophotometry

20040068069 NASA Marshall Space Flight Center, Huntsville, AL, USA

Machine Vision Applied to Navigation of Confined Spaces

Briscoe, Jeri M.; Broderick, David J.; Howard, Ricky; Corder, Eric L.; March 05, 2004; 8 pp.; In English; SPIE Defense and Security Symposium 2004, 12-16 Apr. 2004, Kissimee, FL, USA

Contract(s)/Grant(s): CDDF-CD-CT-CC-C6-03; No Copyright; Avail: CASI; A02, Hardcopy

The reliability of space related assets has been emphasized after the second loss of a Space Shuttle. The intricate nature of the hardware being inspected often requires a complete disassembly to perform a thorough inspection which can be difficult as well as costly. Furthermore, it is imperative that the hardware under inspection not be altered in any other manner than that which is intended. In these cases the use of machine vision can allow for inspection with greater frequency using less intrusive methods. Such systems can provide feedback to guide, not only manually controlled instrumentation, but autonomous robotic platforms as well. This paper serves to detail a method using machine vision to provide such sensing capabilities in a compact package. A single camera is used in conjunction with a projected reference grid to ascertain precise distance measurements. The design of the sensor focuses on the use of conventional components in an unconventional manner with the goal of providing a solution for systems that do not require or cannot accommodate more complex vision systems.

Author

Computer Vision; Robotics; Inspection

37
MECHANICAL ENGINEERING

Includes mechanical devices and equipment; machine elements and processes. For cases where the application of a device or the host vehicle is emphasized see also the specific category where the application or vehicle is treated. For robotics see *63 Cybernetics, Artificial Intelligence, and Robotics*; and *54 Man/System Technology and Life Support*.

20040066106 NASA Ames Research Center, Moffett Field, CA, USA
Human-Interaction Challenges in UAV-Based Autonomous Surveillance
Freed, Michael; Harris, Robert; Shafto, Michael G.; February 06, 2004; 6 pp.; In English; American Association for Artificial Intelligence Spring Symposium, 21-23 Mar. 2004, Palo Alto, CA, USA; Copyright; Avail: CASI; A02, Hardcopy

Autonomous UAVs provide a platform for intelligent surveillance in application domains ranging from security and military operations to scientific information gathering and land management. Surveillance tasks are often long duration, requiring that any approach be adaptive to changes in the environment or user needs. We describe a decision- theoretic model of surveillance, appropriate for use on our autonomous helicopter, that provides a basis for optimizing the value of information returned by the UAV. From this approach arise a range of challenges in making this framework practical for use by human operators lacking specialized knowledge of autonomy and mathematics. This paper describes our platform and approach, then describes human-interaction challenges arising from this approach that we have identified and begun to address.
Author
Surveillance; Military Operations; Decision Theory; Man Machine Systems

39
STRUCTURAL MECHANICS

Includes structural element design, analysis and testing; dynamic responses of structures; weight analysis; fatigue and other structural properties; and mechanical and thermal stresses in structures. For applications see *05 Aircraft Design, Testing and Performance*; and *18 Spacecraft Design, Testing and Performance*.

20040062464 Rhode Island Univ., Kingston, RI, USA
Fiber Reinforcement of Concrete (February 2004)
Feb. 2004; 66 pp.; In English
Report No.(s): PB2004-104758; No Copyright; Avail: CASI; A04, Hardcopy

A comprehensive experimental program on pullout behavior of polypropylene fibers from cementitious matrices is described. The parameters investigated include the effect of embedded length on the pullout characteristics, the development of the interfacial bond with age of curing of matrix and the effect of exposure to degrading environments like seawater and salt water on the interfacial bond between the fibers and cementitious matrix. The aim of these experiments was to understand the properties of fiber/matrix interface, which are of primary significance for the overall behavior of fiber reinforced cement based composites. Polypropylene fibers have a weak bond with cementitious matrix because of smooth surface of fibers, which does not allow for sufficient friction to develop between the two. In this study a new method to improve the frictional bond by means of mechanical indentations of fibers was also proposed. The bonding performance was characterized by means of pullout tests of the plain and modified fibers from a cementitious matrix. An optimum level of fiber modification for maximization of bond efficiency was determined experimentally. Also, recognizing the fact that fibers become most effective only in the post cracking phase of the matrix, a test method called Wedge splitting test was chosen for testing fracture characteristics. This test method allows stable crack propagation, providing valuable information about the post cracking behavior of concrete. Special molds were prepared for making the samples and appropriate fixtures for the experimental setup were fabricated. An experimental scheme to understand the effect of degrading environments on cracked concrete structures was initiated. Wedge splitting tests were used to initiate cracks in concrete samples in a controlled manner. The samples were exposed to salt water to simulate seawater environment. Testing of the control samples has been carried out. The samples exposed to salt water will be tested after one-year exposure.
NTIS
Polypropylene; Concretes; Fiber-Matrix Interfaces; Crack Propagation; Reinforcing Fibers

20040062479 Lawrence Livermore National Lab., Livermore, CA
Kull ALE: II. Grid Motion on Unstructured Arbitrary Polyhedral Meshes
Anninos, P.; Feb. 11, 2002; 18 pp.; In English
Report No.(s): DE2004-15006517; UCRL-ID-147297-P2; No Copyright; Avail: Department of Energy Information Bridge

Several classes of mesh motion algorithms are presented for the remap phase of unstructured mesh ALE codes. The methods range from local shape optimization procedures to more complex variational minimization methods applied to arbitrary unstructured polyhedral meshes necessary for the Kull code.
NTIS
Algorithms; Shape Optimization

20040062494 Lawrence Livermore National Lab., Livermore, CA
Kull ALE: I. Unstructured Mesh Advection, Interface Capturing, and Multiphase 2T RHD with Material Interfaces
Anninos, P.; Feb. 11, 2002; 22 pp.; In English
Report No.(s): DE2004-15006516; UCRL-ID-147297-P1; No Copyright; Avail: Department of Energy Information Bridge
Several advection algorithms are presented within the remap framework Tor unstructured mesh ALE codes. The methods discussed include a generic advection scheme based on a finite volume approach, and three groups of algorithms for the treatment of material boundary interfaces. The interface capturing algorithms belong to the Volume of Fluid (VoF) class of methods to approximate material interfaces from the local fractional volume of fluid distribution in arbitrary unstructured polyhedral meshes appropriate for the Kull code. Also presented are several schemes for extending single material radiation diffusion solvers to account for multi-material interfaces.
NTIS
Advection; Interfaces; Grid Generation (Mathematics)

20040066072 NASA Langley Research Center, Hampton, VA, USA
The Effect of Basis Selection on Thermal-Acoustic Random Response Prediction Using Nonlinear Modal Simulation
Rizzi, Stephen A.; Przekop, Adam; March 30, 2004; 17 pp.; In English; 45th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, 19-22 Apr. 2004, Palm Springs, CA, USA
Contract(s)/Grant(s): 23-794-40-4A
Report No.(s): AIAA Paper 2004-1554; No Copyright; Avail: CASI; A03, Hardcopy
The goal of this investigation is to further develop nonlinear modal numerical simulation methods for prediction of geometrically nonlinear response due to combined thermal-acoustic loadings. As with any such method, the accuracy of the solution is dictated by the selection of the modal basis, through which the nonlinear modal stiffness is determined. In this study, a suite of available bases are considered including (i) bending modes only; (ii) coupled bending and companion modes; (iii) uncoupled bending and companion modes; and (iv) bending and membrane modes. Comparison of these solutions with numerical simulation in physical degrees-of-freedom indicates that inclusion of any membrane mode variants (ii - iv) in the basis affects the bending displacement and stress response predictions. The most significant effect is on the membrane displacement, where it is shown that only the type (iv) basis accurately predicts its behavior. Results are presented for beam and plate structures in the thermally pre-buckled regime.
Author
Bending Fatigue; Acoustics; Nonlinearity; Numerical Analysis; Temperature Effects

20040066101 NASA Langley Research Center, Hampton, VA, USA
Experimental and Numerical Correlation of Gravity Sag in Solar Sail Quality Membranes
Black, Jonathan T.; Leifer, Jack; DeMoss, Joshua A.; Walker, Eric N.; Belvin, W. Keith; [2004]; 9 pp.; In English; 45th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference, 19-22 Apr. 2004, Palm Springs, CA, USA
Contract(s)/Grant(s): 23-755-06-00
Report No.(s): AIAA Paper 2004-1579; Copyright; Avail: CASI; A02, Hardcopy
Solar sails are among the most studied members of the ultra-lightweight and inflatable (Gossamer) space structures family due to their potential to provide propellentless propulsion. They are comprised of ultra-thin membrane panels that, to date, have proven very difficult to experimentally characterize and numerically model due to their reflectivity and flexibility, and the effects of gravity sag and air damping. Numerical models must be correlated with experimental measurements of sub-scale solar sails to verify that the models can be scaled up to represent full-sized solar sails. In this paper, the surface shapes of five horizontally supported 25 micron thick aluminized Kapton membranes were measured to a 1.0 mm resolution using photogrammetry. Several simple numerical models closely match the experimental data, proving the ability of finite element simulations to predict actual behavior of solar sails.
Author
Solar Sails; Membrane Structures; Gravitational Effects

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GEOSCIENCES (GENERAL)

Includes general research topics related to the Earth sciences, and the specific areas of petrology, mineralogy, and general geology. For other specific topics in geosciences see *categories 42 through 48*.

20040065044 Geoscience Australia, Canberra, Australia
The Arkaroola Mars Analogue Region, South Australia
Clarke, Jonathan D. A.; Thomas, Matilda; Norman, Marc; Lunar and Planetary Science XXXV: Mars: Remote Sensing and Terrestrial Analogs; 2004; 2 pp.; In English; See also 20040065031; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Arkaroola region was selected out of six candidate regions as a prime Mars analogue area by the Mars Society of Australia (MSA). The main region of interest includes the immediate Arkaroola area and adjacent Mt Painter Wildlife Sanctuary in the northern Flinders Ranges, and surrounding hinterland. The region comprises many notable Mars analogue landscape features including the dry salt lakes of Lake Frome and Lake Eyre, numerous mound springs, dunes fields of the Strzelecki Desert, and Sturts Stony Desert. The Arkaroola region is of substantial technical and scientific interest, summarized below.
Author
Mars Surface; Earth Surface; Analogs; Planetary Geology

20040065770 Yamaguchi Univ., Japan
Ni Contents by Non-Destructive In-Situ XRF Method of Takamatsu-Kagawa Crater District in Japan
Miura, Y.; Koga, N.; Nakamura, A.; Lunar and Planetary Science XXXV: Impacts: Modeling and Observations; 2004; 2 pp.; In English; See also 20040065753; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Takamatsu-Kagawa buried structure with ca.8 km size which is located in Busshozan-Cho, Takamatsu City, Kagawa Prefecture, Shikoku Islands, Japan (in center site) to Kagawa-Gun, Kagawa Prefecture (in southern part), has been reported by geological, petrologic and mineralogical data on surface and 1,750m in depth. The center of the structure is Latitude 34.3 and Longitude 134.05. The main purpose of this paper is 1) to describe new geological map of the surface (which is considered to be deep drilled data), 2) to analyze Ni contents of both samples with new type X-ray fluorescence (XRF) instrument, and 3) to estimate depth location from Ni contents of surface samples around lifted intrusions.
Derived from text
Nickel; Meteorite Craters; Meteoritic Damage; Mapping

20040065787 California Inst. of Tech., Pasadena, CA, USA
Using Complexity Analysis to Distinguish Field Images of Stromatoloids from Surrounding Rock Matrix in 3.45 Ga Strelley Pool Chert, Western Australia
Storrie-Lombardi, M.; Brown, A. J.; Lunar and Planetary Science XXXV: Astrobiology; 2004; 2 pp.; In English; See also 20040065785; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The biogenicity of stromatolitic features in the Early Archaean Strelley Pool Chert have recently been the subject of some debate. If biogenic, these features would be a valuable source of evidence for Earth s earliest biosphere. If abiogenic, the features may still be able to provide information about distinguishing biogenic from abiogenic stromatoloids. A new method developed for the remote identification of stromatolites and subsequent quantification of their likely biogenicity is herein described. Initial results and future directions are presented. Further applications to planetary missions are outlined. [6].
Derived from text
Paleontology; Quartz; Rocks; Precambrian Period; Biosphere

20040065879 Arizona Univ., Tucson, AZ, USA
Impact-induced Hydrothermal System at the Sudbury Crater: Duration, Temperatures, Mechanics, and Biological Implications
Abramov, O.; Kring, D. A.; Lunar and Planetary Science XXXV: Impacts on Mars and Earth; 2004; 2 pp.; In English; See also 20040065868; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Current research suggests that impact-generated hydrothermal systems may have played an important role on early Earth. Several lines of evidence point to a dramatic increase in the number of impact events at approx. 3.9 Ga, which coincides remarkably well with the earliest isotopic evidence of life at approx. 3.85 Ga. This period, often referred to as the Lunar Cataclysm, lasted 20 to 200 million years, during which time hydrothermal heat generated by impact events may have exceeded that generated by volcanic activity. These impacts would have resurfaced most of the Earth, and may have vaporized the Earth's oceans, virtually eliminating surface habitats. At the same time, an abundance of subsurface habitats in the form of large subsurface hydrothermal systems would have been created. These habitats could have provided sanctuary for existing life or perhaps the site of life's origin. Genetic evidence in the form of phylogenies that suggest that Archaea, Bacteria, and Eukarya have a common ancestor comparable to present-day thermophilic or hyperthermophilic organisms, further underscores the potential importance of hydrothermal systems in general, and impact-induced hydrothermal systems in particular, at the dawn of life. Several hydrothermal systems generated at terrestrial impact craters have been identified based on mineralogical evidence and have been suggested to occur on Mars as well. Perhaps the most important question in assessing the role of impact-induced hydrothermal systems in these and earlier (approx. 3.9 Ga) craters is that of system lifetime. The lifetimes of hydrothermal systems in craters 20 to 200 km in diameter are 10(exp 3) to 10(exp 6) years if purely conductive cooling is assumed. It has been suggested that convective cooling by circulating water would cool the crater faster than purely conductive cooling, but specific effects of circulating water on crater cooling are not thoroughly understood. In order to better constrain the expected lifetimes of these systems and further understand their mechanics, a finite-difference computer simulation is used to evaluate the additional effects of convective cooling. We have applied this code to the Sudbury crater, where the results can be integrated with constraints from the rock record.
Author
Hydrothermal Systems; Meteorite Craters; Water Flow; Heat Transmission; Computer Programs

20040066032 Kivelantie, Keuruu, Finland
Keurusselkae: A New Impact Structure in Central Finland
Hietala, S.; Moilanen, J.; Lunar and Planetary Science XXXV: Impacts; 2004; 2 pp.; In English; See also 20040066027; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We have discovered evidences of a previously unknown impact structure in Finland. The structure is hereafter called as Keurusselk impact structure after the lake Keurusselk which is partly covering it in NE and SW directions. Collected rock samples show evidences of shock metamorphism i.e. shatter cones and planar deformation features. The Keurusselk impact structure is covering at least 9.5 km wide round area. The Keurusselk impact structure is in Central Finland, 220 km north from Helsinki and 60 km west from Jyv skyl . It is only 32 km west from a small Karikkoselk impact structure found in 1995 [2]. The impact structure is situated on a broad land area that divides the lake Keurusselk into two narrow waterways (Fig. 1). The lake Keurusselk is a 27 km long lake between towns Keuruu and M ntt and a part of it is in Vilppula. Shatter cones are present in outcrops throughout the 9.5 km diameter structure. However, shatter cones are restricted inside a 12 km wide area, so the diameter of shatter cone area seems to be between 9.5 km and 12 km. Shatter cone features were found in situ at 25 places. In many places they are well developed and it is easy to make difference between them and tectonic deformation surfaces. Orientations of measured shatter cone features point roughly to the centre of the structure. Shatter cones were observed in porphyritic granites, metamorphic rocks such as gneisses and also in granodiorites and metavolcanic rocks. Some of rocks were strongly mylonited.
Author
Geology; Finland; Deformation; Tectonics

20040066046 Tokyo Univ., Hongo, Japan
Evaluation of Cooling Rate Calculated by Diffusional Modification of Chemical Zoning: Different Initial Profiles for Diffusion Calculation
Miyamoto, M.; Monkawa, A.; Koizumi, E.; Mikouchi, T.; Lunar and Planetary Science XXXV: Meteorites; 2004; 2 pp.; In English; See also 20040066033; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Since chemical zoning in minerals provides information on their thermal history, it is often applied to calculating the cooling rate or burial depth by solving the diffusion equation on the assumption that chemical zoning is produced by diffusional modification or homogenization except for primary igneous zoning. There are several factors to have influence on the result. For example, although the atomic diffusion coefficient in minerals is one of the most important factors, there is often much difference among the reported values of the diffusion coefficient of an atom in a mineral. It is sometimes difficult to

determine the initial zoning profile for starting the diffusion calculation, because the zoning profile now observed is the result of diffusional modification or homogenization. It is, therefore, necessary to examine the difference in the cooling rate calculated by diffusional modification due to the difference in the initial profile. We, in this abstract, evaluate the cooling rate calculated by using the different initial (starting) zoning profiles for the Fe-Mg chemical zoning profile of pallasite olivine used in our previous study.
Author
Chemical Composition; Diffusion; Homogenizing; Inhomogeneity

20040066049 California Univ., Los Angeles, CA, USA
Clues to the Formation of PV1, an Enigmatic Carbon-rich Chondritic Clast from the Plainview H-Chondrite Regolith Breccia
Rubin, Alan E.; Trigo-Rodriguez, Joseph M.; Kunihiro, Takuya; Kallenmeyn, Gregory W.; Wasson, John T.; Lunar and Planetary Science XXXV: Meteorites; 2004; 2 pp.; In English; See also 20040066033; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Chondritic clast PV1 from the Plainview H-chondrite regolith breccia is a subrounded, 5-mm-diameter unequilibrated chondritic fragment that contains 13 percent C; the carbon is poorly graphitized and occurs mainly within irregularly shaped 30-400- m-size opaque patches. Three similar C-rich chondritic clasts in other H-chondrite regolith breccias have been found: DT1 and DT2 from Dimmitt and WN1 from Weston. The clasts are enigmatic for two principal reasons: (1) they appear to lack the fine-grained silicate-rich matrix material that occurs in type-3 ordinary chondrites (OC) and carbonaceous chondrites, and (2) their bulk C contents (6-13 wt.percent) are far higher than those in the most C-rich meteorites (e.g., 2.8 wt. percent C in CI Orgueil and 4.1 wt.percent C in the North Haig ureilite). Our new petrographic observations, SEM studies and previously unpublished INAA data on PV1 combined with literature data directly address these problems and shed new light on the formation of C-rich chondritic clasts.
Author
Neutron Activation Analysis; Matrix Materials; Chondrites; Carbon; Regolith; Breccia

20040068120
Magnetic Fe, Si, Al-Rich Impact Spherules from the P-T Boundary Layer at Graphite Peak, Antarctica
Petaev, M. I.; Jacobsen, S. B.; Basu, A. R.; Becker, L.; Lunar and Planetary Science XXXV: Effects of Impact and Awe; January 2004; 2 pp.; In English; Copyright; Avail: CASI; C01, CD-ROM; A01, Hardcopy

The geological boundary between Triassic and Permian strata coincides with the greatest life extinction in the Earth's history. Although the cause of the extinction is still the subject of intense debates, recent discoveries in the P-T boundary layer of shocked quartz grains, fullerenes with the extraterrestrial noble gases, Fe metal nuggets, and chondritic meteorite fragments all point to a powerful collision of Earth with a celestial body in the late Permian. Here we report the discovery of magnetic Fe, Si, Al-rich impact spherules which accompany the chondritic meteorite fragments in some samples from the P-T boundary layer at Graphite Peak, Antarctica.
Author
Spherules; Impact Melts; Magnetic Materials; Iron; Silicon; Aluminum

43
EARTH RESOURCES AND REMOTE SENSING

Includes remote sensing of earth features, phenomena and resources by aircraft, balloon, rocket, and spacecraft; analysis of remote sensing data and imagery; development of remote sensing products; photogrammetry; and aerial photography. For related instrumentation see *35 Instrumentation and Photography*.

20040065829 Boston Univ., Boston, MA, USA
Land Surface Albedo from MERIS Reflectances Using MODIS Directional Factors
Schaaf, Crystal L. B.; Gao, Feng; Strahler, Alan H.; [2004]; 19 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): NAG5-11263; No Copyright; Avail: CASI; A03, Hardcopy

MERIS Level 2 surface reflectance products are now available to the scientific community. This paper demonstrates the production of MERIS-derived surface albedo and Nadir Bidirectional Reflectance Distribution Function (BRDF) adjusted reflectances by coupling the MERIS data with MODIS BRDF products. Initial efforts rely on the specification of surface anisotropy as provided by the global MODIS BRDF product for a first guess of the shape of the BRDF and then make use

all of the coincidently available, partially atmospherically corrected, cloud cleared, MERIS observations to generate MERIS-derived BRDF and surface albedo quantities for each location. Comparisons between MODIS (aerosol-corrected) and MERIS (not-yet aerosol-corrected) surface values from April and May 2003 are also presented for case studies in Spain and California as well as preliminary comparisons with field data from the Devil's Rock Surfrad/BSRN site.
Author
Earth Surface; Albedo; MODIS (Radiometry)

20040065950
A Passive Method for Detecting Vegetation Stress from Orbit: Chlorophyll Fluorescence Spectra from Fraunhofer Lines
Theisen, Arnold F.; August 15, 2000; 9 pp.; In English; RS2000, 22-25 Oct. 2000, Corpus Christi, TX, USA
Report No.(s): SE-2000-08-00006; No Copyright; Avail: CASI; A02, Hardcopy

Solar-stimulated chlorophyll fluorescence measured with the Fraunhofer line depth method has correlated well with vegetation stress in previous studies. However, the instruments used in those studies were limited to a single solar absorption line (e.g. 656.3 nm), obviating the red/far-red ratio (R/FR) method. Optics and detector technology have reached the level whereby multiple, very narrow Fraunhofer lines are resolvable. Thirteen such lines span the visible spectrum in the red to far-red region where chlorophyll fluorescence occurs. Fluorescence intensities at the 13 Fraunhofer line wavelengths were used to model emission spectra. The source data were collected for summer and fall bean crops (Phaseolus vulgaris L.) subjected to various levels of nitrogen fertilization. The intensities were adjusted to account for Fraunhofer line depth and atmospheric transmittance. Multiple R/FR fluorescence ratios, calculated from the modeled fluorescence spectra, correlated strongly with leaf chlorophyll concentration and well with applied nitrogen. The ratio yielding the best correlation with chlorophyll utilized red fluorescence at the 694.5 nm Fraunhofer line and farred fluorescence at the 755.6 nm Fraunhofer line. Twenty R/FR ratios, each evaluated for the maximum differential between low and high (optimal) nitrogen treatments, ranked higher in some cases and lower in others, possibly related to the time of year the crops were grown and the stage of growth of the crops. Ratios with 728.9 nm and 738.9 nm in the denominator consistently ranked in the lowest and next lowest quartile, respectively. Ratios of the 656.3 nm Fraunhofer line and the 755.6 nm line consistently ranked highest for the summer crop. Ratios with 755.6 nm in the denominator ranked in the upper quartile for 10 out of 12 measurement dates. Differences in ratio ranking indicate that physiological conditions may be estimated using selected ratios of Fraunhofer lines within the context of R/FR analysis. A passive instrument designed to monitor R/FR chlorophyll fluorescence (i.e. vegetation stress) from orbit could be built today.
Author
Chlorophylls; Fluorescence; Plant Stress

20040068086 University of South Florida, Saint Petersburg, FL, USA
High Spectral Resolution MODIS Algorithms for Ocean Chlorophyll in Case II Waters
Carder, Kendall L.; May 2004; 85 pp.; In English
Contract(s)/Grant(s): NAS5-31716; No Copyright; Avail: CASI; A05, Hardcopy

The Case 2 chlorophyll a algorithm is based on a semi-analytical, bio-optical model of remote sensing reflectance, R(sub rs)(lambda), where R(sub rs)(lambda) is defined as the water-leaving radiance, L(sub w)(lambda), divided by the downwelling irradiance just above the sea surface, E(sub d)(lambda,0(+)). The R(sub rs)(lambda) model (Section 3) has two free variables, the absorption coefficient due to phytoplankton at 675 nm, a(sub phi)(675), and the absorption coefficient due to colored dissolved organic matter (CDOM) or gelbstoff at 400 nm, a(sub g)(400). The R(rs) model has several parameters that are fixed or can be specified based on the region and season of the MODIS scene. These control the spectral shapes of the optical constituents of the model. R(sub rs)(lambda(sub i)) values from the MODIS data processing system are placed into the model, the model is inverted, and a(sub phi)(675), a(sub g)(400) (MOD24), and chlorophyll a (MOD21, Chlor_a_3) are computed. Algorithm development is initially focused on tropical, subtropical, and summer temperate environments, and the model is parameterized in Section 4 for three different bio-optical domains: (1) high ratios of photoprotective pigments to chlorophyll and low self-shading, which for brevity, we designate as 'unpackaged'; (2) low ratios and high self-shading, which we designate as 'packaged'; and (3) a transitional or global-average type. These domains can be identified from space by comparing sea-surface temperature to nitrogen-depletion temperatures for each domain (Section 5). Algorithm errors of more than 45% are reduced to errors of less than 30% with this approach, with the greatest effect occurring at the eastern and polar boundaries of the basins. Section 6 provides an expansion of bio-optical domains into high-latitude waters. The 'fully packaged' pigment domain is introduced in this section along with a revised strategy for implementing these variable packaging domains. Chlor_a_3 values derived semi-analytically and Chlor_a_2 values derived empirically using the O Reilly

et al. OC3M algorithm from MODIS Terra radiances are compared to field chlorophyll-a concentrations in Sections 7 and 8. Derived from text
MODIS (Radiometry); Algorithms; Chlorophylls; Oceans; Water Color

20040068118 NASA Stennis Space Center, Bay Saint Louis, MS, USA, Lockheed Martin Space Operations, Bay Saint Louis, MS, USA
Nutrient Stress Detection in Corn Using Neural Networks and AVIRIS Hyperspectral Imagery
Estep, Lee; January 05, 2001; 1 pp.; In English; 2001 AVIRIS Earth Science and Applications Workshop, 27 Feb. - 2 Mar. 2001, Pasadena, CA, USA
Contract(s)/Grant(s): NAS13-650
Report No.(s): SE-2001-01-00003-SSC; No Copyright; Avail: Other Sources; Abstract Only

AVIRIS image cube data has been processed for the detection of nutrient stress in corn by both known, ratio-type algorithms and by trained neural networks. The USDA Shelton, NE, ARS Variable Rate Nitrogen Application (VRAT) experimental farm was the site used in the study. Upon application of ANOVA and Dunnett multiple comparsion tests on the outcome of both the neural network processing and the ratio-type algorithm results, it was found that the neural network methodology provides a better overall capability to separate nutrient stressed crops from in-field controls.
Author
Corn; Plant Stress; Nutrients; Neural Nets; Remote Sensing

44
ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells; and solar, geothermal, windpower, and waterwave conversion systems; energy storage; and traditional power generators. For technologies related to nuclear energy production see *73 Nuclear Physics*. For related information see also *07 Aircraft Propulsion and Power; 20 Spacecraft Propulsion and Power*, and *28 Propellants and Fuels*.

20040067853 Colorado School of Mines, Golden, CO
Structure of Silicon Based Thin Film Solar Cell Materials. Annual Technical Progress Report, 1 April 2002-31 August 2002
Williamson, D. L.; Jan. 2004; 82 pp.; In English
Report No.(s): DE2004-15006546; No Copyright; Avail: Department of Energy Information Bridge

The purpose of this research is to achieve a better understanding to improve materials used as the intrinsic layers of amorphous and microcrystalline silicon-based solar cells. Fundamental structural properties will be investigated on atomic and nano-scales. A powerful combination of techniques will be used: analytical high-resolution transmission electron microscopy (HRTEM), including special associated spectroscopic methods, small-angle scattering techniques (SAXS, ASAXS, SANS), and conventional wide-angle X-ray diffraction (XRD).
NTIS
Solar Cells; Amorphous Silicon; Thin Films

20040067862 First Solar, LLC, Perrysbury, OH, USA
Specific PVMaT R&D in CdTe Product Manufacturing. Final Subcontractor Report, March 2003
Bohland, J.; McMaster, A.; Henson, S.; Hanak, J.; Jan. 2004; 78 pp.; In English
Report No.(s): DE2004-15006545; No Copyright; Avail: Department of Energy Information Bridge

Results of a 3+ year subcontract are presented. The research was conducted under Phase 5A2 of the subcontract. The three areas of effort in the subcontract were (1) manufacturing line improvements, (2) product readiness, and (3) environmental, safety, and health programs. The subcontract consisted of three phases, approximately 1 year each.
NTIS
Manufacturing; Cadmium Tellurides

45
ENVIRONMENT POLLUTION

Includes atmospheric, water, soil, noise, and thermal pollution.

20040065755 Universidade Federal de Ouro Preto, Ouro Preto, Brazil
Brazilian Impact Craters: A Review
Ramano, R.; Crosta, A. P.; Lunar and Planetary Science XXXV: Impacts: Modeling and Observations; 2004; 2 pp.; In English; See also 20040065753; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Brazilian territory covers 8.5 million sq km, a significant proportion of which comprises terrains older than Mesozoic that represent quite stable tectonic regimes for the past 500 million years. Considering this scenario, it should be expected that a large number of eroded impact craters would be known in Brazil, as in other countries that have similar geological conditions, such as Canada and Australia. However, the current record of proven and possible impact sites in Brazil does not go beyond a dozen, almost all of them being well exposed circular structures. The reasons for this modest number are the lack of basic geological mapping at scales that would allow the recognition of such structures and the fact that no specific surveys for impact sites were ever conducted in the country. Also, most of the country is subject to tropical climate, favoring the occurrence of intense weathering processes. This does not favor the preservation of geomorphologically prominent features and allows the development of dense vegetation cover, making the recognition of candidate impact sites even more difficult. A brief review of the currently known astroblemes in Brazil, and of some possible ones, is presented here.
Derived from text
Craters; Tectonics; Thematic Mapping; Terrain

20040066104 Lawrence Livermore National Lab., Livermore, CA
National Atmospheric Release Advisory Center Internet Client (NARACiClient) On-line Help System Documentation
Belles, R.; Fischer, K.; Foster, C.; Foster, K.; Gash, J.; Jul. 23, 2001; 28 pp.; In English
Report No.(s): DE2004-15006863; UCRL-MA-146970; No Copyright; Avail: Department of Energy Information Bridge

No abstract available
Internets; Atmospheric Turbulence

20040067927 National Inst. for Occupational Safety and Health, Cincinnati, OH, USA
Third Supplement to NIOSH Manual of Analytical Methods (NMAM(Trade Name)) Fourth Edition
Schlecht, P. C.; O'Connor, P. F.; Mar. 15, 2003; 636 pp.; In English
Report No.(s): PB2004-105028; DHHS (NIOSH)/PUB-2003-154; No Copyright; Avail: CASI; A99, Hardcopy

NMAM(R) is a compilation of methods for sampling and analysis of contaminants in workplace air, and in the bodily fluids of workers who are occupationally exposed to that air. These methods have been developed specifically to have adequate sensitivity to detect the lowest concentrations and sufficient flexibility of range to detect concentrations exceeding safe levels of exposure, as regulated by OSHA and recommended by NIOSH. The Threshold Values (TLV(tm)s) and Biological Exposure Indices (BEI(tm)s) of the American Conference of Governmental Industrial Hygienists (ACGIH) are also cited.
NTIS
Air Sampling; Contaminants; Exposure

20040067940 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA, National Petroleum Technology Office, Tulsa, OK, USA, Independent Petroleum Association of Mountain States, Denver, CO, USA
Characterizing the Formation of Secondary Organic Aerosols
Lunden, M.; Black, D.; Brown, N.; Feb. 2004; In English
Report No.(s): DE2004-821339; No Copyright; Avail: National Technical Information Service (NTIS)

Organic aerosol is an important fraction of the fine particulate matter present in the atmosphere. This organic aerosol comes from a variety of sources; primary organic aerosol emitted directly from combustion process, and secondary aerosol formed in the atmosphere from condensable vapors. This secondary organic aerosol (SOA) can result from both anthropogenic and biogenic sources. In rural areas of the USA, organic aerosols can be a significant part of the aerosol load in the atmosphere. However, the extent to which gas-phase biogenic emissions contribute to this organic load is poorly understood. Such an understanding is crucial to properly apportion the effect of anthropogenic emissions in these rural areas that are sometimes dominated by biogenic sources. To help gain insight on the effect of biogenic emissions on particle concentrations in rural

areas, we have been conducting a field measurement program at the University of California Blodgett Forest Research Facility. The field location includes has been used to acquire an extensive suite of measurements resulting in a rich data set, containing a combination of aerosol, organic, and nitrogenous species concentration and meteorological data with a long time record. The field location was established in 1997 by Allen Goldstein, a professor in the Department of Environmental Science, Policy and Management at the University of California at Berkeley to study interactions between the biosphere and the atmosphere. The Goldstein group focuses on measurements of concentrations and whole ecosystem biosphere-atmosphere fluxes for volatile organic compounds (VOC's), oxygenated volatile organic compounds (OVOC's), ozone, carbon dioxide, water vapor, and energy. Another important collaborator at the Blodgett field location is Ronald Cohen, a professor in the Chemistry Department at the University of California at Berkeley.
NTIS
Organic Compounds; Aerosols; Atmospheric Models

20040067950 Istituto Superiore di Sanita, Rome, Italy
Assessment Study on Inhalation Exposure to Atmospheric Pollution in Ferrara. First Phase
Bastone, A.; Soggiu, M. E.; Vollono, C.; Masciocchi, M.; Rago, G.; 2003; In Italian
Report No.(s): PB2004-104252; ISTISAN 03/19; Copyright; Avail: National Technical Information Service (NTIS)

The stochastic analysis of exposure is a valid tool to quantify exposure to environmental contamination taking into account the wide variability observed in the population. The approach is also able to identify the high-risk population groups in order to support an effective management of risk. This approach requires the knowledge of variables as behaviours and lifestyles influencing exposure. Population studies, carried out using questionnaires and personal diaries, can provide a valid support in acquiring information on individual variability to be used in the probabilistic analysis. A population survey, specifically designed to describe and quantify inhalation exposure to atmospheric pollution, was performed in Ferrara (Italy). The results of the study represent a support to local authorities in planning effective mitigation measures of risk.
NTIS
Air Pollution; Risk; Respiration; Environmental Quality

20040067956 Harvard Univ., Cambridge, MA, USA
New National Ambient Air Quality Standards in Transportation Planning
Howitt, A. M.; Mar. 2004; 12 pp.; In English
Report No.(s): PB2004-104615; HVDE16-8; No Copyright; Avail: CASI; A03, Hardcopy

The purpose of this project is to identify the strategies adopted by several states around the country for preparing to adjust their transportation planning practices to the regulatory requirements associated with designation as an air quality non-attainment area, namely transportation conformity.
NTIS
Air Quality; Standards

20040067957 Harvard Univ., Cambridge, MA, USA
Emissions Modeling in Transportation Planning; Institutional and Policy Processes
Howitt, A. M.; Mar. 2004; 12 pp.; In English
Report No.(s): PB2004-104616; HVDR15-3A; No Copyright; Avail: CASI; A03, Hardcopy

The purpose of this pilot project, generally, was to examine the dynamic in transportation planning between the evolution of technical planning tools and the political process in which transportation plans are developed, adopted, and implemented. Specifically, the project concept emerged in anticipation of the release of a new emission factor model by the U.S. Environmental Protection Agency. This model is used in the calculation of air pollution from motor vehicles; it is central to several regulatory requirements on which federal approval and funding depends.
NTIS
Air Pollution; Environment Protection; Emission; Models

46
GEOPHYSICS

Includes Earth structure and dynamics, aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism. For related information see *47 Meteorology and Climatology*; and *93 Space Radiation*.

20040065759 Yamaguchi Univ., Japan
Akiyoshi Limestone Blocks Transported by the P/T Boundary Event to Japan Islands
Miura, Y.; Tanaka, S.; Lunar and Planetary Science XXXV: Impacts: Modeling and Observations; 2004; 2 pp.; In English; See also 20040065753; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Akiyoshi limestone plateau with Shuhoudo Cave in Yamaguchi, Japan is the largest limestone blocks of Carboniferous to Permian Periods in Japanese islands which is the first location to discuss the formation of Japanese islands called as "Akiyoshi Orogeny in Japan" by Ozawa (1923)[1]. He found the "overturned structure of limestone blocks" from fossil record, and three-type mountain-range as geosyncline orogeny, which is here considered to be "similar impact crater structure" of two rims (nonlimestones) and central peak (Akiyoshi limestone). All scientific papers from 1923 [1] are mainly limestone blocks formed by geosyncline (formed at the present location), lagoon [2], sea-mount by plate tectonics [3], or continental-drift movement from southern location with overturned structure by collision [4-6]. Recently, senior author reports new model of Akiyoshi limestone by using satellite images and shocked materials of carbon and Fe-Ni- bearing grains in the Akiyoshi limestone blocks (fossil record from 350Ma to 250Ma ago) as mixing process of limestone islands by the Permian-Triassic (P/T) geological boundary event at the Equator region to form the present Akiyoshi limestone group separated to China and Japan (Hiraodai, Taishakudai and so on) [6]. Purpose of the present paper is to make report of the Akiyoshi limestone blocks originally formed by impact event and transported by continental-drift system finally to show similar impact structure with central peaks of limestone blocks.
Derived from text
Craters; Limestone; Geology; Fossils; Plates (Tectonics)

20040065760 Academy of Sciences (Russia), Moscow, Russia
Popigai Impact Structure Modeling: Morphology and Worldwide Ejecta
Ivanov, B. A.; Artemieva, N. A.; Pierazzo, E.; Lunar and Planetary Science XXXV: Impacts: Modeling and Observations; 2004; 2 pp.; In English; See also 20040065753
Contract(s)/Grant(s): NAG5-13429; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The approx. 100 km in diameter, 35.7 0.2 Ma old Popigai structure [1], northern Siberia (Russia), is the best-preserved of the large terrestrial complex crater structures containing a central-peak ring [2- 4]. Although remotely located, the excellent outcrops, large number of drill cores, and wealth of geochemical data make Popigai ideal for the general study of the cratering processes. It is most famous for its impact-diamonds [2,5]. Popigai is the best candidate for the source crater of the worldwide late Eocene ejecta [6,7].
Derived from text
Cratering; Geochemistry; Ejecta; Core Sampling

20040065762 NASA Ames Research Center, Moffett Field, CA, USA
Flynn Creek Impact Structure: New Insights from Breccias, Melt Features, Shatter Cones, and Remote Sensing
Evenick, J. C.; Lee, P.; Deane, B.; Lunar and Planetary Science XXXV: Impacts: Modeling and Observations; 2004; 2 pp.; In English; See also 20040065753; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Flynn Creek impact structure is located in Tennessee, USA (36 deg.17 min.N, 85 deg.40 min.W). The structure was first mapped as a crypto-volcanic by Wilson and Born in 1936 [1]. Although they did not properly identify the stratigraphy within the crater or the causal mechanism, they did correctly define the horizontal extent of the crater. More detailed surface and subsurface research by Roddy (1979) accurately described the crater as being an impact structure with a diameter of 3.8 km. It formed around 360 Ma, which corresponds to the interval between the deposition of the Nashville Group and the Chattanooga Shale. Although there is limited rock outcrop in the area, there are exposed surface faults, folds, and large outcrops of impact breccia within the crater.
Author
Breccia; Craters; Deposition; Volcanoes; Impact Melts

20040065769 Witwatersrand Univ., Johannesburg, South Africa

A SRTM Investigation of Serra da Cangalho Impact Structure, Brazil

Reimold, W. U.; Cooper, G. R. J.; Romano, R.; Cowan D,; Koeberl, C.; Lunar and Planetary Science XXXV: Impacts: Modeling and Observations; 2004; 2 pp.; In English; See also 20040065753; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We review the current knowledge about the Serra da Cangalha (SdC) impact structure in Brazil and compare observations from MSS Landsat and STRM. The Serra da Cangalha crater structure (8o05 S/46o52 W) in the extreme northeast of Tocantins state of Brazil, is a confirmed impact structure [1-4] of 12 or 13 km diameter. It comprises several ring features, most prominent a 3 km (5 km according to [5]) circular ring of 250-300 m high mountains that lends this structure an appearance very similar to that of the Gosses Bluff structure, Australia, which has a 4.5 km inner ring and a subdued outer ring feature at 24 km diameter; 6]. This inner ring is, as for Gosses Bluff and the Oasis structure in Libya, interpreted as the result of differential erosion of a lithologically diverse central uplift. The SdC structure was formed in the intracratonic Parna ba basin (formerly known as Maranh o basin) that comprises a stratigraphy of Upper Silurian to Cretaceous sedimentary rocks. Target rocks include upper Permian Pedra do Fogo sandstones, Permian/Carboniferous sandstones, carbonaceous shales of the 323-290 Ma Piau Formation and the 354-323 Ma Poti Formation, and dark shales of the Long Formation. In the center, these strata have vertical dip and are intensely deformed [7]. The base to these supracrustals in the region is estimated at 100-1300 m. A strong NE-SE depositional direction was obtained for the sedimentary rocks in the crater region [8].

Derived from text

Brazil; Landsat Satellites; Craters; Sedimentary Rocks; Cratons; Deformation

20040065778 Brown Univ., Providence, RI, USA

Isolating the Ricochet-induced Vaporization Process

Schultz, P. H.; Sugita, S.; Eberhardy, C. A.; Ernst, C. M.; Lunar and Planetary Science XXXV: Impact Experiments; 2004; 2 pp.; In English; See also 20040065777; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Impact vaporization is not simply the result of shock effects. Previous experimental studies document multiple components reflecting the effects of jetting, shock, ricochet, and shear [1]. As a result, separate components of vapor can be observed and measured by imaging [1], electrostatics [2], and spectroscopy [1,3,4]. Peak shock pressures decrease with decreasing impact angle (from the horizontal), yet impact vaporization increases by three orders of magnitude from 90deg to 30deg [1]. Such enhanced heating is not confirmed, however, by theoretical computations [5]. Consequently, new laboratory experiments were designed in order to isolate the contribution of impactor failure and post-contact shear to the vaporization process as a possible explanation for the discrepancy.

Derived from text

Impactors; Vaporizing; Reflection; Electrostatics

20040065779 Witwatersrand Univ., Johannesburg, South Africa

Raman Spectroscopy of Olivine in Dunite Experimentally Shocked to Pressures Between 5 and 59 GPa

Turner, S.; Reimold, W. U.; Niewoudt, M.; Erasmus, R.; Lunar and Planetary Science XXXV: Impact Experiments; 2004; 2 pp.; In English; See also 20040065777; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Raman spectroscopic analysis of olivine in dunite samples experimentally shock-loaded to pressures between 5 and 59 GPa showed no significant shift of the 824 and 856/ cm Raman bands with increasing shock pressure.

Author

Olivine; Spectroscopic Analysis

20040065780 California Inst. of Tech., Pasadena, CA, USA

An Experimental Tomography Study of Impact-induced Damage Beneath Craters

Ai, H. Anita; Ahrens, Thomas J.; Lunar and Planetary Science XXXV: Impact Experiments; 2004; 1 pp.; In English; See also 20040065777; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Large scale reductions in compressional velocity caused by impact-induced damage is an important but largely unstudied feature of impact craters [1]. Damage depth beneath impact craters can be used to extract information about the impact

cratering process. A new non-destructive method is developed to study the damage structure beneath impact craters in the laboratory.
Derived from text
Cratering; Impact Damage; Targets; Tomography

20040065781 Harvard Univ., Cambridge, MA, USA
The Shock Compression Laboratory at Harvard: A New Facility for Planetary Impact Processes
Stewart, S. T.; Lunar and Planetary Science XXXV: Impact Experiments; 2004; 2 pp.; In English; See also 20040065777; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Shock Compression Laboratory in the Department of Earth and Planetary Sciences at Harvard is a new facility for the study of impact and collisional phenomena. The following describes the experimental capabilities of the laboratory.
Derived from text
Earth Sciences; Laboratories; Research Facilities; Laboratory Equipment

20040065784 NASA Ames Research Center, Moffett Field, CA, USA
Migration of the Cratering Flow-Field Center with Implications for Scaling Oblique Impacts
Anderson, J. L. B.; Schultz, P. H.; Heineck, J. T.; Lunar and Planetary Science XXXV: Impact Experiments; 2004; 2 pp.; In English; See also 20040065777
Contract(s)/Grant(s): NAG5-3877; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Crater-scaling relationships are used to predict many cratering phenomena such as final crater diameter and ejection speeds. Such nondimensional relationships are commonly determined from experimental impact and explosion data. Almost without exception, these crater-scaling relationships have used data from vertical impacts (90 deg. to the horizontal). The majority of impact craters, however, form by impacts at angles near 45 deg. to the horizontal. While even low impact angles result in relatively circular craters in sand targets, the effects of impact angle have been shown to extend well into the excavation stage of crater growth. Thus, the scaling of oblique impacts needs to be investigated more thoroughly in order to quantify fully how impact angle affects ejection speed and angle. In this study, ejection parameters from vertical (90 deg.) and 30 deg. oblique impacts are measured using three-dimensional particle image velocimetry (3D PIV) at the NASA Ames Vertical Gun Range (AVGR). The primary goal is to determine the horizontal migration of the cratering flow-field center (FFC). The location of the FFC at the time of ejection controls the scaling of oblique impacts. For vertical impacts the FFC coincides with the impact point (IP) and the crater center (CC). Oblique impacts reflect a more complex, horizontally migrating flow-field. A single, stationary point-source model cannot be used accurately to describe the evolution of the ejection angles from oblique impacts. The ejection speeds for oblique impacts also do not follow standard scaling relationships. The migration of the FFC needs to be understood and incorporated into any revised scaling relationships.
Derived from text
Ejection; Flow Distribution; Projectile Cratering; Meteorite Craters

20040065790 Universidad Rey Juan Carlos, Madrid, Spain
The Geology of Atlantis Basin, Mars, and Its Astrobiological Interest
dePablo, M. A.; Fairen, A. G.; Marquez, A.; Lunar and Planetary Science XXXV: Astrobiology; 2004; 2 pp.; In English; See also 20040065785; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Atlantis Basin, formed into an eroded impact crater in the southern hemisphere of Mars, is one of the regions where ancient lakes existed on Mars. The geological study of these basins drives to a better knowledge of history of the ancient water evolution of the water on the planet. On the other hand, the places where ancient lakes existed are of enhanced astrobiological interest. In the case of the Atlantis Basin, the existence of some geological features as ancient volcanic edifices, collapse areas, sedimentary deposits of an ancient lake, possible dike systems and recent gullies, seem to indicate the longterm presence of a thermal source and a water reservoir stable enough to sustain biological processes.
Derived from text
Craters; Mars Surface; Activity (Biology); Exobiology; Planetary Geology

20040065811 Clemson Univ., SC, USA

Helium-Shell Nucleosynthesis and Extinct Radioactivities

Meyer, B. S.; The, L.-S.; Clayton, D. D.; ElEid, M. F.; Lunar and Planetary Science XXXV: Early Solar System Chronology; 2004; 2 pp.; In English; See also 20040065806

Contract(s)/Grant(s): NSF AST-98-19877; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Although the exact site for the origin of the r-process isotopes remains mysterious, most thinking has centered on matter ejected from the cores of massive stars in core-collapse supernovae [13]. In the 1970's and 1980's, however, difficulties in understanding the yields from such models led workers to consider the possibility of r-process nucleosynthesis farther out in the exploding star, in particular, in the helium burning shell [4,5]. The essential idea was that shock passage through this shell would heat and compress this material to the point that the reactions 13C(alpha; n)16O and, especially, 22Ne(alpha; n)25Mg would generate enough neutrons to capture on preexisting seed nuclei and drive an "n process" [6], which could reproduce the r-process abundances. Subsequent work showed that the required 13C and 22Ne abundances were too large compared to the amounts available in realistic models [7] and recent thinking has returned to supernova core material or matter ejected from neutron star-neutron star collisions as the more likely r-process sites.

Derived from text

Radioactivity; Collisions; Helium; Isotopes; Neutron Stars; Nuclear Fusion; Extinction

20040066027 Lunar and Planetary Inst., Houston, TX, USA

Lunar and Planetary Science XXXV: Impacts

2004; In English; Lunar and Planetary Sciences XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040066028 - 20040066032

Contract(s)/Grant(s): NCC5-679

Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The session "Impacts" included the following reports: Impacts in Two-layered Targets on Earth: Effects of Cover Thickness on Crater Morphostructure; Keurusselkae, A New Impact Structure in Central Finland; The Great Permian Extinction Debate; Towards a Better Understanding of Marine Impact Processes: What a Potential Drilling of the Mj lnir Crater (Barents Sea) Has to Offer; and Field Studies in the Central Uplift of the Vredefort Impact Structure.

Derived from text

Planetary Craters; Morphology

20040066065 Hawaii Univ., Honolulu, HI, USA

Spatial Analysis of Rootless Cone Groups on Iceland and Mars

Bruno, B. C.; Fagents, S. A.; Thordarson, T.; Baloga, S. M.; Lunar and Planetary Science XXXV: Mars; 2004; 2 pp.; In English; See also 20040066050; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This paper examines the spatial distribution of cones within several Icelandic rootless cone groups (RCG's) in order to: (1) better understand the underlying processes governing cone distribution (e.g., the relative roles of lava tube distribution and substrate hydrology); and (2) develop a remote sensing tool to identify RCG's on Earth and other planets. Of particular interest is Mars, where potential RCG's have been identified. If confirmed, they have important implications for the presence of water (or ice) on Mars. This analysis uses two methods to independently assess the degree of spatial randomness within a cone field and to evaluate the statistical confidence in this assessment. Method 1: Nearest Neighbor (NN) analysis quantifies the characteristic spacing among points within a given spatial area. The key parameters are R (the ratio of the mean actual distance between a point and its NN to that expected of a random (Poisson) distribution) and c (a confidence estimate in the departure from randomness). Randomly distributed cones have R approx. 1, whereas R < 1 indicates aggregation. R > 1 indicates that cones tend to form away from existing cones, with Uniform distributions (i.e., maximum spacing) having maximum R. Method 2: The Chi-Squared Goodness-of-Fit test determines if a given dataset is likely to be produced from random sampling of a population with a specific distribution (e.g., Poisson or Uniform). It outputs two parameters: degrees of freedom (df) and a test statistic (U), which is compared to a critical chi-squared value.

Derived from text

Iceland; Spatial Distribution; Mars Volcanoes

20040066074 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
Development and Implementation of Joint Programs in Laser Ranging and other Space Geodetic Techniques
Carter, David, Technical Monitor; Pearlman, Michael R.; April 2004; 34 pp.; In English
Contract(s)/Grant(s): NAS5-01133; No Copyright; Avail: CASI; A03, Hardcopy

Dr. Michael R. Pearlman provided technical and management support to the NASA Space Geodesy Program. Author

Geodesy; NASA Space Programs; Project Management

47
METEOROLOGY AND CLIMATOLOGY

Includes weather observation forecasting and modification.

20040062562 Oklahoma State Univ., Stillwater, OK, USA
Comparison of Geomorphically Determined Winds with a General Circulation Model: Herschel Crater, Mars
Adcock, C. T.; Stanley, B. D.; Marston, R. A.; Lunar and Planetary Science XXXV: Mars: Wind, Dust Sand, and Debris; 2004; 2 pp.; In English; See also 20040062560; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Wind is the dominate geologic process currently at work on the surface of Mars [1]. An understanding of surface winds is paramount if we are to understand Mars as a planet. Further, winds and the entrained particles within them can have a detrimental impact on equipment, structures, and future missions [2]. The Russian probe Mars 3, for example, is thought to have been rendered inoperative by winds it encountered during landing [3]. General circulation models (GCM) have been created for surface winds of Mars [4, 5]. These GCM are powerful tools for describing and understanding surface winds of a planet. However, the GCM for Mars have not been thoroughly validated due to a lack of ground truth data. Interpretation and correlation of wind regimes from geomorphic analogy may be useful for validating GCM in the absence of ground truth data.

Derived from text

Mars Surface; Wind (Meteorology); Mars Atmosphere; Analogies; Atmospheric General Circulation Models; Craters; Geomorphology

20040067883 Lawrence Livermore National Lab., Livermore, CA
Statistical Study of SCM Simulations using Continuous Forcing Data Derived from NWP Products with the ARM Data Constraints
Xie, S.; Cederwall, R.; Zhang, M.; Yo, J. J.; Jun. 30, 2003; In English
Report No.(s): DE2003-15005401; UCRL-JC-151604; No Copyright; Avail: National Technical Information Service (NTIS)

Statistical study of Single Column Model (SCM) results has been recently advocated by the ARM cloud parameterization and modeling working group. This is partly due to the sensitivity nature of Single Column Models (SCMs) to uncertainties in the initial conditions and the specified large-scale forcing. In addition, given the limitation of SCM framework (e.g. the lack of effective internal feedback between the SCM and the specified forcing) and the inevitable error in the initial conditions and the large-scale forcing, it might not be realistic to expect that SCMs can correctly capture every individual synoptic event. Statistical studies can help smooth out those random errors related to uncertainties in the initial conditions and the specified large-scale forcing so that one can focus on those physically important systematic errors from SCM simulations. Noted that, for climate simulations, it is more important for a given physical parameterization to successfully simulate statistics right for the process that is being parameterized. This study conducts a statistical study of SCM simulations by using the ARM recently developed continuous forcing data for the year 2000.

NTIS

Clouds (Meteorology); Precipitation (Meteorology); Climate

20040067948 Commerce Dept., Washington, DC, USA
National Space Weather Program. Implementation Plan 2nd Edition
Jul. 2000; In English
Report No.(s): PB2004-104238; FCM-931-2000; No Copyright; Avail: National Technical Information Service (NTIS)

In the six years since the inception of the National Space Weather Program (NSWP), space weather has virtually become a household word. Space weather refers to conditions on the Sun and in the solar wind, magnetosphere, ionosphere, and

thermosphere that can influence the performance and reliability of space-borne and ground-based technological systems and can endanger human life or health. The growing awareness within the general public is largely the result of a conscious effort by all space weather stakeholders to educate the nation on the effects of solar storms and their potential impacts on the modern technology so important to daily life. In addition to increased awareness, solid advances have been made in our knowledge of the space weather system and in our ability to forecast potentially disruptive space weather events.
NTIS
Space Weather; Weather Forecasting; Solar Storms

20040067949 National Oceanic and Atmospheric Administration, Rockville, MD, USA
U.S. Wind Profilers: A Review
Mar. 1998; In English
Report No.(s): PB2004-104239; FCM-R14-1998; No Copyright; Avail: National Technical Information Service (NTIS)

Over the past two decades, wind profiling technology has proved valuable in both research and operational applications, including severe weather analysis and forecasting, numerical modeling, pollution monitoring and space launch support. Individual profilers and networks of profilers provide continuous measurements, economically and automatically, with high space and time resolutions which are necessary in defining smaller scale as well as synoptic scale phenomena. Following a discussion of the theory of operation and history of wind profiler development, this paper examines the state-of-the-art of wind profiling in the USA. Many examples of the profilers widespread use are described along with new avenues of research that are now possible because of profilers. Strengths and limitations of the technology as it is currently implemented are examined. Ongoing efforts to improve the technology are discussed.
NTIS
Pollution Monitoring; Weather Forecasting; Spacecraft Launching; Wind Profiles; Radio Meteorology

20040067955 National Center for Atmospheric Research, Boulder, CO, USA
Hydrological Enhancements to the Community Noah Land Surface Model
Gochis, D. J.; Chen, F.; Sep. 2003; In English
Report No.(s): PB2004-104537; NCAR/TN-454-STR; No Copyright; Avail: National Technical Information Service (NTIS)

The Noah land surface model has recently undergone several enhancements in its representation of hydrological processes. Key improvements include methodologies for: (1) the introduction of ponded surface water and associated evaporation and re-infiltration; (2) lateral routing of overland flow; and (3) the lateral routing of saturated subsurface flow. Simulations using the enhanced Noah model over the Walnut River watershed in south-central Kansas for a detailed description of the experimental site and forcing data) revealed many changes in the modeled soil moisture and evaporative flux fields in an offline simulation. Principal findings include significant increases in near surface soil moisture attributed to the re-infiltration of local infiltration excess. The model exhibits scale-dependent behavior in the production of stream flow volume and soil moisture states.
NTIS
Augmentation; Earth Surface; Evaporation; Infiltration; Watersheds

20040068067 Computer Sciences Corp., Huntsville, AL, USA
Connecting Atmospheric Science and Atmospheric Models for Aerocaptured Missions to Titan and the Outer Planets
Justus, C. G.; Duvall, Aleta; Keller, Vernon W.; December 19, 2003; 1 pp.; In English; International Conference: European Geosciences Union 1st General Assembly, 25-30 Apr. 2004, Nice, France
Contract(s)/Grant(s): NAS8-60000; No Copyright; Avail: Other Sources; Abstract Only

Many atmospheric measurement systems, such as the sounding instruments on Voyager, gather atmospheric information in the form of temperature versus pressure level. In these terms, there is considerable consistency among the mean atmospheric profiles of the outer planets Jupiter through Neptune, including Titan. On a given planet or on Titan, the range of variability of temperature versus pressure level due to seasonal, latitudinal, and diurnal variations is also not large. However, many engineering needs for atmospheric models relate not to temperature versus pressure level but atmospheric density versus geometric altitude. This need is especially true for design and analysis of aerocapture systems. Aerocapture drag force available for aerocapture is directly proportional to atmospheric density. Available aerocapture "corridor width" (allowable range of atmospheric entry angle) also depends on height rate of change of atmospheric density, as characterized by density scale height. Characteristics of hydrostatics and the gas law equation mean that relatively small systematic differences in temperature-versus-pressure profiles can integrate at high altitudes to very large differences in density-versus-

altitude profiles. Thus a given periapsis density required to accomplish successful aerocapture can occur at substantially different altitudes (approx. 150 - 300 km) on the various outer planets, and significantly different density scale heights (approx. 20 - 50 km) can occur at these periapsis altitudes. This paper will illustrate these effects and discuss implications for improvements in atmospheric measurements to yield significant impact on design of aerocapture systems for future missions to Titan and the outer planets. Relatively small- scale atmospheric perturbations, such as gravity waves, tides, and other atmospheric variations can also have significant effect on design details for aerocapture guidance and control systems. This paper will also discuss benefits that would result from improved understanding of Titan and outer planetary atmospheric perturbation characteristics. Details of recent engineering-level atmospheric models for Titan and Neptune will be presented, and effects of present and future levels of atmospheric uncertainty and variability characteristics will be examined.
Author
Atmospheric Physics; Atmospheric Models; Aerocapture; Planetary Atmospheres; Atmospheric Density; Annual Variations

20040068121 Meteorological Satellite Center, Kiyose, Japan
Monthly Report of the Meteorological Satellite Center: January 2004
January 2004; In English; In Japanese; Document files and Satellite data are recorded in either ASCII or shift JIS code; Full Disk Earth's Cloud Images are recorded in Bit-Map (BMP) format; Copyright; Avail: Other Sources

The CD-ROM concerning the January 2004 Monthly Report of the Meteorological Satellite Center (MSC) contains the observation data derived from the Geostationary Meteorological Satellite (GMS) of Japan and the Polar Orbital Meteorological Satellites operated by NOAA. The CD-ROM contains the following observation data: Full Disk Earth's Cloud Image; Cloud Image of Japan and its vicinity; Cloud Amount; Sea Surface Temperature; Cloud Motion Wind; Water Vapor Motion Wind; Equivalent Blackbody Temperature; OLR (Out-going Longwave Radiation), Solar Radiation; Snow and Ice Index; Orbit Data; Attitude Data; VISSR Image Data Catalog (Cartridge Magnetic Tape (CMT), Micro Film); TOVS (TIROS Operational Vertical Sounder) Vertical Profile of Temperature and Precipitable Water; and TOVS Total Ozone Amount.
Author
Japan; Satellite Observation; Satellite Sounding; Atmospheric Sounding; Meteorological Parameters

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OCEANOGRAPHY

Includes the physical, chemical and biological aspects of oceans and seas; ocean dynamics; and marine resources. For related information see also *43 Earth Resources and Remote Sensing*.

20040065767 Arizona Univ., Tucson, AZ, USA
Hydrocode Simulations of the Chesapeake Bay Impact
Collins, G. S.; Melosh, H. J.; Lunar and Planetary Science XXXV: Impacts: Modeling and Observations; 2004; 2 pp.; In English; See also 20040065753
Contract(s)/Grant(s): NAG5-11493; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Chesapeake Bay Impact Crater (CBIC) formed about 35 million years ago (late Eocene), in a shallow marine environment (400-600 m water depth). The crater is complex and developed in a multi-layer, rheologically-variable target that comprised 400-1000 meters of soft, water-saturated sediments overlying crystalline basement. Seismic reflection data illustrates that the Chesapeake Bay crater morphology - often described as an "inverted sombrero" - is similar to other marine-target impact craters. It consists of a approx. 1 - 1.5-km deep, highly disturbed central crater, surrounded by a shallower, less deformed basin. The inner crater has a diameter of approx. 40 km; the edge of the outer basin extends to ~85-km diameter. The morphological divide between the inner and outer crater is termed the inner ring or peak ring. Little is known about the nature of the inner ring. Seismic reflection data show that the underlying basement is modestly uplifted; however, it is unclear whether the pristine surface expression of the inner ring was elevated above the floor of the outer crater.
Derived from text
Chesapeake Bay (Us); Craters; Marine Environments; Water Depth

20040065852 NASA, Washington, DC, USA
Wind Induced Sediment Resuspension in a Microtidal Estuary
Booth, J. G.; Miller, R. L.; McKee, B. A.; Leathers, R. A.; April 1999; 44 pp.; In English
Report No.(s): SE-1999-05-00018-SSC; No Copyright; Avail: CASI; A03, Hardcopy

Bottom sediment resuspension frequency, duration and extent (% of bottom sediments affected) were characterized for the fifteen month period from September 1995 to January 1997 for the Barataria Basin, LA. An empirical model of sediment resuspension as a function of wind speed, direction, fetch and water depth was derived from wave theory. Water column turbidity was examined by processing remotely sensed radiance information from visible and near-IR AVHRR imagery. Based on model predictions, wind induced resuspension occurred during all seasons of this study. Seasonal characteristics for resuspension reveal that late fall, winter and early spring are the periods of most frequent and intense resuspension. Model predictions of the critical wind speed required to induce resuspension indicate that winds of 4 m/s (averaged over all wind directions resuspend approximately 50% of bottom sediments in the water bodies examined. Winds of this magnitude (4 m/s) occurred for 80% of the time during the late fall, winter and early spring and for approximately 30% of the time during the summer. More than 50% of the bottom sedimets are resuspended throughout the year, indicating the importance of resuspension as a process affecting sediment and biogeochemical fluxes in the Barataria Basin.
Author
Suspensions; Sediments; Estuaries; Annual Variations

20040066028 Oslo Univ., Norway
Towards a Better Understanding of Marine Impact Processes: What a Potential Drilling of the Mjoulnir Crater (Barents Sea) Has to Offer
Tsikalas, F.; Dypvik, H.; Faleide, J. I.; Smelror, M.; Lunar and Planetary Science XXXV: Impacts; 2004; 2 pp.; In English; See also 20040066027; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The 40-km-diameter Mjoulnir Crater in the central Barents Sea is one of the very few cases globally where an intactly-preserved source-crater and ejecta-layer correlation has been established. Both geophysical and geological data unequivocally substantiate an asteroid impact at about 142 Ma (Jurassic- Cretaceous boundary) into a sedimentary platform with 300-500 m paleo-water depth. A total of approx. 2100 km of seismic reflection profiles clearly image the impact-related and post-impact structure and stratigraphy. In addition, free-air gravity, seismic velocity, and porosity anomalies exhibit close correspondence to the impact-induced structure and physical property distributions. Two shallow boreholes, one near the center (7329/03-U-01, 121-m-long core) and another approx. 30 km from the crater periphery (7430/10-U- 01, 51.1-m-long core) have confirmed the impact origin of the structure and offer a seismic stratigraphic correlation.
Author
Barents Sea; Boreholes; Craters; Geophysics; Water Depth

20040067974 NASA Goddard Space Flight Center, Greenbelt, MD, USA
SIMBIOS Project; 2003 Annual Report
McClain, Charles R.; Fargion, Giulietta S.; November 2003; 209 pp.; In English; See also 20040067975 - 20040067992; Original contains color illustrations
Report No.(s): NASA/TM-2003-212251; Rept-2004-00415-0; No Copyright; Avail: CASI; A10, Hardcopy

The purpose of this technical report is to provide current documentation of the the Sensor Intercomparison and Merger for Biological and Interdisciplinary Oceanic Studies (SIMBIOS) Project activities, NASA Research Announcement (NRA) research status, satellite data processing, data product validation, and field calibration. This documentation is necessary to ensure that critical information is related to the scientific community and NASA management. This critical information includes the technical difficulties and challenges of validating and combining ocean color data from an array of independent satellite systems to form consistent and accurate global bio-optical time series products. This technical report is not meant as a substitute for scientific literature. Instead, it will provide a ready and responsive vehicle for the multitude of technical reports issued by an operational project. The SIMBIOS Science Team Principal Investigators (PIs) original contributions to this report are in chapters four and above. The purpose of these contributions is to describe the current research status of the SIMBIOS-NRA-99 funded research. The contributions are published as submitted, with the exception of minor edits to correct obvious grammatical or clerical errors.
Author
Calibrating; Water Color; Oceans; Time Series Analysis

20040067975 NASA Goddard Space Flight Center, Greenbelt, MD, USA
An Overview of SIMBIOS Program Activities and Accomplishments, Chapter 1
Fargion, Giulietta S.; McClain, Charles R.; SIMBIOS Project; 2003 Annual Report; November 2003, pp. 1-33; In English; See also 20040067974; No Copyright; Avail: CASI; A03, Hardcopy

The SIMBIOS Program was conceived in 1994 as a result of a NASA management review of the agency's strategy for monitoring the bio-optical properties of the global ocean through space-based ocean color remote sensing. At that time, the NASA ocean color flight manifest included two data buy missions, the Sea-viewing Wide Field-of-view Sensor (SeaWiFS) and Earth Observing System (EOS) Color, and three sensors, two Moderate Resolution Imaging Spectroradiometers (MODIS) and the Multi-angle Imaging Spectro-Radiometer (MISR), scheduled for flight on the EOS-Terra and EOS-Aqua satellites. The review led to a decision that the international assemblage of ocean color satellite systems provided ample redundancy to assure continuous global coverage, with no need for the EOS Color mission. At the same time, it was noted that non-trivial technical difficulties attended the challenge (and opportunity) of combining ocean color data from this array of independent satellite systems to form consistent and accurate global bio-optical time series products. Thus, it was announced at the October 1994 EOS Interdisciplinary Working Group meeting that some of the resources budgeted for EOS Color should be redirected into an intercalibration and validation program (McClain et al., 2002).
Derived from text
Water Color; Time Series Analysis; Spectroradiometers; Optical Properties; Oceans; Imaging Techniques; Intercalibration

20040067976 National Ocean Service, Silver Spring, MD, USA
Algorithms for Processing and Analysis of Ocean Color Satellite Data for Coastal Case 2 Waters, Chapter 16
Stumpf, Richard P.; Arnone, Robert A.; Gould, Richard W., Jr.; Ransibrahmanakul, Varis; Tester, Patricia A.; SIMBIOS Project; 2003 Annual Report; November 2003, pp. 160-174; In English; See also 20040067974
Contract(s)/Grant(s): NASA Order S-44796-X; NASA Order S-44791-X; No Copyright; Avail: CASI; A03, Hardcopy

SeaWiFS has the ability to enhance our understanding of many oceanographic processes. However, its utility in the coastal zone has been limited by valid bio-optical algorithms and by the determination of accurate water reflectances, particularly in the blue bands (412-490 nm), which have a significant impact on the effectiveness of all bio-optical algorithms. We have made advances in three areas: algorithm development (Table 16.1), field data collection, and data applications.
Derived from text
Algorithms; Water Color; Oceanography; Coastal Water; Sea-Viewing Wide Field-of-View Sensor

20040067977 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Merging Ocean Color Data From Multiple Missions, Chapter 6
Gregg, Watson W.; SIMBIOS Project; 2003 Annual Report; November 2003, pp. 73-83; In English; See also 20040067974; No Copyright; Avail: CASI; A03, Hardcopy

Oceanic phytoplankton may play an important role in the cycling of carbon on the Earth, through the uptake of carbon dioxide in the process of photosynthesis. Although they are ubiquitous in the global oceans, their abundances and dynamics are difficult to estimate, primarily due to the vast spatial extent of the oceans and the short time scales over which their abundances can change. Consequently, the effects of oceanic phytoplankton on biogeochemical cycling, climate change, and fisheries are not well known. In response to the potential importance of phytoplankton in the global carbon cycle and the lack of comprehensive data, NASA and the international community have established high priority satellite missions designed to acquire and produce high quality ocean color data (Table 6.1). Ten of the missions are routine global observational missions: the Ocean Color and Temperature Sensor (OCTS), the Polarization and Directionality of the Earth's Reflectances sensor (POLDER), Sea-viewing Wide Field-of-view Sensor (SeaWiFS), Moderate Resolution Imaging Spectrometer-AM (MODIS-AM), Medium Resolution Imaging Spectrometer (MERIS), Global Imager (GLI), MODIS-PM, Super-GLI (S-GLI), and the Visible/Infrared Imager and Radiometer Suite (VIIRS) on the NPOESS Preparatory Project (NPP) and the National Polar-orbiting Operational Environmental Satellite System (NPOESS). In addition, there are several other missions capable of providing ocean color data on smaller scales. Most of these missions contain the spectral band complement considered necessary to derive oceanic chlorophyll concentrations and other related parameters. Many contain additional bands that can provide important ancillary information about the optical and biological state of the oceans.
Derived from text
Phytoplankton; Oceans; Spectral Bands; Water Color; Biogeochemistry; Climate Change; Sea-Viewing Wide Field-of-View Sensor

20040067978 Maryland Univ., Cambridge, MD, USA
Bio-Optical and Remote Sensing Observations in Chesapeake Bay, Chapter 7
Harding, Lawrence W., Jr.; Magnuson, Andrea; SIMBIOS Project; 2003 Annual Report; November 2003, pp. 84-97; In English; See also 20040067974
Contract(s)/Grant(s): NASA Order 00195; No Copyright; Avail: CASI; A03, Hardcopy

The high temporal and spatial resolution of satellite ocean color observations will prove invaluable for monitoring the health of coastal ecosystems where physical and biological variability demands sampling scales beyond that possible by ship. However, ocean color remote sensing of Case 2 waters is a challenging undertaking due to the optical complexity of the water. The focus of this SIMBIOS support has been to provide in situ optical measurements from Chesapeake Bay (CB) and adjacent mid-Atlantic bight (MAB) waters for use in algorithm development and validation efforts to improve the satellite retrieval of chlorophyll (chl a) in Case 2 waters. CB provides a valuable site for validation of data from ocean color sensors for a number of reasons. First, the physical dimensions of the Bay (> 6,500 km2) make retrievals from satellites with a spatial resolution of approx. 1 km (i.e., SeaWiFS) or less (i.e., MODIS) reasonable for most of the ecosystem. Second, CB is highly influenced by freshwater flow from major rivers, making it a classic Case 2 water body with significant concentrations of chlorophyll, particulates and chromophoric dissolved organic matter (CDOM) that highly impact the shape of reflectance spectra.
Derived from text
Bays (Topographic Features); Chesapeake Bay (Us); Remote Sensing; Optical Measurement; Chlorophylls; Dissolved Organic Matter

20040067979 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Refinement of Protocols for Measuring the Apparent Optical Properties of Seawater, Chapter 8
Hooker, Stanford B.; Zibordi, Giuseppe; Berthon, Jean-Francois; Nirek, Andre; Antoine, David; SIMBIOS Project; 2003 Annual Report; November 2003, pp. 98-113; In English; See also 20040067974; No Copyright; Avail: CASI; A03, Hardcopy

Ocean color satellite missions, like the Sea-viewing Wide Field-of-view Sensor (SeaWiFS) or the Moderate Resolution Imaging Spectroradiometer (MODIS) projects, are tasked with acquiring a global ocean color data set, validating and monitoring the accuracy and quality of the data, processing the radiometric data into geophysical units using a set of atmospheric and bio-optical algorithms, and distributing the final products to the scientific community. The long-standing requirement of the SeaWiFS Project, for example, is to produce spectral water-leaving radiances, LW(lambda), to within 5% absolute (lambda denotes wavelength) and chlorophyll a concentrations to within 35% (Hooker and Esaias 1993), and most ocean color sensors have the same or similar requirements. Although a diverse set of activities are required to ensure the accuracy requirements are met (Hooker and McClain 2000), the perspective here is with field observations. The accurate determination of upper ocean apparent optical properties (AOPs) is essential for the vicarious calibration of ocean color data and the validation of the derived data products, because the sea-truth measurements are used to evaluate the satellite observations (Hooker and McClain 2000). The uncertainties with in situ AOP measurements have various sources: a) the sampling procedures used in the field, including the environmental conditions encountered; b) the absolute characterization of the radiometers in the laboratory; c) the conversion of the light signals to geophysical units in a processing scheme, and d) the stability of the radiometers in the harsh environment they are subjected to during transport and use. Assuming ideal environmental conditions, so this aspect can be neglected, the SeaWiFS ground-truth uncertainty budget can only be satisfied if each uncertainty is on the order of 1-2%, or what is generally referred to as 1% radiometry. In recent years, progress has been made in estimating the magnitude of some of these uncertainties and in defining procedures for minimizing them. For the SeaWiFS Project, the first step was to convene a workshop to draft the SeaWiFS Ocean Optics Protocols (hereafter referred to as the Protocols). The Protocols initially adhered to the Joint Global Ocean Flux Study (JGOFS) sampling procedures (JGOFS 1991) and defined the standards for optical measurements to be used in SeaWiFS calibration and validation activities (Mueller and Austin 1992). Over time, the Protocols were revised (Mueller and Austin 1995), and then recurringly updated on essentially an annual basis (Mueller 2000, 2002, and 2003) as part of the Sensor Inter-comparison and Merger for Biological and Interdisciplinary Oceanic Studies (SIMBIOS) project. 98
Derived from text
Optical Properties; Sea Water; In Situ Measurement; Optical Measurement; Water Color

20040067980 Scripps Institution of Oceanography, La Jolla, CA, USA
Satellite Ocean-Color Validation Using Ships of Opportunity, Chapter 5
Frouin, Robert; Cutchin, David L.; Gross-Colzy, Lydwine; Poteau, Antoine; Deschamps, Pierre-Yves; SIMBIOS Project; 2003 Annual Report; November 2003, pp. 52-72; In English; See also 20040067974
Contract(s)/Grant(s): NASA Order 00194; No Copyright; Avail: CASI; A03, Hardcopy

The investigation s main objective is to collect from platforms of opportunity (merchant ships, research vessels) concomitant normalized water-leaving radiance and aerosol optical thickness data over the world s oceans. A global, long-term data set of these variables is needed to verify whether satellite retrievals of normalized water-leaving radiance are within acceptable error limits and, eventually, to adjust atmospheric correction schemes. To achieve this objective, volunteer officers, technicians, and scientists onboard the selected ships collect data from portable SIMBAD and Advanced SIMBAD

(SIMBADA) radiometers. These instruments are specifically designed for evaluation of satellite-derived ocean color. They measure radiance in spectral bands typical of ocean-color sensors. The SIMBAD version measures in 5 spectral bands centered at 443, 490, 560, 670, and 870 nm, and the Advanced SIMBAD version in 11 spectral bands centered at 350, 380, 412, 443, 490, 510, 565, 620, 670, 750, and 870 nm. Aerosol optical thickness is obtained by viewing the sun disk like a classic sun photometer. Normalized water-leaving radiance, or marine reflectance, is obtained by viewing the ocean surface through a vertical polarizer in a specific geometry (nadir angle of 45o and relative azimuth angle of 135deg) to minimize direct sun glint and reflected sky radiation. The SIMBAD and SIMBADA data, after proper quality control and processing, are delivered to the SIMBIOS project office for inclusion in the SeaBASS archive. They complement data collected in a similar way by the Laboratoire d'Optique Atmospherique of the University of Lille, France. The SIMBAD and SIMBADA data are used to check the radiometric calibration of satellite ocean-color sensors after launch and to evaluate derived ocean-color variables (i.e., normalized water-leaving radiance, aerosol optical thickness, and aerosol type). Analysis of the SIMBAD and SIMBADA data provides information on the accuracy of satellite retrievals of normalized water-leaving radiance, an understanding of the discrepancies between satellite and in situ data, and algorithms that reduce the discrepancies, contributing to more accurate and consistent global ocean color data sets.
Derived from text
Water Color; Oceans; Reflectance; Ocean Surface; In Situ Measurement; Aerosols; Optical Thickness

20040067981 Scripps Institution of Oceanography, La Jolla, CA, USA
Bio-Optical Measurement and Modeling of the California Current and Southern Oceans, Chapter 11
Mitchell, B. Greg; SIMBIOS Project; 2003 Annual Report; November 2003, pp. 131-137; In English; See also 20040067974; No Copyright; Avail: CASI; A02, Hardcopy

This SIMBIOS project contract has supported in situ ocean optical observations in the California Current, and in the north Pacific, Southern and Indian Oceans. Our principal goals are to validate standard or experimental ocean color products through detailed bio-optical and biogeochemical measurements, and to combine ocean optical observations with modeling to contribute to satellite vicarious radiometric calibration and algorithm development. In collaboration with major oceanographic ship-based observation programs (CalCOFI, JGOFS, AMLR, INDOEX, and ACE Asia) our SIMBIOS effort has resulted in data from diverse bio-optical provinces. For these global deployments we generate a methodologically consistent data set encompassing a wide-range of oceanic conditions. We have initiated several collaborations with scientists in East Asian countries to study the complex Case-2 waters of their marginal seas. Global data collected in recent years are routinely evaluated relative to our CalCOFI time-series. The combined database we have assembled now comprises more than 1000 stations and includes observations for the clearest oligotrophic waters, highly eutrophic blooms, red-tides and coastal Case-2 conditions. The data has been used to validate water-leaving radiance estimated with OCTS, SeaWiFS, MODIS and GLI as well as bio-optical algorithms for chlorophyll pigments. During the past year we continued to process and quality control our data and carried out a detailed calibration/validation exercise in the California Current for the Japanese GLI instrument. For this GLI initialization effort, we coordinated with the Mexico IMECOCAL program to get extra data to complement our CalCOFI data for the simultaneous April, 2003 cruises. The comprehensive data is utilized for development of standard and experimental algorithms.
Derived from text
Biogeochemistry; Ocean Currents; Optical Measurement; Water Color

20040067982 Brookhaven National Lab., Upton, NY, USA
The Marine Fast-Rotating Shadow-band Network: Status Report and New Retrieval Techniques, Chapter 10
Miller, Mark A.; Reynolds, R. M.; Vogelmann, A.; Bartholomew, M. J.; SIMBIOS Project; 2003 Annual Report; November 2003, pp. 124-130; In English; See also 20040067974; No Copyright; Avail: CASI; A02, Hardcopy

The radiation transfer characteristics of certain types of aerosols and mixtures of aerosols found over the world s oceans are poorly known. To simulate the radiative impacts of these aerosols requires detailed knowledge of five basic physical characteristics: the size distribution, chemical composition, optical thickness, single scattering albedo, and the asymmetry parameter. The single scattering albedo describes the total amount of incoming energy that is scattered by the aerosol particle and the asymmetry parameter describes the angular distribution of this scattered energy relative to the incident direction. Given this information, it is possible to accurately simulate the interaction of these aerosols with incoming solar radiation and the radiant energy scattered into space from the upper layers of the ocean, which is known as the water-leaving radiance. At present, the atmospheric correction schemes that are applied to satellite ocean color measurements are based primarily on the results of radiation transfer codes, which are supplied information about the physical characteristics of the aerosols from measurements made in the late 70 s (Gordon and Wang, Shettle and Fenn). These aerosol measurements and the

radiation-transfer-based atmospheric correction algorithms that result from them have been recently shown to be inadequate to describe the observed distribution of Angstrom Exponent that has resulted from a subset of the SIMBIOS measurements (Knoblespiesse et al., 2003). This implies that the aerosol models that are currently used to develop atmospheric correction algorithms do not adequately describe the physical characteristics of some of the aerosols that are present in the marine environment.
Derived from text
Aerosols; Atmospheric Correction; Chemical Composition; Size Distribution; Radiant Flux Density; Optical Thickness

20040067983 Woods Hole Oceanographic Inst., MA, USA
Variability in Ocean Color Associated with Phytoplankton and Terrigenous Matter: Time Series Measurements and Algorithm Development at the FRONT Site on the New England Continental Shelf, Chapter 12
Morrison, John R.; Sosik, Heidi M.; SIMBIOS Project; 2003 Annual Report; November 2003, pp. 138-144; In English; See also 20040067974
Contract(s)/Grant(s): NASA Order 00198; No Copyright; Avail: CASI; A02, Hardcopy

Fronts in the coastal ocean describe areas of strong horizontal gradients in both physical and biological properties associated with tidal mixing and freshwater estuarine output (e.g. Simpson, 1981 and O Donnell, 1993). Related gradients in optically important constituents mean that fronts can be observed from space as changes in ocean color as well as sea surface temperature (e.g., Dupouy et al., 1986). This research program is designed to determine which processes and optically important constituents must be considered to explain ocean color variations associated with coastal fronts on the New England continental shelf, in particular the National Ocean Partnership Program (NOPP) Front Resolving Observational Network with Telemetry (FRONT) site. This site is located at the mouth of Long Island sound and was selected after the analysis of 12 years of AVHRR data showed the region to be an area of strong frontal activity (Ullman and Cornillon, 1999). FRONT consists of a network of modem nodes that link bottom mounted Acoustic Doppler Current Profilers (ADCPs) and profiling arrays. At the center of the network is the Autonomous Vertically Profiling Plankton Observatory (AVPPO) (Thwaites et al. 1998). The AVPPO consists of buoyant sampling vehicle and a trawl-resistant bottom-mounted enclosure, which holds a winch, the vehicle (when not sampling), batteries, and controller. Three sampling systems are present on the vehicle, a video plankton recorder, a CTD with accessory sensors, and a suite of bio-optical sensors including Satlantic OCI-200 and OCR-200 spectral radiometers and a WetLabs ac-9 dual path absorption and attenuation meter. At preprogrammed times the vehicle is released, floats to the surface, and is then winched back into the enclosure with power and data connection maintained through the winch cable. Communication to shore is possible through a bottom cable and nearby surface telemetry buoy, equipped with a mobile modem, giving the capability for near-real time data transmission and interactive sampling control.
Derived from text
Water Color; Phytoplankton; Marine Meteorology; Oceans; Interactive Control; Optical Measuring Instruments

20040067984 California Univ., Santa Barbara, CA, USA
Optimization Of Ocean Color Algorithms: Application To Satellite And In Situ Data Merging, Chapter 9
Maritorena, Stephane; Siegel, David A.; Morel, Andre; SIMBIOS Project; 2003 Annual Report; November 2003, pp. 114-123; In English; See also 20040067974
Contract(s)/Grant(s): NASA Order 00196; No Copyright; Avail: CASI; A02, Hardcopy

The objective of our program is to develop and validate a procedure for ocean color data merging which is one of the major goals of the SIMBIOS project (McClain et al., 1995). The need for a merging capability is dictated by the fact that since the launch of MODIS on the Terra platform and over the next decade, several global ocean color missions from various space agencies are or will be operational simultaneously. The apparent redundancy in simultaneous ocean color missions can actually be exploited to various benefits. The most obvious benefit is improved coverage (Gregg et al., 1998; Gregg & Woodward, 1998). The patchy and uneven daily coverage from any single sensor can be improved by using a combination of sensors. Beside improved coverage of the global ocean the merging of ocean color data should also result in new, improved, more diverse and better data products with lower uncertainties. Ultimately, ocean color data merging should result in the development of a unified, scientific quality, ocean color time series, from SeaWiFS to NPOESS and beyond. Various approaches can be used for ocean color data merging and several have been tested within the frame of the SIMBIOS program (see e.g. Kwiatkowska & Fargion, 2003, Franz et al., 2003). As part of the SIMBIOS Program, we have developed a merging method for ocean color data. Conversely to other methods our approach does not combine end-products like the subsurface chlorophyll concentration (chl) from different sensors to generate a unified product. Instead, our procedure uses the normalized waterleaving radiances (LwN( )) from single or multiple sensors and uses them in the inversion of a semianalytical ocean color model that allows the retrieval of several ocean color variables simultaneously. Beside ensuring simultaneity and

consistency of the retrievals (all products are derived from a single algorithm), this model-based approach has various benefits over techniques that blend end-products (e.g. chlorophyll): 1) it works with single or multiple data sources regardless of their specific bands, 2) it exploits band redundancies and band differences, 3) it accounts for uncertainties in the LwN( ) data and, 4) it provides uncertainty estimates for the retrieved variables.
Derived from text
Water Color; Oceans; Time Series Analysis; In Situ Measurement

20040067985 Maryland Univ., College Park, MD, USA
Varied Waters and Hazy Skies: Validation of Ocean Color Satellite Data Products in Under-Sampled Marine Areas, Chapter 17
Subramaniam, Ajit; DelVecchio, R.; Carpenter, Edward J.; Capone, Douglas G.; SIMBIOS Project; 2003 Annual Report; November 2003, pp. 175-184; In English; See also 20040067974; No Copyright; Avail: CASI; A02, Hardcopy

It has been hypothesized that one of the limiting micronutrients for nitrogen fixation is Iron. It has also been hypothesized that aeolian dust is the primary source of Iron for near surface open ocean waters. As a part of two National Science Foundation funded studies Factors affecting, and impacts of, diazotrophic microorganisms in the western equatorial Atlantic and Oceanic N2 fixation and global climate we conducted 6 field surveys in the tropical and subtropical Atlantic and Pacific Oceans between 2001 and 2003 (Table 17.1, Figures 17.1-17.6). The cruises were conducted during times of high and low aeolian dust activity in both ocean basins in order to study the impact of dust on nitrogen fixation. In addiction to dust, we also hypothesized that the Amazon River is a significant source of nutrients that stimulate nitrogen fixation, specifically Silicon and Iron that stimulate endosymbiotic diazotrophic cyanobacteria and cruises were also conducted to study the effects of the Amazon River on the phytoplankton species composition, the underwater light field and nutrient concentrations of the western Tropical Atlantic Ocean. Our SIMBIOS activity dove-tailed on the NSF funded grants and the main objectives of our SIMBIOS funded project were to obtain field measurements of Aerosol Optical Thickness (AOT), normalized water leaving radiance (nLw), absorption due to dissolved (aCDOM), particulate (Ap), detrital (Ad) material, and phytoplankton pigments, under dusty skies, in the Amazon River plume, as well as in blooms of the marine diazotrophic cyanobacteria Trichodesmium. These measurements can then be used to validate satellite ocean color products such as those for chlorophyll concentration (chl a mg/m3), absorption due to chromophoric and detrital material (Acdm), reparameterize the algorithms for these products for specific locations such as the Amazon River plume, or to develop entirely new algorithms. In addition to the core SIMBIOS funded cruises, we also participated in six additional cruises in coastal waters where normalized water leaving radiance, aerosol optical thickness, absorption, and phytoplankton pigments were measured and data submitted to the SeaBASS archive. We also deployed a suite of optical instruments at a PIRATA mooring at 8N, 38W between April 2002 and July 2003 (Subramaniam 2002). These instruments are have just been recovered. After they have been recalibrated, the data will be analyzed to obtain a high temporal resolution time-series of normalized water leaving radiance at that site. This data will be compared to that derived from satellites as well as to study the potential enhancement of chlorophyll concentration at this site by Iron from aeolian dust.
Derived from text
Water Color; Phytoplankton; Surface Water; Oceans; Optical Thickness; Algorithms; Aerosols

20040067986 San Diego State Univ., San Diego, CA, USA
HPLC Pigment Measurements For Algorithm Development and Validation in Support of the SIMBIOS Science Team, Chapter 18
Trees, Charles C.; Perl, Jason R.; SIMBIOS Project; 2003 Annual Report; November 2003, pp. 185-192; In English; See also 20040067974; No Copyright; Avail: CASI; A02, Hardcopy

Remotely sensed ocean color is determined by the absorption and scattering properties of dissolved and suspended in-water constituents. For most oceanic and coastal areas phytoplankton, with their associated suite of pigments, dominate the optical signal viewed by satellite ocean color sensors. Phytoplankton use chlorophyll a as their major light harvesting pigment for carbon fixation, yet there are other accessory pigment compounds (chlorophylls b and c, carotenoids, and phycobiliproteins) that play a significant role in photosynthesis. These pigments have distinct spectral signatures, and therefore, changes in the pigment-algal assemblage result in spectral shifts in absorption and scattering. Accurate measurements of phytoplankton pigments are essential in understanding global carbon cycles in oceanic and coastal areas by minimizing satellite retrieval uncertainties when mapping these properties at regional to global scales. The focus of this 3-year program was to characterize phytoplankton pigments (excluding phycobiliproteins) in the water column during NASA s Sensor Intercomparison and Merger for Biological and Interdisciplinary Oceanic Studies (SIMBIOS) program. This research was to provide high performance liquid chromatography (HPLC) pigment analysis on samples collected by the SIMBIOS

Science Team for bio-optical algorithm validation and development. The effort provided the SIMBIOS program with an internally consistent pigment database of the highest quality to evaluate ocean color products.
Derived from text
Pigments; Spectral Signatures; Water Color; Algorithms; Liquid Chromatography; Optical Measuring Instruments; Phytoplankton; Absorption Spectra

20040067987 Maryland Univ. Baltimore County, Catonsville, MD, USA
Assessment, Validation, and Refinement of the Atmospheric Correction Algorithm for the Ocean Color Sensors, Chapter 19
Wang, Menghua; SIMBIOS Project; 2003 Annual Report; November 2003, pp. 193-202; In English; See also 20040067974
Contract(s)/Grant(s): NASA Order 00203; No Copyright; Avail: CASI; A02, Hardcopy

The primary focus of this proposed research is for the atmospheric correction algorithm evaluation and development and satellite sensor calibration and characterization. It is well known that the atmospheric correction, which removes more than 90% of sensor-measured signals contributed from atmosphere in the visible, is the key procedure in the ocean color remote sensing (Gordon and Wang, 1994). The accuracy and effectiveness of the atmospheric correction directly affect the remotely retrieved ocean bio-optical products. On the other hand, for ocean color remote sensing, in order to obtain the required accuracy in the derived water-leaving signals from satellite measurements, an on-orbit vicarious calibration of the whole system, i.e., sensor and algorithms, is necessary. In addition, it is important to address issues of (i) cross-calibration of two or more sensors and (ii) in-orbit vicarious calibration of the sensor-atmosphere system. The goal of these researches is to develop methods for meaningful comparison and possible merging of data products from multiple ocean color missions. In the past year, much efforts have been on (a) understanding and correcting the artifacts appeared in the SeaWiFS-derived ocean and atmospheric produces; (b) developing an efficient method in generating the SeaWiFS aerosol lookup tables, (c) evaluating the effects of calibration error in the near-infrared (NIR) band to the atmospheric correction of the ocean color remote sensors, (d) comparing the aerosol correction algorithm using the singlescattering epsilon (the current SeaWiFS algorithm) vs. the multiple-scattering epsilon method, and (e) continuing on activities for the International Ocean-Color Coordinating Group (IOCCG) atmospheric correction working group. In this report, I will briefly present and discuss these and some other research activities.
Derived from text
Atmospheric Correction; Satellite Observation; Remote Sensing; Calibrating; Algorithms; Water Color

20040067988 Naval Research Lab., Washington, DC, USA
Adaptation of a Hyperspectral Atmospheric Correction Algorithm for Multi-spectral Ocean Color Data in Coastal Waters, Chapter 3
Gao, Bo-Cai; Montes, Marcos J.; Davis, Curtiss O.; SIMBIOS Project; 2003 Annual Report; November 2003, pp. 35-40; In English; See also 20040067974
Contract(s)/Grant(s): NASA Order S-44797-X; No Copyright; Avail: CASI; A02, Hardcopy

This SIMBIOS contract supports several activities over its three-year time-span. These include certain computational aspects of atmospheric correction, including the modification of our hyperspectral atmospheric correction algorithm Tafkaa for various multi-spectral instruments, such as SeaWiFS, MODIS, and GLI. Additionally, since absorbing aerosols are becoming common in many coastal areas, we are making the model calculations to incorporate various absorbing aerosol models into tables used by our Tafkaa atmospheric correction algorithm. Finally, we have developed the algorithms to use MODIS data to characterize thin cirrus effects on aerosol retrieval.
Derived from text
Aerosols; Algorithms; Atmospheric Correction; Water Color

20040067989 Monterey Bay Aquarium Research Inst., Moss Landing, CA, USA
Bio-Optical Measurements in Upwelling Ecosystems in Support of SIMBIOS, Chapter 4
Chavez, Francisco P.; Strutton, Peter G.; Kuwahara, Victor S.; Mahoney, Kevin L.; Drake, Eric; SIMBIOS Project; 2003 Annual Report; November 2003, pp. 41-51; In English; See also 20040067974
Contract(s)/Grant(s): NASA Order 00193; No Copyright; Avail: CASI; A03, Hardcopy

The upwelling region of the equatorial Pacific Ocean, which spans one quarter of the earth s circumference, strongly impacts global biogeochemistry. This upwelling system has significant implications for global CO2 fluxes (Tans et al., 1990; Takahashi et al., 1997; Feely et al., 1999), as well as primary and secondary production (Chavez and Barber, 1987; Chavez

and Toggweiler, 1995; Chavez et al., 1996; Dugdale and Wilkerson, 1998; Chavez et al., 1999; Strutton and Chavez, 2000). In addition, the region represents a vast oceanic (case 1) region over which validation data for SeaWiFS are needed. This project consists of an optical mooring program and cruise-based measurements focused on measuring biological and chemical variability in the equatorial Pacific and obtaining validation data for SeaWiFS.
Derived from text
Biogeochemistry; Ecosystems; Optical Measurement; Upwelling Water

20040067990 California Univ., Santa Barbara, CA, USA
Bermuda Bio Optics Project, Chapter 14
Nelson, Norm; SIMBIOS Project; 2003 Annual Report; November 2003, pp. 147-152; In English; See also 20040067974
Contract(s)/Grant(s): NASA Order 00200; No Copyright; Avail: CASI; A02, Hardcopy

The Bermuda BioOptics Project (BBOP) is a collaborative effort between the Institute for Computational Earth System Science (ICESS) at the University of California at Santa Barbara (UCSB) and the Bermuda Biological Station for Research (BBSR). This research program is designed to characterize light availability and utilization in the Sargasso Sea, and to provide an optical link by which biogeochemical observations may be used to evaluate bio-optical models for pigment concentration, primary production, and sinking particle fluxes from satellite-based ocean color sensors. The BBOP time-series was initiated in 1992, and is carried out in conjunction with the U.S. JGOFS Bermuda Atlantic Time-series Study (BATS) at the Bermuda Biological Station for Research. The BATS program itself has been observing biogeochemical processes (primary productivity, particle flux and elemental cycles) in the mesotrophic waters of the Sargasso Sea since 1988. Closely affiliated with BBOP and BATS is a separate NASA-funded study of the spatial variability of biogeochemical processes in the Sargasso Sea using high-resolution AVHRR and SeaWiFS data collected at Bermuda (N. Nelson, P.I.). The collaboration between BATS and BBOP measurements has resulted in a unique data set that addresses not only the SIMBIOS goals but also the broader issues of important factors controlling the carbon cycle.
Author
Sargasso Sea; Biogeochemistry; Optical Properties

20040067991 California Univ., Santa Barbara, CA, USA
Plumes and Blooms: Modeling the Case II Waters of the Santa Barbara Channel, Chapter 15
Siegel, D. A.; Maritorena, S.; Nelson, N. B.; SIMBIOS Project; 2003 Annual Report; November 2003, pp. 153-159; In English; See also 20040067974
Contract(s)/Grant(s): NASA Order 00201; No Copyright; Avail: CASI; A02, Hardcopy

The goal of the Plumes and Blooms (PnB) project is to develop, validate and apply to imagery state-of-the-art ocean color algorithms for quantifying sediment plumes and phytoplankton blooms for the Case II environment of the Santa Barbara Channel. We conduct monthly to twice-monthly transect observations across the Santa Barbara Channel to develop an algorithm development and product validation data set. The PnB field program started in the summer of 1996. At each of the 7 PnB stations, a complete verification bio-geo-optical data set is collected. Included are redundant measures of apparent optical properties (remote sensing reflectance and diffuse attenuation spectra), as well as in situ profiles of spectral absorption, beam attenuation and backscattering coefficients. Water samples are analyzed for component in vivo absorption spectra, fluorometric chlorophyll, phytoplankton pigment (by the SDSU CHORS laboratory), and inorganic nutrient concentrations. A primary goal is to use the PnB field data set to objectively tune semi-analytical models of ocean color for this site and apply them using available satellite imagery (SeaWiFS and MODIS). In support of this goal, we have also been addressing SeaWiFS ocean color and AVHRR SST imagery. We also are using the PnB data set to address time/space variability of water masses in the Santa Barbara Channel and its relationship to the 1997/1998 El Nino. However, the comparison between PnB field observations and satellite estimates of primary products has been disappointing. We find that field estimates of water-leaving radiance, L(sub wN)(lambda), correspond poorly to satellite estimates for both SeaWiFS and MODIS local area coverage imagery. We believe this is due to poor atmospheric correction due to complex mixtures of aerosol types found in these near-coastal regions. Last, we remain active in outreach activities.
Author
Oceans; Phytoplankton; Water Color

20040067992 San Diego State Univ., San Diego, CA, USA
Ocean Optics Protocols and SIMBIOS Protocol Intercomparison Round Robin Experiments (SPIRREX), Chapter 13
Mueller, James L.; SIMBIOS Project; 2003 Annual Report; November 2003, pp. 145-146; In English; See also 20040067974; No Copyright; Avail: CASI; A01, Hardcopy

The objective of research under this contract is the maintenance and annual revision of the document Ocean Optics Protocols for Satellite Ocean Color Sensor Validation (e.g. Fargion and Mueller 2000; Mueller et al. 2002; Mueller et al. 2003a 2003e; Pegau et al. 2003).
Derived from text
Water Color; Oceans; Protocol (Computers)

51
LIFE SCIENCES (GENERAL)

Includes general research topics related to plant and animal biology (non-human); ecology; microbiology; and also the origin, development, structure, and maintenance of animals and plants in space and related environmental conditions. For specific topics in life sciences see *categories 52 through 55*.

20040065851 NASA Stennis Space Center, Bay Saint Louis, MS, USA
Leaf Optical Properties in Higher Plants: Linking Spectral Characteristics with Plant Stress
Carter, Gregory A.; Knapp, Alan K.; April 1, 1999; 2 pp.; In English; International Botanical Congress, Aug. 1999, Saint Louis, MO, USA
Report No.(s): SE-1999-04-00016-SSC; No Copyright; Avail: Other Sources; Abstract Only

A number of studies have addressed responses of leaf spectral reflectance, transmittance, or absorptance to physiological stress. Stressors included dehydration, ozone, herbicides, disease, insufficient mycorrhizae and N fertilization, flooding and insects. Species included conifers, grasses, and broadleaved trees. Increased reflectance with maximum responses near 700 nm wavelength occurred in all cases. Varying the chlorophyll content in leaves or pigment extracts can simulate this effect. Thus, common optical responses to stress result from decreases in leaf chlorophyll contents or the capacity of chloroplasts to absorb light. Leaf optic can be quite sensitive to any stressor that alters soil-plant-atmosphere processes.
Author
Plant Stress; Spectral Reflectance; Leaves

20040066103 American Museum of Natural History, New York, NY, USA
Deuterostome Evolution: Large Data Set Analysis
Janies, Daniel; Wheeler, Ward; [2004]; 6 pp.; In English
Contract(s)/Grant(s): NAG2-1399; No Copyright; Avail: CASI; A02, Hardcopy

This award allowed us to develop novel hardware for phylogenetics, collect genomic data and produce several phylogenies of deuterostome organisms, communicate the results publicly, release software into the public domain, publish textbooks and papers, and prepare for the next research projects. There are no resulting subject inventions to report. We review these activities in three sections: 1) Hardware and software and development; 2) Evolutionary biology research; 3) Our proposed future direction, predictive analysis of pathogens in support of the NASA mission.
Author (revised)
Biological Evolution; Computer Techniques; Data Processing; Animals

52
AEROSPACE MEDICINE

Includes the biological and physiological effects of atmospheric and space flight (weightlessness, space radiation, acceleration, and altitude stress) on the human being; and the prevention of adverse effects on those environments. For psychological and behavioral effects of aerospace environments, see *53 Behavioral Sciences*. For the effects of space on animals and plants see *51 Life Sciences*.

20040062362 International Society for Gravitational Physiology, Davis, CA, USA
Journal of Gravitational Physiology, Volume 10, No. 1
Fuller, Charles, Editor; Cogoli, Augusto, Editor; Hargens, Alan R., Editor; Smith, Arthur H., Editor; Alberts, Jeffrey, Editor; Baldwin, Kenneth, Editor; Bjurstedt, Hilding, Editor; Blomqvist, C. Gunnar, Editor; Burton, Russell, Editor; Cardus, David, Editor, et al.; July 2003; ISSN 1077-9248; 135 pp.; In English; 24th Annual Gravitational Physiology Meeting, 4-9 May 2003, Santa Monica, CA, USA
Contract(s)/Grant(s): NAG2-6072; Copyright; Avail: Other Sources

The topics addressed in this issue include: 1) Biosatellites: Past, Present, and Future; 2) Plant Physiology; 3)

Neural/Sensory; 4) Musculoskeletal; 5) Endocrinology/Immunology; 6) Development; 7) Cardiovascular; 8) Countermeasures/Applied; 9) Technical.
CASI
Aerospace Medicine; Gravitational Physiology; Microgravity

20040065979 NASA Johnson Space Center, Houston, TX, USA
Introduction to Radiation Issues for International Space Station Extravehicular Activities, Chapter 1
Shavers, M. R.; Saganti, P. B.; Miller, J.; Cucinotta, F. A.; Radiation Protection Studies of International Space Station Extravehicular Activity Space Suits; See also Doc ID 20040031719; December 2003, pp. 1-17; In English; No Copyright; Avail: CASI; A03, Hardcopy

The International Space Station (ISS) provides significant challenges for radiation protection of the crew due to a combination of circumstances including: the extended duration of missions for many crewmembers, the exceptionally dynamic nature of the radiation environment in ISS orbit, and the necessity for numerous planned extravehicular activities (EVA) for station construction and maintenance. Radiation protection requires accurate radiation dose measurements and precise risk modeling of the transmission of high fluxes of energetic electrons and protons through the relatively thin shielding provided by the space suits worn during EVA. Experiments and analyses have been performed due to the necessity to assure complete radiation safety for the EVA crew and thereby ensure mission success. The detailed characterization described of the material and topological properties of the ISS space suits can be used as a basis for design of space suits used in future exploration missions. In radiation protection practices, risk from exposure to ionizing radiation is determined analytically by the level of exposure, the detrimental quality of the radiation field, the inherent radiosensitivity of the tissues or organs irradiated, and the age and gender of the person at the time of exposure. During low Earth orbit (LEO) EVA, the relatively high fluxes of low-energy electrons and protons lead to large variations in exposure of the skin, lens of the eye, and tissues in other shallow anatomical locations. The technical papers in this publication describe a number of ground-based experiments that precisely measure the thickness of the NASA extravehicular mobility unit (EMU) and Russian Zvezda Orlan-M suits using medical computerized tomography (CT) X-ray analysis, and particle accelerator experiments that measure the minimum kinetic energy required by electrons and photons to penetrate major components of the suits. These studies provide information necessary for improving the understanding of the current ISS space suits and provide insights into improved approaches for the design of future suits. This chapter begins with a summary of the dynamic ionizing radiation environment in LEO space and introduces the concepts and quantities used to quantify exposure to space radiation in LEO. The space suits used for EVA and the experimental partial human phantom are described. Subsequent chapters report results from measured charged particle fields before and after incident protons and secondary particles are transported through the space suits and into organs and tissues.
Author
Radiation Protection; Extravehicular Mobility Units; Earth Orbital Environments

20040065985 NASA Marshall Space Flight Center, Huntsville, AL, USA
Radiation Risk Assessment of the Individual Astronaut: A Complement to Radiation Interests at the NIH
Richmond, Robert C.; [2004]; 1 pp.; In English; Invited Talk to National Institute of Health, 19 Apr. 2004, Rockville, MD, USA; No Copyright; Avail: Other Sources; Abstract Only

Predicting human risks following exposure to space radiation is uncertain in part because of unpredictable distribution of high-LET and low-dose-derived damage amongst cells in tissues, unknown synergistic effects of microgravity upon gene- and protein-expression, and inadequately modeled processing of radiation-induced damage within cells to produce rare and late-appearing malignant cancers. Furthermore, estimation of risks of radiogenic outcome within small numbers of astronauts is not possible using classic epidemiologic study. It therefore seems useful to develop strategies of risk-assessment based upon large datasets acquired from correlated biological models useful for resolving radiogenic risk-assessment for irradiated individuals. In this regard, it is suggested that sensitive cellular biodosimeters that simultaneously report 1) the quantity of absorbed dose after exposure to ionizing radiation, 2) the quality of radiation delivering that dose, and 3) the biomolecular risk of malignant transformation be developed in order to resolve these NASA-specific challenges. Multiparametric cellular biodosimeters could be developed using analyses of gene-expression and protein-expression whereby large datasets of cellular response to radiation-induced damage are analyzed for markers predictive for acute response as well as cancer-risk. A new paradigm is accordingly addressed wherein genomic and proteomic datasets are registered and interrogated in order to provide statistically significant dose-dependent risk estimation in individual astronauts. This evaluation of the individual for assessment of radiogenic outcomes connects to NIH program in that such a paradigm also supports assignment of a given patient to a specific therapy, the diagnosis of response of that patient to therapy, and the prediction of risks accumulated by

that patient during therapy - such as risks incurred by scatter and neutrons produced during high-energy Intensity-Modulated Radiation Therapy. Value of assessment of radiogenic outcome for individuals exposed to radiation is suggested to be common to both NASA and NIH.
Author
Radiation Therapy; Extraterrestrial Radiation; Microgravity; Ionizing Radiation; Assessments

20040068089 Loma Linda Univ., CA, USA
In Vitro Studies on Space Radiation-Induced Delayed Genetic Responses: Shielding Effects
Kadhim, Munira A.; Green, Lora M.; Gridley, Daila S.; Murray, Deborah K.; Tran, Da Thao; Andres, Melba; Pocock, Debbie; Macdonald, Denise; Goodhead, Dudley T.; Moyers, Michael F.; December 2003; 9 pp.; In English
Contract(s)/Grant(s): NCC9-79; No Copyright; Avail: CASI; A02, Hardcopy

Understanding the radiation risks involved in spaceflight is of considerable importance, especially with the long-term occupation of ISS and the planned crewed exploration missions. Several independent causes may contribute to the overall risk to astronauts exposed to the complex space environment, such as exposure to GCR as well as SPES. Protons and high-Z energetic particles comprise the GCR spectrum and may exert considerable biological effects even at low fluence. There are also considerable uncertainties associated with secondary particle effects (e.g. HZE fragments, neutrons etc.). The interaction of protons and high-LET particles with biological materials at all levels of biological organization needs to be investigated fully in order to establish a scientific basis for risk assessment. The results of these types of investigation will foster the development of appropriately directed countermeasures. In this study, we compared the biological responses to proton irradiation presented to the target cells as a monoenergetic beam of particles of complex composition delivered to cells outside or inside a tissue phantom head placed in the USA EVA space suit helmet. Measurements of chromosome aberrations, apoptosis, and the induction of key proteins were made in bone marrow from CBA/CaJ and C57BL/6 mice at early and late times post exposure to radiation at 0, 0.5, 1 and 2 Gy while inside or outside of the helmet. The data showed that proton irradiation induced transmissible chromosomal/genomic instability in haematopoietic stem cells in both strains of mice under both irradiation conditions and especially at low doses. Although differences were noted between the mouse strains in the degree and kinetics of transforming growth factor-beta 1 and tumor necrosis factor-alpha secretion, there were no significant differences observed in the level of the induced instability under either radiation condition, or for both strains of mice. Consequently, when normalized to physical dose, the monoenergetic proton field present inside the helmet-protected phantom produced equivalent biological responses, when compared to unshielded cells, as measured by the induction of delayed genetic effects in murine haematopoietic stem cells.
Author (revised)
Radiation Effects; Radiation Shielding; Proton Irradiation; Mutations

20040068091 NASA Johnson Space Center, Houston, TX, USA
Risk of Skin Cancer from Space Radiation, Chapter 11
Cucinotta, Francis A.; Kim, Myung-Hee Y.; George, Kerry A.; Wu, Hong-Lu; Radiation Protection Studies of International Space Station Extravehicular Activity Space Suits; See also Doc ID 20040031719; December 2003, pp. 171-176; In English; No Copyright; Avail: CASI; A02, Hardcopy

We review the methods for estimating the probability of increased incidence of skin cancers from space radiation exposure, and describe some of the individual factors that may contribute to risk projection models, including skin pigment, and synergistic effects of combined ionizing and UV exposure. The steep dose gradients from trapped electrons, protons, and heavy ions radiation during EVA and limitations in EVA dosimetry are important factors for projecting skin cancer risk of astronauts. We estimate that the probability of increased skin cancer risk varies more than 10-fold for individual astronauts and that the risk of skin cancer could exceed 1 % for future lunar base operations for astronauts with light skin color and hair. Limitations in physical dosimetry in estimating the distribution of dose at the skin suggest that new biodosimetry methods be developed for responding to accidental overexposure of the skin during future space missions.
Author
Astronauts; Cancer; Extraterrestrial Radiation; Radiation Dosage; Risk; Skin (Anatomy)

20040068093 NASA Langley Research Center, Hampton, VA, USA
Radiation Exposure Analysis for ISS: The Female Astronaut in EVA, Chapter 10
Anderson, Brooke M.; Wilson, John W.; Atwell, William; Hugger, Craig; Nealy, John E.; Radiation Protection Studies of International Space Station Extravehicular Activity Space Suits; See also Doc ID 20040031719; December 2003, pp. 155-169; In English; Copyright; Avail: CASI; A03, Hardcopy

Special exposure limit recommendations have been designated by the NCRP for US. astronauts in LEO operations. These have been established from consideration of a 3% lifetime excess risk of cancer mortality for a 10-yr. active career. The most recent recommendations of the NCRP have incorporated modified procedures for evaluating exposures with accompanying adjustments in career limits. Of special importance are the limit specifications for female exposures, which are approximately 40% less than those for males. Furthermore, radiosensitive organs unique to females require additional attention.
Author
Astronauts; Exposure; Extravehicular Activity; Females; Radiation Dosage

54
MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human factors engineering, bionics, man-machine systems, life support, space suits and protective clothing. For related information see also *16 Space Transportation and Safety* and *52 Aerospace Medicine*.

20040062471 National Inst. for Occupational Safety and Health, Washington, DC, USA, California Univ., Los Angeles, CA, USA
Statistical Modeling of Respirator Penetration Data, Final Performance Report, Summary Report (Option 2)
Spear, R. C.; Jan. 31, 2003; 24 pp.; In English
Report No.(s): PB2004-104819; No Copyright; Avail: CASI; A03, Hardcopy
No abstract available
Mathematical Models; Statistical Analysis

20040062472 National Inst. for Occupational Safety and Health, Washington, DC, USA
Understanding Vibration Injury
Oct. 06, 2003; 12 pp.; In English
Report No.(s): PB2004-104818; No Copyright; Avail: CASI; A03, Hardcopy
The present understanding of hand-arm vibration syndrome (HAVS) suffers from the lack of knowledge regarding the onset and progression of vibration injury of cells and tissues. Repeated injury generates neurovascular symptoms and, with longer exposures, matures into an irreversible disease. Without elucidating these basic mechanisms, the foundation is lacking on which to develop early detection and monitoring methods, countermeasure techniques and exposure guidelines for protecting workers. The current thinking for setting exposure guidelines relies on frequency weighted predictions, which progressively minimize the impact of frequencies above 16 Hz, even though recent reports from many laboratories, including ours, suggest this approach underestimates damage inflicted at higher frequencies.
NTIS
Vibration; Occupational Diseases

20040065771 NASA Langley Research Center, Hampton, VA, USA
Head-Up Displays and Attention Capture
Prinzel, Lawrence J., III; February 2004; 36 pp.; In English
Contract(s)/Grant(s): L-18450
Report No.(s): NASA/TM-2004-213000; No Copyright; Avail: CASI; A03, Hardcopy
The primary role of head-up displays (HUDs) is to provide primary flight, navigation, and guidance information to the pilot in a forward field-of-view on a head-up transparent screen. Therefore, this theoretically allows for optimal control of an aircraft through the simultaneous scanning of both instrument data and the out-the-window scene. However, despite significant aviation safety benefits afforded by HUDs, a number of accidents have shown that their use does not come without costs. The human factors community has identified significant issues related to the pilot distribution of near and far domain attentional resources because of the compellingness of symbology elements on the HUD; a concern termed, attention or cognitive capture. The paper describes the phenomena of attention capture and presents a selected survey of the literature on the etiology and potential prescriptions.
Author
Human Factors Engineering; Aircraft Safety; Head-Up Displays; Etiology

20040065910 Human Systems Information Analysis Center, Wright-Patterson AFB, OH, USA
Human Systems Gateway, Volume 13, No. 3
January 2002; 17 pp.; In English; Original contains color illustrations
Report No.(s): AD-A410690; No Copyright; Avail: CASI; A03, Hardcopy

This newsletter contains information on multifunction displays, visual symptoms related to helmet-mounted displays, Human Error on Crew station changes, and Developing Crew Rest. It also has a calendar of upcoming human factors events. DTIC

Display Devices; Human Factors Engineering

20040065983 Eril Research, Inc., San Rafael, CA, USA
Characterization of the Radiation Shielding Properties of U.S. and Russian Extravehicular Activity Suits, Chapter 4
Benton, E. R.; Benton, E. V.; Frank, A. L.; December 2003; 26 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

Reported herein are results from the Eril Research, Inc. (ERI) participation in the JSC-sponsored study characterizing the radiation shielding properties of the two types of space suit that astronauts are wearing during the EVA on-orbit assembly of ISS. Measurements using passive detectors were carried out to assess the shielding properties of the U.S. EMU Suit and the Russian Orlan-M suit during irradiations of the suits and a tissue-equivalent phantom to monoenergetic proton and electron beams at LLUMC. During irradiations of 6 MeV electrons and 60 MeV protons, absorbed dose as a function of depth was measured using TLDs exposed behind swatches of the two suit materials and inside the two EVA helmets. Considerable reduction in electron dose was measured behind all suit materials in exposures to 6 MeV electrons. Slowing of the proton beam in the suit materials led to an increase in dose measured in exposures to 60 MeV protons. During 232 MeV proton irradiations, measurements were made with TLDs and CR-39 PNTDs at five organ locations inside a tissue-equivalent phantom, exposed both with and without the two EVA suits. The EVA helmets produce a 13% to 27% reduction in total dose and a 0% to 25% reduction in dose equivalent when compared to measurements made in the phantom head alone. Differences in dose and dose equivalent between the suit and non-suit irradiations for the lower portions of the two EVA suits tended to be smaller. Proton-induced target fragmentation was found to be a significant source of increased dose equivalent, especially within the two EVA helmets, and average quality factor inside the EMU and Orlan-M helmets was 2% to 14% greater than that measured in the bare phantom head.
Author

Radiation Shielding; Extravehicular Mobility Units; Astronauts; Cosmonauts

20040065984 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
Radiation Tests of the Extravehicular Mobility Unit Space Suit for the International Space Station Using Energetic Protons, Chapter 3
Zeitlin, C.; Heilbronn, L.; Miller, J.; Shavers, M.; December 2003; 34 pp.; In English
Contract(s)/Grant(s): NASA Order T-5606-W; DE-AC-03076SF00098; No Copyright; Avail: CASI; A03, Hardcopy

Measurements using silicon detectors to characterize the radiation transmitted through the EMU space suit and a human phantom have been performed using 155 and 250 MeV proton beams at LLUMC. The beams simulate radiation encountered in space, where trapped protons having kinetic energies on the order of 100 MeV are copious. Protons with 100 MeV kinetic energy and above can penetrate many centimeters of water or other light materials, so that astronauts exposed to such energetic particles will receive doses to their internal organs. This dose can be enhanced or reduced by shielding - either from the space suit or the self-shielding of the body - but minimization of the risk depends on details of the incident particle flux (in particular the energy spectrum) and on the dose responses of the various critical organs. Data were taken to characterize the beams and to calibrate the detectors using the beam in a treatment room at LLUPTF, in preparation for an experiment with the same beams incident on detectors placed in a human phantom within the EMU suit. Nuclear interactions of high-energy protons in various materials produce a small flux of highly ionizing, low-energy secondary radiation. Secondaries are of interest for their biological effects, since they cause doses and especially dose-equivalents to increase relative to the values expected simply from ionization energy loss along the Bragg curve. Because many secondaries have very short ranges, they are best measured in passive track detectors such as CR-39. The silicon detector data presented here are intended to supplement the CR-39 data in regions where silicon has greater sensitivity, in particular the portion of the LET spectrum below 5 keV/micron. The results obtained in this study suggest that optimizing the radiation shielding properties of space suits is a formidable task. The naive assumption that adding mass can reduce risk is not supported by the data, which show that reducing the dose delivered at or near the skin by low-energy particles may increase the dose delivered by energetic particles to points deeper in the body.
Author

Extravehicular Mobility Units; Radiation Shielding; Energetic Particles; Protons

20040065986 Lockheed Martin Corp., Houston, TX, USA

A Comparison of Model Calculation and Measurement of Absorbed Dose for Proton Irradiation, Chapter 5

Zapp, N.; Semones, E.; Saganti, P.; Cucinotta, F.; December 2003; 7 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

With the increase in the amount of time spent EVA that is necessary to complete the construction and subsequent maintenance of ISS, it will become increasingly important for ground support personnel to accurately characterize the radiation exposures incurred by EVA crewmembers. Since exposure measurements cannot be taken within the organs of interest, it is necessary to estimate these exposures by calculation. To validate the methods and tools used to develop these estimates, it is necessary to model experiments performed in a controlled environment. This work is such an effort. A human phantom was outfitted with detector equipment and then placed in American EMU and Orlan-M EVA space suits. The suited phantom was irradiated at the LLUPTF with proton beams of known energies. Absorbed dose measurements were made by the spaceflight operational dosimetrist from JSC at multiple sites in the skin, eye, brain, stomach, and small intestine locations in the phantom. These exposures are then modeled using the BRYNTRN radiation transport code developed at the NASA Langley Research Center, and the CAM (computerized anatomical male) human geometry model of Billings and Yucker. Comparisons of absorbed dose calculations with measurements show excellent agreement. This suggests that there is reason to be confident in the ability of both the transport code and the human body model to estimate proton exposure in ground-based laboratory experiments.

Author

Extravehicular Mobility Units; Radiation Dosage; Proton Irradiation

20040065987 NASA Langley Research Center, Hampton, VA, USA

Shuttle Space Suit: Fabric/LCVG Model Validation, Chapter 8

Wilson, J. W.; Tweed, J.; Zeitlin, C.; Kim, M.-H. Y.; Anderson, B. M.; Cucinotta, F. A.; Ware, J.; Persans, A. E.; Radiation Protection Studies of International Space Station Extravehicular Activity Space Suits; See also Doc ID 20040031719; December 2003, pp. 127-134; In English; No Copyright; Avail: CASI; A02, Hardcopy

A detailed space suit computational model is being developed at the Langley Research Center for radiation exposure evaluation studies. The details of the construction of the space suit are critical to estimation of exposures and assessing the risk to the astronaut on EVA. Past evaluations of space suit shielding properties assumed the basic fabric layup (Thermal Micrometeoroid Garment, fabric restraints, and pressure envelope) and LCVG could be homogenized as a single layer overestimating the protective properties over 60 percent of the fabric area. The present space suit model represents the inhomogeneous distributions of LCVG materials (mainly the water filled cooling tubes). An experimental test is performed using a 34-MeV proton beam and high-resolution detectors to compare with model-predicted transmission factors. Some suggestions are made on possible improved construction methods to improve the space suit s protection properties.

Author

Space Suits; Radiation Protection

20040065988 NASA Langley Research Center, Hampton, VA, USA

Preliminary Shuttle Space Suit Shielding Model, Chapter 9

Anderson, Brooke M.; Nealy, J. E.; Qualls, G. D.; Staritz, P. J.; Wilson, J. W.; Kim, M.-H. Y.; Cucinotta, F. A.; Atwell, W.; DeAngelis, G.; Ware, J.; Persans, A. E.; Radiation Protection Studies of International Space Station Extravehicular Activity Space Suits; See also Doc ID 20040031719; December 2003, pp. 135-154; In English; No Copyright; Avail: CASI; A03, Hardcopy

There are two space suits in current usage within the space program: EMU [2] and Orlan-M Space Suit . The Shuttle space suit components are discussed elsewhere [2,5,6] and serve as a guide to development of the current model. The present model is somewhat simplified in details which are considered to be second order in their effects on exposures. A more systematic approach is ongoing on a part-by-part basis with the most important ones in terms of exposure contributions being addressed first with detailed studies of the relatively thin space suit fabric as the first example . Additional studies to validate the model of the head coverings (bubble, helmet, visors.. .) will be undertaken in the near future. The purpose of this paper is to present the details of the model as it is now and to examine its impact on estimates of astronaut health risks. In this respect, the nonuniform distribution of mass of the space suit provides increased shielding in some directions and some organs. These effects can be most important in terms of health risks and especially critical to evaluation of potential early radiation effects.

Author

Space Suits; Portable Life Support Systems; Computer Aided Design

20040065989 NASA Marshall Space Flight Center, Huntsville, AL, USA

Radiation Hazards and Countermeasures for Human Space Flight

Adams, James H., Jr.; [2004]; 1 pp.; In English; 2004 NASA/JPL Workshop on Physics for Planetary Exploration, 19-22 Apr. 2004, Solvang, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

Protection of the astronauts from space radiation is NASA's moral and legal responsibility. There can be no manned deep space missions without adequate protection from the ionizing radiation in space. There are tow parts to radiation protection, determining the effects of space radiation on humans so that adequate exposure limits can be set and providing radiation protection that insures those limits will not be exceeded. This talk will review the status of work on these two parts and identify areas that are currently being investigated and gaps in the research that have been identified.

Author

Radiation Hazards; Countermeasures; Manned Space Flight; Extraterrestrial Radiation; Exposure

20040067926 National Inst. for Occupational Safety and Health, Pittsburgh, PA, USA

Developing Random Virtual Human Motions and Risky Work Behaviors for Studying Anthropotechnical Systems

Ambrose, D. H.; Mar. 2004; 36 pp.; In English

Report No.(s): PB2004-104817; NIOSH-IC-9468; No Copyright; Avail: CASI; A03, Hardcopy

A computer model was created that generates contact data by means of simulation while altering several variables associated with the machine and its operator. These variables include work environment, the operator's anthropometry, work posture, choice of risky work behavior, and the machine's appendage velocity. In the model, a contact means two or more objects intersecting or touching each other, e.g., the appendage colliding with the operator's hand, arm, head, or leg. This report documents the code development of special features of the computer model, random virtual human motions and behaviors, which made it possible for researchers to study hazardous interactions, such as contacts between the operator and machine. The original idea for random virtual human motions began with the need for a model that, when simulated, would experimentally mimic machine and human actions that could cause actual injuries or fatalities in the workplace. Injury incident investigation reports do not usually contain enough information to aid in studying this problem, and lab experiments with human subjects are also not feasible because of safety issues and ethical issues.

NTIS

Computerized Simulation; Anthropometry; Safety; Human Behavior

20040068092 NASA Johnson Space Center, Houston, TX, USA

Summary and Recommendations for Future Work, Chapter 12

Cucinotta, Francis A.; Shavers, Mark R.; Saganti, Premkumar B.; Miller, Jack; Radiation Protection Studies of International Space Station Extravehicular Activity Space Suits; See also Doc ID 20040031719; December 2003, pp. 177-181; In English; No Copyright; Avail: CASI; A01, Hardcopy

The safety of astronauts is the primary concern of all space missions. Space radiation has been identified as a major concern for ISS, and minimizing radiation risks during EVA is a principle component of NASA s radiation protection program. The space suit plays a critical role in shielding astronauts from EVA radiation exposures. In cooperation with the JSC Extravehicular Activity Project Office, and the Space Radiation Health Project Office, the NASA EMU and RSA Orlan space suits were taken to the LLUPTF for a series of measurements with proton and electron beams to simulate exposures during EVA operations. Additional tests with material layouts of the EMU suit sleeve were made in collaboration with NASA LaRC at the LBNL 88-inch cyclotron and at the Brookhaven National Laboratory Alternating Gradient Synchrotron.

Derived from text

Astronauts; Extraterrestrial Radiation; Radiation Protection; Radiation Shielding; Space Suits; Recommendations

55
EXOBIOLOGY

Includes astrobiology; planetary biology; and extraterrestrial life. For the biological effects of aerospace environments on humans see *52 Aerospace Medicine*; on animals and plants see *51 Life Sciences*. For psychological and behavioral effects of aerospace environments see *53 Behavioral Sciences*.

20040065785 Lunar and Planetary Inst., Houston, TX, USA
Lunar and Planetary Science XXXV: Astrobiology
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040065786 - 20040065805
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The presentations in this session are: 1. A Prototype Life Detection Chip 2. The Geology of Atlantis Basin, Mars, and Its Astrobiological Interest 3. Collecting Bacteria Together with Aerosols in the Martian Atmosphere by the FOELDIX Experimental Instrument Developed with a Nutrient Detector Pattern: Model Measurements of Effectivity 4. 2D and 3D X-ray Imaging of Microorganisms in Meteorites Using Complexity Analysis to Distinguish Field Images of Stromatoloids from Surrounding Rock Matrix in 3.45 Ga Strelley Pool Chert, Western Australia 4. Characterization of Two Isolates from Andean Lakes in Bolivia Short Time Scale Evolution of Microbiolites in Rapidly Receding Altiplanic Lakes: Learning How to Recognize Changing Signatures of Life 5. The Effect of Salts on Electrospray Ionization of Amino Acids in the Negative Mode 6. Determination of Aromatic Ring Number Using Multi-Channel Deep UV Native Fluorescence 7. Microbial D/H Fractionation in Extraterrestrial Materials: Application to Micrometeorites and Mars 8. Carbon Isotope Characteristics of Spring-fed Iron-precipitating Microbial Mats 9. Amino Acid Survival Under Ambient Martian Surface UV Lighting Extraction of Organic Molecules from Terrestrial Material: Quantitative Yields from Heat and Water Extractions 10. Laboratory Detection and Analysis of Organic Compounds in Rocks Using HPLC and XRD Methods 11. Thermal Decomposition of Siderite-Pyrite Assemblages: Implications for Sulfide Mineralogy in Martian Meteorite ALH84001 Carbonate Globules 12. Determination of the Three-Dimensional Morphology of ALH84001 and Biogenic MV-1 Magnetite: Comparison of Results from Electron Tomography and Classical Transmission Electron Microscopy 13. On the Possibility of a Crypto-Biotic Crust on Mars Based on Northern and Southern Ringed Polar Dune Spots 14. Comparative Planetology of the Terrestrial Inner Planets: Implications for Astrobiology 15. A Possible Europa Exobiology 16. A Possible Biogeochemical Model for Titan
CASI
Biogeochemistry; Detection; Exobiology; Microorganisms; Organic Compounds; Signatures; Extraterrestrial Life; Planetary Environments

20040065788 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
The Effect of Salts on Electrospray Ionization of Amino Acids in the Negative Mode
Kim, H. I.; Johnson, P. V.; Beegle, L. W.; Kanik, I.; Lunar and Planetary Science XXXV: Astrobiology; 2004; 2 pp.; In English; See also 20040065785; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The continued search for organics on Mars will require the development of simplified procedures for handling and processing of soil or rock core samples prior to analysis by onboard instrumentation. Extraction of certain organic molecules such as amino acids from rock and soil samples using a liquid solvent (H2O) has been shown to be more efficient (by approximately an order of magnitude) than heat extraction methods. As such, liquid extraction (using H2O) of amino acid molecules from rock cores or regolith material is a prime candidate for the required processing. In this scenario, electrospray ionization (ESI) of the liquid extract would be a natural choice for ionization of the analyte prior to interrogation by one of a variety of potential analytical separation techniques (mass spectroscopy, ion mobility spectroscopy, etc.). Aside from the obvious compatibility of ESI and liquid samples, ESI offers simplicity and a soft ionization capability. In order to demonstrate that liquid extraction and ESI can work as part of an in situ instrument on Mars, we must better understand and quantify the effect salts have on the ESI process. In the current work, we have endeavored to investigate the feasibility and limitations of negative mode ESI of Martian surface samples in the context of sample salt content using ion mobility spectroscopy (IMS). Derived from text
Amino Acids; Ionization; Solvents; Salts; Exobiology

20040065791 Carnegie Institution of Washington, Washington, DC, USA

A Prototype Life Detection Chip

Maule, J. G.; Steele, A.; Lunar and Planetary Science XXXV: Astrobiology; 2004; 1 pp.; In English; See also 20040065785; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

NASA's goal of "finding life beyond" will be addressed partly by in situ analysis of planetary rocks/regolith/soil. The scientific instrumentation on lander spacecraft should be lightweight, compact, stable in the space environment and be able to detect a diverse set of biological molecules, all of which may be present at very low concentrations. We have developed prototype life-detection "chips", also known as antibody microarrays, consisting of several different antibodies printed onto a glass surface. Each "chip" covers an area of 3 sq. mm, weighing about 10 mg, stable over time. Chips are capable of detecting biological molecules that are shown in an accompanying table.

Derived from text

Chips; Exobiology; Extraterrestrial Life; Life Detectors

20040065792 FOELDIX, Budapest, Hungary

Collecting Bacteria Together with Aerosols in the Martian Atmosphere by the FOELDIX Experimental Instrument Developed with a Nutrient Detector Pattern: Model Measurements of Effectivity

Foldi, T.; Berczi, S.; Lunar and Planetary Science XXXV: Astrobiology; 2004; 2 pp.; In English; See also 20040065785 Contract(s)/Grant(s): MUI-TP-190/2002; MUI-TP-190/2003; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Collecting Martian bacteria from the atmosphere is a capable technology by FOELDIX-1 instrument on Hunveyor. This style of bacteria collecting method is based on the electrostatic coagulation properties of both the dust above planetary surfaces and the FOELDIX-1 instrument. We developed a detector unit to FOELDIX-1 in order to observe the main characteristics of the bacteria collected. It consists of nutrient containers forming a pattern on the detector wall. We plan to carry out 3 phases of the research. First is the production of the instrument. This is phase is ready. The second is the model experiment phase with two stages. Stage a) labor experiments in order to measure the effectivity of FOELDIX-1; - this is also carried out; stage b) experiment on Hunveyor in terrain conditions - this is in process. The third phase is the use of the instrument in a Martian space probe. This phase is a farther future. The dust thrown out from dusty regions by dust devils on Mars are always levitating above the surface of Mars. Space probe in low altitude orbit can carry out coagulation of electrostatically charged dust particles, rare H2O molecules and the suggested bacteria from the dusty Martian atmosphere. This atmospheric gas is transported by the FOELDIX experimental assemblage through the instrument's space where electrodes and allows to precipitate in the vicinity of some specially charged electrodes. We think that a desert warnish, or CBC type consortia of bacteria exist in Mars and they will be attached to the coagulated soil particles. This way they can serve as aerosol sources.

Author

Aerosols; Bacteria; Mars Atmosphere; Effectiveness; Coagulation; Static Electricity; Space Probes

20040065793 Ecole Normale Superieure, Lyon, France

2D and 3D X-ray Imaging of Microorganisms in Meteorites

Lemelle, L.; Simionovici, A.; Salome, M.; Golosio, B.; Gillet, P.; Lunar and Planetary Science XXXV: Astrobiology; 2004; 2 pp.; In English; See also 20040065785; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The identification of microbial cells in meteorites is a key stage in searching for extraterrestrial life traces and in studying the pristine matter of the solar system. It is essential for describing the precious extraterrestrial samples that could contribute to such questions to use non-destructive and non-penetrating techniques. In this respect, X-ray diffraction, absorption, fluorescence and associated imaging techniques at the best spatial resolutions using synchrotron facilities are among the most powerful tools to be used. We applied state-of-the-art developments of scanning X-ray microscopy and combined X-ray micro-tomographies, in the 5 to 20 keV range, at the ID21/ID22 beamlines of the ESRF, in order to address the following general questions: 1) What are the possibilities of these X-ray imaging techniques if samples must be kept under some level of confinement or quarantine conditions 2) What are the structural, mineralogical and chemical criteria necessary for assessing by these X-ray imaging techniques the presence of remnants of life forms in rocks? We started by looking for microorganism cells and for the aqueous alteration traces in silicate assemblages since liquid water is required for all the reactions in any terrestrial life.

Derived from text

Extraterrestrial Life; Imaging Techniques; Microorganisms; Meteorites; X Ray Imagery

20040065794 Imperial Coll. of Science, Technology and Medicine, London, UK

Microbial D/H Fractionation in Extraterrestrial Materials: Application to Micrometeorites and Mars

Blackhurst, R. L.; Genge, M. J.; Grady, M. M.; Lunar and Planetary Science XXXV: Astrobiology; 2004; 2 pp.; In English; See also 20040065785; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

High D/H ratios in extraterrestrial materials are frequently considered to be indicative of an extraterrestrial origin. Deuterium (D) enrichments, for example, are common in many primitive meteorites and interplanetary dust particles and are thought to have been caused by isotopic fractionation in interstellar molecular clouds. Studies on Earth show that stable isotope (D/H) fractionation can arise from anaerobic microbial processes. Biological fractionation leads to unequal distribution of heavier and lighter isotopes between the reactants and products of a reaction. In most cases the lighter isotope is preferentially used and the heavier isotope enriched in the residual substrate fraction. This is a well known phenomenon for CO2 fixation in photosynthesis, methanogenesis and methane oxidation. In this paper we evaluate the potential for microbial D fractionation in micrometeorites in the terrestrial environment and discuss its wider implications for other planetary materials including martian meteorites.

Derived from text

Deuterium; Fractionation; Micrometeorites; Microorganisms; Hydrogen Isotopes; Methane; Isotopes

20040065796 Indiana Univ., Bloomington, IN, USA

Carbon Isotope Characteristics of Spring-fed Iron-precipitating Microbial Mats

Strapoc, D.; Scheiber, J.; Lunar and Planetary Science XXXV: Astrobiology; 2004; 2 pp.; In English; See also 20040065785; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We have investigated the isotopic composition of iron-rich microbial mat deposits that formed at the outflow of a freshwater spring along Jackson Creek in SE Bloomington/Indiana. The spring waters are of near neutral pH and contain dissolved iron (Fe2+) that is derived from oxidation of diagenetic pyrite in the Mississippian Borden Formation. Although one might assume that iron deposition is simply due to oxidation to Fe3+ and subsequent precipitation of iron hydroxides, iron deposition is directly correlated with a thriving community of iron bacteria. The bacteria form loaf-shaped and bulbous buildups up to 20cm diameter, as well as undulose mats of a few cm thickness that cover the creek bed. The sheath forming bacterium Leptothrix dominates, but spiral stalks of Gallionella are commonly present, as well as other currently unidentified microbes. Microbial growth forms are fragile and are flushed out entirely during peak runoff associated with heavy rains. However, regrowth of microbial mats is vigorous and full mat coverage can be achieved within a weeks time.

Derived from text

Carbon Isotopes; Fresh Water; Microorganisms; Biogeochemistry

20040065804 Brazilian Centre for Research in Physics, Rio de Janeiro, Brazil

A Possible Europa Exobiology

deMorais, A.; Lunar and Planetary Science XXXV: Astrobiology; 2004; 2 pp.; In English; See also 20040065785; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Near Infrared Mapping Spectrometer (NIMS) of the NASA's Jet Propulsion Laboratory's Galileo spacecraft was used to study the atmospheric and surface composition of Jupiter and its moons, as Galileo orbited that planet. The NIMS covered the wavelength (lambda) range 0.7 to 5.2 microns with up to 408 spectral channels and a resolving power of 40 to 200 (lambda/Delta lambda). The instrument s instantaneous field of view was 0.5 mrad, giving a spatial resolution (pixel size) of 5 km at 10,000-km distance. The spectra were calibrated to units of reflectance at the specific geometry of the observation compared with the reflectance of a perfectly diffusing (Lambert) surface with the use of the solar spectrum and a combination of ground and in-flight NIMS measurements of calibration targets. In this paper I suggest a comparison between laboratory infrared spectroscopic data of phosphorus salt minerals, and NIMS data of the optically darker (lower visible albedo) areas of Europa's icy surface, including lineaments and spots; I also propose a biogeochemical model for a possible microbial life inside Europa, in a state analogous to the pre-Archaen period on the Earth.

Author

Europa; Exobiology; Infrared Spectroscopy; Phosphorus; Biogeochemistry

20040065805 Brazilian Centre for Research in Physics, Rio de Janeiro, Brazil

A Possible Biogeochemical Model for Titan

deMorais, A.; Lunar and Planetary Science XXXV: Astrobiology; 2004; 2 pp.; In English; See also 20040065785; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Titan is the largest moon of planet Saturn and possesses a nitrogen-rich atmosphere. Titan is one of the most interesting bodies of the Solar System, because in its high atmosphere there is the production of several organic molecules, necessary for the existence of biomolecules, forming a haze. The interaction of the Sun's light (in UV and visible light) - photochemistry of organic molecules - and the Saturn's magnetosphere with the high atmosphere of Titan produces numerous agglomerates of organic molecules (organic particles), which fall down to the Titan's surface, since its formation at 4.5 Gyrs ago. In this paper I suggest that a quantum phenomenon, 'potential barrier penetration' (or 'tunnel effect'), can be significant at such low temperatures for catalyzing chemical reactions of complex organic molecules since Titan froze. These chemical reactions by quantum tunneling in low temperatures are common, as studied in several experiments done, and the tunnel effect is one of the fundamental aspects of nature. In an experiment of laboratory synthesize of organic material from the same gases of Titan's atmosphere, I observed that water vapor in low pressures fluoresces after electrons discharges and possesses a hystheresis behavior. I also propose a model for a possible biogeochemical evolution of Titan based in two pathways: At 4.4 Gyrs Titan was much hotter than today, with a surface liquid water ocean coupled with ices and the atmosphere, and the chemical evolution there began from the same simple molecules, N2, CH4, and other species. As Titan was freezing the liquid water migrated and was trapped close to the rocky core/mantle region beneath shells of different types of water ice. The organic chemistry on the surface, relying on complexes of ethan and methan then began to evolve without liquid water, and the organic chemistry within the liquid shell began to evolve based on S2 and H2 redox mechanisms. A link from beneath to the surface of these two worlds were possibly kept during a geological period by hydrothermal volcanic geysers (which could still be active today in an much lesser extent, due to the radiative transfer of heat from the core to the atmosphere by possible cracks and hot spot mechanisms in the crust).
Derived from text
Titan; Biogeochemistry; Water; Extraterrestrial Oceans

20040067860 Universidad Autonoma de Madrid, Spain
The Role of Cometary and Meteoritic Delivery in the Origin and Evolution of Life: Biogeological Evidences Revisited
Fairen, Alberto G.; Lunar and Planetary Science XXXV: Astrobiology; 2004; 2 pp.; In English; See also 20040067858; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Is life a highly improbable event, or is it rather the inevitable consequence of the evolution of a chemically-enriched Universe? How important is interstellar chemistry to understanding the creation of biological molecules? How is the biological evolution influenced by the stochastic meteoritic delivery? These concepts are intrinsically joined, and together have determined the history of life on Earth.
Author
Biological Evolution; Stochastic Processes; Interstellar Chemistry

20040067861 Aberdeen Univ., UK
Survival of Organic Matter After High Temperature Events (Meteorite Impacts, Igneous Intrusions)
Wycherley, H. L.; Parnell, J.; Baron, M. L.; Lunar and Planetary Science XXXV: Astrobiology; 2004; 2 pp.; In English; See also 20040067858; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A potential consequence of the high temperatures involved in impact events is that organic matter in the target is destroyed. Where the temperatures are so high that rocks are volatilized, destruction of the organic matter is intrinsic, although conceivably some methane generated by the process could become entrapped in adjacent rocks. Where rocks are simply heated and deformed by the impact, some organic matter may survive, but heating above 200 to 300 C is likely to leave this matter as a refractory solid from which little bio-molecular data can be extracted. However a small fraction of organic material may be entrapped within fluid inclusions in rocks, where it has a greater chance of survival. Valuable lessons about the fate of organic matter can be gained from the response to igneous intrusions: intrusions and impacts both involve temperatures of several hundred degrees and higher, sudden exposure for a geologically instantaneous period, and cross-cutting of existing formations where organic matter resides. The preservation of organic matter after impacts is important, as this gives us an insight into the likely survival of life/fossil remains on heavily cratered planets like Mars and the early Earth.
Author
Deformation; Destruction; Exposure; Fossils; High Temperature; Organic Materials; Preserving; Survival

59
MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

Includes general topics and overviews related to mathematics and computer science. For specific topics in these areas see *categories 60 through 67*.

20040062449 Lawrence Livermore National Lab., Livermore, CA
Building a High Performance Raw Disk Subsystem for Alpha/Linux
Garlick, J.; Jul. 02, 2001; 22 pp.; In English
Report No.(s): DE2004-15006845; UCRL-ID-144213; No Copyright; Avail: Department of Energy Information Bridge

The Linux kernel version 2.2.19 lacks UNIX-style raw disk support, and its SCSI layer is optimized for small transfer sizes. This report describes kernel patches to add raw disk support and enhance performance in the SCSI layer and QLA2x00 Fibre Channel device driver for large transfer sizes. Benchmarks demonstrate raw disk performance of 191 megabytes/second write, 176 megabytes/second read for one megabyte random I/O on a Compaq ES40 computer system with two QLogic QLA2200F Fibre Channel host bus adapters, each connected to two Ciprico RF7010 arrays on arbitrated loop.
NTIS
Unix (Operating System); Disk Operating System (Dos)

20040062468 National Inst. of Standards and Technology, Gaithersburg, MD
Journal of Research of the National Institute of Standards and Technology, Sep-Oct 2003. Volume 108, No. 5
Oct. 31, 2003; 84 pp.; In English
Report No.(s): PB2004-104953; No Copyright; Avail: CASI; A05, Hardcopy

Contents include the following: New National Air-Kerma-Strength Standards for Iodine 125 and Palladium 103; Changes in the U.S. Primary Standards for the Air Kerma from Gamma-Ray Beams; Comparison of the NIST and BIPM Medium-Energy X-Ray Air-Kerma Measurements; Optical-Fiber Power Meter Comparison Between NIST and PTB; and A Logical Model of Conceptual Integrity in Data Integration.
NTIS
Palladium Isotopes; Radioactive Isotopes

20040062482 Lawrence Livermore National Lab., Livermore, CA
Coscheduling Technique for Symmetric Multiprocessor Clusters
Yoo, A. B.; Jette, M. A.; Sep. 18, 2000; 24 pp.; In English
Report No.(s): DE2004-15006498; UCRL-JC-138583-R1; No Copyright; Avail: Department of Energy Information Bridge

Coscheduling is essential for obtaining good performance in a time-shared symmetric multiprocessor (SMP) cluster environment. However, the most common technique, gang scheduling, has limitations such as poor scalability and vulnerability to faults mainly due to explicit synchronization between its components. A decentralized approach called dynamic coscheduling (DCS) has been shown to be effective for network of workstations (NOW), but this technique is not suitable for the workloads on a very large SMP-cluster with thousands of processors. Furthermore, its implementation can be prohibitively expensive for such a large-scale machine. IN this paper, they propose a novel coscheduling technique based on the DCS approach which can achieve coscheduling on very large SMP-clusters in a scalable, efficient, and cost-effective way. In the proposed technique, each local scheduler achieves coscheduling based upon message traffic between the components of parallel jobs. Message trapping is carried out at the user-level, eliminating the need for unsupported hardware or device-level programming. A sending process attaches its status to outgoing messages so local schedulers on remote nodes can make more intelligent scheduling decisions. Once scheduled, processes are guaranteed some minimum period of time to execute. This provides an opportunity to synchronize the parallel job's components across all nodes and achieve good program performance. The results from a performance study reveal that the proposed technique is a promising approach that can reduce response time significantly over uncoordinated time-sharing and batch scheduling.
NTIS
Cluster Analysis; Workloads (Psychophysiology); Synchronism; Scheduling; Multiprocessing (Computers)

20040062483 Lawrence Livermore National Lab., Livermore, CA
Graph Based Multilevel Algorithms for Preconditioning Finite Element Problems
Vassilevski, P. S.; Mar. 24, 2000; 48 pp.; In English
Report No.(s): DE2004-15006492; UCRL-JC-137238; No Copyright; Avail: Department of Energy Information Bridge

This paper discusses: (1) A general block-factorization (matrix) form of multilevel preconditioners; algebraic methods; (2) Selecting parameters based on the matrix topology; graph based algorithms; (3) Examples of coarsening; (4) Numerical experiments.
NTIS
Algorithms; Finite Element Method; Algebra; Graph Theory

20040062485 Lawrence Livermore National Lab., Livermore, CA
Sensitivity Analysis Using Parallel ODE Solvers and Automatic Differentiation in C: SensPVODE and ADIC
Lee, S. L.; Hovland, P. D.; Sep. 15, 2000; 16 pp.; In English
Report No.(s): DE2004-15006495; UCRL-JC-137728; No Copyright; Avail: Department of Energy Information Bridge
PVODE is a high-performance ordinary differential equation solver for the types of initial value problems (IVPs) that arise in large-scale computational simulations. often, one wants to compute sensitivities with respect to certain parameters in the IVP. They discuss the use of automatic differentiation (AD) to compute these sensitivities in the context of PVODE. Results on a simple test problem indicate that the use of AD-generated derivative code can reduce the time to solution over finite difference approximations.
NTIS
Sensitivity Analysis; Boundary Value Problems; Finite Difference Theory

20040062488 Lawrence Livermore National Lab., Livermore, CA
Physics and Applications of NIS Junctions
Ullom, J. N.; Aug. 2001; 12 pp.; In English
Report No.(s): DE2004-15006508; UCRL-JC-143634; No Copyright; Avail: Department of Energy Information Bridge
This paper reviews the physics and applications of Normal-Insulator-Superconductor (NIS) tunnel junctions. The current-voltage properties of NIS junctions are diode-like with a strong temperature dependence. Hence, these structures can be used as sensitive thermometers at temperatures well below the energy gap,(Delta), of the superconducting electrode. For junction voltages comparable to(Delta)/q, current flow removes energy from the normal electrode. This property has been exploited to build refrigerators capable of cooling thin-film circuits from 0.3 K to 0.1 K. Calorimeters and bolometers for the detection of X-rays and millimeter-wave radiation, respectively, have successfully been built from NIS junctions. NIS junctions have also been used to probe the superconducting state. Finally, recent ideas for the use of NIS junctions as simple circuit elements are described.
NTIS
Tunnel Junctions; Energy Gaps (Solid State)

20040062495 Lawrence Livermore National Lab., Livermore, CA
Almost Optimal Interior Penalty Discontinuous Approximations of Symmetric Elliptic Problems on Non-Matching Grids
Lazarov, R. D.; Pasciak, J. E.; Schoeberl, J.; Vassilevski, P. S.; Aug. 08, 2001; 24 pp.; In English
Report No.(s): DE2004-15006515; UCRL-ID-144892; No Copyright; Avail: Department of Energy Information Bridge
We consider an interior penalty discontinuous approximation for symmetric elliptic problems of second order on non-matching grids in this paper. The main result is an almost optimal error estimate for the interior penalty approximation of the original problem based on the partition of the domain into a finite number of subdomains. Further, an error analysis for the finite element approximation of the penalty formulation is given. Finally, numerical experiments on a series of model second order problems are presented.
NTIS
Elliptic Differential Equations; Approximation; Finite Element Method

20040062496 Lawrence Livermore National Lab., Livermore, CA
Design and Implementation of a Parallel, Object-Oriented, Image Processing Toolkit
Kamath, C.; Baldwin, C. H.; Fodor, I. K.; Tang, N. A.; Jun. 22, 2000; 18 pp.; In English
Report No.(s): DE2004-15006502; UCRL-JC-138953; No Copyright; Avail: Department of Energy Information Bridge
Advances in technology have enabled us to collect data from observations, experiments, and simulations at an ever increasing pace. As these data sets approach the terabyte and petabyte range, scientists are increasingly using semi-automated techniques from data mining and pattern recognition to find useful information in the data. In order for data mining to be

successful, the raw data must first be processed into a form suitable for the detection of patterns. When the data is in the form of images, this can involve a substantial amount of processing on very large data sets. To help make this task more efficient, they are designing and implementing an object-oriented image processing toolkit that specifically targets massively-parallel, distributed-memory architectures. They first show that it is possible to use object-oriented technology to effectively address the diverse needs of image applications. Next, they describe how we abstract out the similarities in image processing algorithms to enable re-use in the software. They will also discuss the difficulties encountered in parallelizing image algorithms on massively parallel machines as well as the bottlenecks to high performance. They will demonstrate the work using images from an astronomical data set, and illustrate how techniques such as filters and denoising through the thresholding of wavelet coefficients can be applied when a large image is distributed across several processors.
NTIS
Algorithms; Architecture (Computers); Data Simulation; Data Storage; Massively Parallel Processors

20040067855 Lawrence Livermore National Lab., Livermore, CA
Alpha Dithering to Correct Low-Opacity 8 Bit Compositing Errors
Williams, P. L.; Frank, R. J.; LaMar, E. C.; Mar. 31, 2003; In English
Report No.(s): DE2003-15004537; UCRL-ID-153185; No Copyright; Avail: National Technical Information Service (NTIS)
This paper describes and analyzes a dithering technique for accurately specifying small values of opacity that would normally not be possible because of the limited number of bits available in the alpha channel of graphics hardware. This dithering technique addresses problems related to compositing numerous low-opacity semitransparent polygons to create volumetric effects with graphics hardware. The paper also describes the causes and a possible solution to artifacts that arise from parallel or distributed volume rendering using bricking on multiple GPU's.
NTIS
Opacity; Errors

20040067856 Lawrence Livermore National Lab., Livermore, CA
Analytical Solutins for Testing Ray-Effect Errors in Numerical Solutions of the Transport Equation
Chang, B.; May 12, 2003; In English
Report No.(s): DE2003-15004539; UCRL-ID-153272; No Copyright; Avail: National Technical Information Service (NTIS)
This paper contains three analytical solutions of transport problems which can be used to test ray-effect errors in the numerical solutions of the Boltzmann Transport Equation (BTE).
NTIS
Numerical Analysis; Problem Solving

20040067893 National Inst. of Standards and Technology, Gaithersburg, MD, USA
Information Technology Laboratory, Technical Accomplishments, 2003
2003; In English
Report No.(s): PB2004-103741; NISTIR-7034; No Copyright; Avail: National Technical Information Service (NTIS)
In 2003, the Information Technology Laboratory (ITL) continued its work in a growing number of legislative mandates in areas ranging from cyber security research and development to electronic voting standards and guidelines. Areas of interest include: Security, Information access, software, information integration, Mathematics, and statistics.
NTIS
Information Systems; Voting; Research and Development

20040067917 National Energy Research Supercomputer Center, Livermore, CA, USA
Exploring HPSS Bandwidth-NERSC Production Experience
Holmes, H.; Meyer, N.; Andrews, M.; Cholia, S.; Hazen, D.; Nov. 2003; In English
Report No.(s): DE2004-822183; LBNL-54515; No Copyright; Avail: National Technical Information Service (NTIS)
We have developed tools to help us analyze transfer logs from a production High Performance Storage System (HPSS) system at the National Energy Research Scientific Computing Center (NERSC). These tools provide graphical displays of data transfer performance over relatively short (24 hour or less) time spans.
NTIS
Supercomputers; Architecture (Computers); Display Devices

20040067932 Rhode Island Univ., Kingston, RI, USA

Effect of Microstructure on the Static and Dynamic Behavior of Recycled Asphalt Material

Sadd, M. H.; Shukla, A.; Parameswaran, V.; Dai, Q.; Jul. 2002; In English

Report No.(s): PB2004-104006; No Copyright; Avail: National Technical Information Service (NTIS)

This report describes the research activities of a project dealing with theoretical/numerical modeling and experimental studies of the micromechanical behavior of recycled asphalt material. The theoretical work employed finite element techniques to develop a microstructural model of heterogeneous asphalt materials. The model simulates the load transfer between aggregates using a microframe network scheme whereby the binder-aggregate system is replaced by an equivalent network of finite elements. A nonlinear, softening model was developed through the use of a damage mechanics formulation. Preliminary model results compared favorably with experimental data for indirect tension tests. Experimental work included model verification studies, which investigated idealized cemented particulate systems in order to collect data on particle displacements under load. This data compared favorably with model simulation results. Indirect tension testing was also conducted for a material with a fix percentage of RAP, and preliminary visualization of IDT sample damage evolution was done. Experimental binder characterization studies were conducted on compressive and indirect tension samples.

NTIS

Asphalt; Micromechanics; Microstructure; Mathematical Models; Recycling

20040067938 Lister Hill National Center for Biomedical Communications, Bethesda, MD, USA

3D Informatics: A Research Program in High Performance Computing. A Report to the Board of Scientific Counselors

Yoo, T. S.; May 2003; In English

Report No.(s): PB2004-103998; LHNCBC-TR-2003-002; No Copyright; Avail: National Technical Information Service (NTIS)

This report describes ongoing efforts at the Lister Hill National Center for Biomedical Communications and the National Library of Medicine to promote, advance, and to provide leadership in non-text, data-intensive informatics. This program concentrates heavily on information science surrounding image data of 2, 3, and higher dimensions. Our mission reaches beyond high dimensional image processing or medical computer graphics; it attempts to synthesize semantic information and dynamic user navigation with visualizations created from real medical data. In the cases where we use models of biological structures, all of these models are generated from sources of real data, firmly grounding this work in the practical aspects of medicine. We have developed a 3D Informatics research program for the gathering, manipulation, classification, storage, retrieval, representation, navigation, and display of complex, high-dimensional medical data. We consider the entire enterprise of medical visualization from data storage and retrieval to the rendering of the final visual presentation; conceived as a pipeline, the process is seen to be connected and yet divisible into separate subfields that can be studied and improved. Our intention is to perform cutting edge scientific research in particular areas of this pipeline and to incorporate the latest technologies where the application of advanced engineering is appropriate.

NTIS

Image Processing; Information Management; Digital Techniques; Computer Graphics

20040067944 Lawrence Livermore National Lab., Livermore, CA

Out-of-Core Compression and Decompression of Large n-Dimensional Scalar Fields

Ibarria, L.; Lindstrom, P.; Rossignac, J.; Szymczak, A.; Feb. 03, 2003; In English

Report No.(s): DE2003-15004618; UCRL-JC-151934; No Copyright; Avail: National Technical Information Service (NTIS)

We present a simple method for compressing very large and regularly sampled scalar fields. Our method is particularly attractive when the entire data set does not fit in memory and when the sampling rate is high relative to the feature size of the scalar field in all dimensions. Although we report results for R(sup 3) and R(sup 4) data sets, the proposed approach may be applied to higher dimensions. The method is based on the new Lorenzo predictor, introduced here, which estimates the value of the scalar field at each sample from the values at processed neighbors. The predicted values are exact when the n-dimensional scalar field is an implicit polynomial of degree n-1. Surprisingly, when the residuals (differences between the actual and predicted values) are encoded using arithmetic coding, the proposed method often outperforms wavelet compression in an L(infinity) sense. The proposed approach may be used both for lossy and lossless compression and is well suited for out-of-core compression and decompression, because a trivial implementation, which sweeps through the data set reading it once, requires maintaining only a small buffer in core memory, whose size barely exceeds a single n-1 dimensional slice of the data.

NTIS

Data Compression; Data Sampling; Computer Graphics; Image Processing

20040068035 Defence Research and Development Canada, Val-Belair, Quebec, Canada

Ontological Approach to Military Knowledge Modeling and Management

Boury-Brisset, Anne-Claire; Military Data and Information Fusion; March 2004, pp. 17-1 - 17-13; In English; See also 20040068014; Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Ontologies have received increasing interest in the computer science community and their benefits are now recognized for military applications. In addition to explicitly encode a shared understanding of some domain, ontologies can be used in a wide range of applications including natural language processing, intelligent search engines, information retrieval, or as a means to facilitate interoperability between heterogeneous knowledge sources at a high level of abstraction. Our objective is to contribute to the building of ontological models in the information fusion domain and to exploit these models to provide enhanced knowledge management assistance to military commanders. In the paper, we first review the roles of ontologies for military applications. Then, we describe the characteristics of high-level information fusion processes and address methodological aspects related to ontological engineering. This leads us to derive an ontological approach to situation and threat assessment domain modeling. Finally, we present ontology-based knowledge management services that could be exploited in support of high-level information fusion processes.

Author

Information Retrieval; Military Technology; Natural Language Processing

20040068036 Military Academy, Brno, Czech Republic

Ontological Approach to the Representation of Military Knowledge

Winklerova, Zdenka; Military Data and Information Fusion; March 2004, pp. 18-1 - 18-13; In English; See also 20040068014; Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The answers to commanders' priority intelligence requirements are typically based on a speedy, partial analysis of the information available. The research findings have made a significant progress in certain areas of data interpretation for intelligence analyses which are also referred to as sensor fusion, data fusion and information fusion. The accuracy and speed of the fusion can be significantly improved by utilizing the knowledge processed at the appropriate level. In this document, the general problem of information provision for decision making is addressed. The most appropriate solution for implementation of a data fusion system, the-multi-agent architecture, is suggested. One multi-agent application related to a specific kind of knowledge, the social knowledge, is outlined, presenting some experience about usability of ontological approach to the representation of military knowledge.

Author

Multisensor Fusion; Data Processing; Decision Making; Intelligence

20040068084 Geophysical Observatory, Helsinki, Finland

Annals of the Finnish Academy of Sciences: Mathematics, Volume 29, No. 1

Martio, Oili, Editor; Drasia, David, Editor; Gehring, Frederick, Editor; Iwaniec, Tadeusz, Editor; Jutila, Matti, Editor; Keen, Linda, Editor; Kulkarni, Ravi S., Editor; Laine, Ilpo, Editor; Lehto, Olli, Editor; Lindenstrauss, J., Editor, et al.; 2004; ISSN 1239-629X; 250 pp.; In English; Copyright; Avail: Other Sources

Articles in this issue are: Myrberg's numerical uniformization of hyperelliptic curves; Quasiconformal images of Hoelder domains; Triangulations of closed sets and bases in function spaces; Mappings of finite distortion: Global homeomorphism theorem; Composition Operators between weighted spaces of holomorphic functions on Banach spaces; Asymptotic growth of Cauchy transforms; David maps and Hausdorff dimension; Pointwise multipliers from weighted Bergman spaces and Hardy spaces to weighted Bergman spaces; Positive solutions of some nonlinear elliptic problems in unbounded domain; On boundedness of maximal functions in Sobolev spaces; Pathwise connectivity in uniform domains with small exceptional sets; Hamilton sequences and extremality for certain Teichmiiller mappings; Singular behavior of conformal Martin kernels and non-tangential limits of conformal mappings; Quasiregular mappings of maximal local modulus of continuity; Weakly compact wedge operators on Koethe echelon spaces; Growth estimates for solutions of linear complex differential equations; Correction to "The maximal function on variable L p spaces"

Derived from text

Analytic Functions; Banach Space; Cauchy Problem; Differential Equations; Linear Equations; Transformations (Mathematics); Triangulation

60
COMPUTER OPERATIONS AND HARDWARE

Includes hardware for computer graphics, firmware and data processing. For components see *33 Electronics and Electrical Engineering*. For computer vision see *63 Cybernetics, Artificial Intelligence and Robotics*.

20040068023 Thales Communications, Colombes, France
Operational Requirements for Fusion in the Fields of Information and Intelligence: Fusion, Natural Compliment of the Operational?
deChantal, Louis; Military Data and Information Fusion; March 2004, pp. KN1-17 - KN1-19; In English; See also 20040068014; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Operational functions related to action, reflection and decision do not receive the necessary support enabling the full completion of the tasks. The dissemination of raw and processed information at various levels and the support of decision aid systems are crucial requirements for the operational world in the battle for information dominance. This support, which is deeply related to the specific needs of the operational entities, collides with the huge volume of available data, the diversity of the need, the different due times and the specific constraints. The ever-increasing constraint of the operational tempo and the developing complexity of operations in civilian environment rises the need for processed products and aids, with a recurrent function of compiling objects and parameters. As human processing cannot achieve its operational tasks in a satisfactory manner, the complementarity of man and system looks more than ever key to better handle the operational situations. Fusion under its various forms appears to be the natural complement to the operational.
Derived from text
Information Dissemination; Decision Making; Time Dependence

20040068032 Swedish Defence Research Establishment, Stockholm, Sweden
Representation and Recognition of Uncertain Enemy Policies Using Statistical Models
Suzic, Robert; Military Data and Information Fusion; March 2004, pp. 10-1 - 10-17; In English; See also 20040068014; Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In this work we extend from the single agent to the on-line multi-agent stochastic policy recognition problem using a network structure. By using knowledge of agents interrelations we can create a policy structure that is compatible with that of a hostile military organization. Using this approach we make use of existing knowledge about the military organization and thereby strongly reduce the size of the hypothesis space. In this way we are able to bring down the problem complexity to a level that is tractable. Also, by using statistical models in policy recognition we are able to deal with uncertainty in a consistent way. This means that we have achieved improved policy recognition robustness. We have developed a proof of concept Bayesian Network model. For the information fusion purpose, we show with our model that it is possible to integrate the pre-processed uncertain dynamical sensor data such as the enemy position and combine this knowledge with terrain data and uncertain a priori knowledge such as the doctrine knowledge to infer multi-agent policy in a robust and statistically sound manner.
Author
Mathematical Models; On-Line Systems; Policies; Stochastic Processes; Networks

20040068073 North Carolina Agricultural and Technical State Univ., Greensboro, NC, USA
Self-Timed Digital System Design
Walker, Alvernon; [2001]; 15 pp.; In English
Contract(s)/Grant(s): NAG5-7158; No Copyright; Avail: CASI; A03, Hardcopy

A timing and control strategy that can be used to realize synchronous systems with a level of performance that approaches that of asynchronous circuits or systems was developed in this work. This approach is based upon a single-phase synchronous circuit/system architecture with a variable period clock. The handshaking signals required for asynchronous self-timed circuits are not needed. Dynamic power supply current monitoring is used to generate the timing information, that is comparable to the completion signal found in self-timed circuits; this timing information is used to modify the circuit clock period.
Author
Digital Systems; Design Analysis; Synchronism

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COMPUTER PROGRAMMING AND SOFTWARE

Includes software engineering, computer programs, routines, algorithms, and specific applications, e.g., CAD/CAM. For computer software applied to specific applications, see also the associated category.

20040065758 Washington Univ., Seattle, WA, USA
The Cratering Database: Making Code Jockeys Honest
Holsapple, K. A.; Housen, K. R.; Lunar and Planetary Science XXXV: Impacts: Modeling and Observations; 2004; 2 pp.; In English; See also 20040065753; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Computer codes provide the only avenue to studying many aspects of asteroid collisions and large-scale impacts on the planets, so there is a significant need to put code calculations of impacts on a firm and robust basis. The calculation of cratering and other impact phenomena is extremely complicated as a result of the complexity of the behavior of dirt, rocks, ices and other geological materials. New and more complex models are being proposed, developed and tried. Thus it is essential to verify the efficacy of code results by comparisons to real data where it is available. The development of new material models must be coupled to a comparison of code results to significant benchmark events. The database of craters with known conditions consists of both laboratory impact experiments and laboratory and field explosive cratering events, but mostly the latter. The similarities between these two types of events is known [6] , so both can be used for benchmarking calculations. Since the explosive cratering data has been mainly in DOD reports, it has not been readily accessible to the Planetary Science community. As a consequent, researchers commonly skip important validation steps of their code development and calculations.
Derived from text
Asteroid Collisions; Computer Programs; Data Bases; Craters; Analogies

20040065847 NASA Goddard Space Flight Center, Greenbelt, MD, USA
GRIDVIEW: Recent Improvements in Research and Education Software for Exploring Mars Topography
Roark, J. H.; Masuoka, C. M.; Frey, H. V.; Lunar and Planetary Science XXXV: Undergraduate Education and Research Programs, Facilities, and Information Access; 2004; 2 pp.; In English; See also 20040065834; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

GRIDVIEW is being developed by the GEODYNAMICS Branch at NASA's Goddard Space Flight Center and can be downloaded on the web at http://geodynamics.gsfc.nasa.gov/gridview/. The program is very mature and has been successfully used for more than four years, but is still under development as we add new features for data analysis and visualization. The software can run on any computer supported by the IDL virtual machine application supplied by RSI. The virtual machine application is currently available for recent versions of MS Windows, MacOS X, Red Hat Linux and UNIX. Minimum system memory requirement is 32 MB, however loading large data sets may require larger amounts of RAM to function adequately.
Derived from text
Geodynamics; Education; Reusable Heat Shielding; Unix (Operating System)

20040065850 Defence Science and Technology Organisation, Edinburgh, Australia
The Compression of Digital Terrain Evaluation Data (DTED)using JPEG2000
Owen, M. J.; Grigg, M. W.; February 2004; 19 pp.; In English
Report No.(s): DSTO-TR-1548; DODA-AR-013-023; Copyright; Avail: Other Sources

This report summarises the results of an investigation of the applicability of the JPEG2000 compression system to Digital Terrain Elevation Data (DTED) and in particular the application of the region-of-interest, ROI, capabilities built into the standard. JPEG2000 is a new image compression standard offering a number of advantages, particularly relevant to Defence, over previous image compression standards. Its application to DTED would not normally be considered, given that DTED is not an imagery data type. However DTED has similar characteristics to monochrome imagery data and the utility of JPEG2000 and in particular ROI capability would have benefits for the storage and dissemination of DTED within Defence. The advantage of ROI coding is that very high compression ratios can be achieved while maintaining high fidelity of the data in regions of importance. Possible applications of such techniques would be in the distribution or dissemination of DTED, or

mission rehearsal products containing elevation data, to deployed units where they could be used to support tactical mission planning and rehearsal.
Author
Data Compression; Digital Data; Image Processing; Terrain; Landforms; Terrain Analysis

20040067925 Vermont Univ., Burlington, VT, USA
Load Monitoring for Safe Construction
Huston, D. R.; Mar. 22, 1998; 152 pp.; In English
Report No.(s): PB2004-104625; No Copyright; Avail: CASI; A08, Hardcopy

The overall goal of this project was to measure the vertical and lateral loads experienced by the shoring system of a reinforced concrete building under construction and to use the measurements to evaluate and improve shoring system design codes so that future construction site collapses can be prevented. The development and use of this shoring instrumentation was proposed to have four main phases: Design, develop and verify the load-monitoring instrumentation; Conduct field measurements; Analyze data; and Produce applications, guidelines and recommendations.
NTIS
Loads (Forces); Computer Programs; Composite Materials

20040068016 Forschungsgesellschaft fuer Angewandte Naturwissenschaften e.V, Wachtberg-Werthhoven, Germany
Analysis of Free-Form Battlefield Reports with Shallow Parsing Techniques
Hecking, Matthias; Military Data and Information Fusion; March 2004, pp. 19-1 - 19-9; In English; See also 20040068014; Copyright; Avail: CASI; A02, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A natural way to communicate with C2 systems would be to use natural language. There are already natural language components used in military systems, e.g. CommandTalk is a spoken-language interface to the ModSAF battlefield simulator. In our project SOKRATES we use shallow parsing techniques for written language to analyze German free-form battlefield reports. These reports are processed by transducers. The extraction result is formalized in feature structures, semantically enriched by the semantic analysis and the augmented result is then stored in the ATCCIS database. After storing in the database, triggers initiate a change in the position of a tactical symbol on the tactical map. Shallow parsing techniques are the basis for information extraction. In this paper, we therefore first introduce to the promising field of information extraction. Then, we describe in detail how shallow parsing techniques are used in our project SOKRATES.
Author
Actuators; Natural Language (Computers); Parsing Algorithms; Speech; Transducers

20040068018 Swedish Defence Research Establishment, Stockholm, Sweden
Technical Survey and Forecast for Information Fusion
Svensson, Per; Military Data and Information Fusion; March 2004, pp. 4-1 - 4-8; In English; See also 20040068014; Copyright; Avail: CASI; A02, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This paper summarizes the results of a study forecasting the development of information fusion technology over the next 20 years. The study was carried out on behalf of the Swedish Armed Forces, as part of an effort to estimate future developments in some technology areas of high relevance for the development of a Network-Based Defence system.
Author
Information Systems; Surveys; Computer Networks

20040068020 Office National d'Etudes et de Recherches Aerospatiales, Toulouse, France
Information Evaluation: Discussion about STANAG 2022 Recommendations
Cholvy, Laurence; Nimier, Vincent; Military Data and Information Fusion; March 2004, pp. 11-1 - 11-9; In English; See also 20040068014; Copyright; Avail: CASI; A02, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

An important step in the intelligence gathering process is the fusion of information provided by several sources. The objective of this process is to build an up-to-date and correct view of the current situation with the overall available information in order to make adequate decisions. Moreover, to succeed in this process, it is important to associate with each available information, some attributes like the number of the sources that support it, their reliability, the degree of truth of the information etc. For the moment, these attributes are managed by the human operator when he fuses information provided by the different sources. However, there is no real methodology to do this in a formal manner. And, when relaying this fusion

process to a machine, we need to develop formal definitions and algorithms to manage these attributes in addition to fusing information. Furthermore, in a context of interoperability where different systems exchange information, common definitions of these attributes have to be shared. The Standardization Agreements (STANAG) 2022 of North Atlantic Treaty Organization (NATO) defines a framework for such common definitions. The purpose of this paper is first to analyze the STANAG 2022 recommendations about information evaluation and then to set a first step in the definition of a formal and non ambiguous system for evaluating information. Indeed, as it will be shown, the present recommendations, written in natural language are rather ambiguous and imprecise and are open to discussion. This paper is organized as follows. Section 2 presents a review of STANAG 2022 recommendations and points out to the main notions that underline these recommendations. Section 3 analyzes the different assumption underlying the evaluation proposed in the STANAG. Section 4, an example of symbolical formalism for the fusion of information is presented. In this example, we consider some of the assumption of STANAG 2002. Finally, section 5 is devoted to a discussion.
Author
Algorithms; Reliability; Standardization; Data Transmission; Multisensor Fusion

20040068022 Air Force Research Inst., Prague, Czech Republic
Data Collection and Global Data Fusion in C4ISR in the Czech Armed Forces
Orsak, Radek; Military Data and Information Fusion; March 2004, pp. 26-1 - 26-3; In English; See also 20040068014; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The beginning of the research of control and information systems started in the deep past. At first the systems were based on simple mechanic and electro mechanic utilities, able to control single element, but during the development of new technologies the systems became much more difficult. These systems allowed to control more elements and their command posts, support operators and their decide processes and also included needed communication infrastructure. From original purpose to control single weapons systems research gets to building of whole complexes, which provides control of units command, fire coordination, data gathering and so on. During complex system realizations there is one serious problem, which is not as resoluble by technical tool, as system s intelligence. This problem is in processing a big number of data, fusing its content to explicit context, interpretable by automated systems. This is the main problem of systems for fire control.
Author
Data Acquisition; Armed Forces (Foreign); Information Systems; Fire Control; Automatic Control

20040068025 Turkish Navy, Istanbul, Turkey
A Wide-Area Surveillance Prototype System from Identification Fusion Perspective
Balci, A. Metin; Military Data and Information Fusion; March 2004, pp. 2-1 - 2-7; In English; See also 20040068014; Copyright; Avail: CASI; A02, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Along with our efforts to prepare an operational prototype for a wide area surveillance system, identity fusion was considered as one of the major system components. Many problems have been detected about how the sensors produce the identity information, how they sent this information, registration of the information, detecting the conflicts, combining the appropriate information in an effective way, the presentation of the final fused information to the operators, and consequently interpreting the results for the coordination of sensors for further identification efforts. On the other hand, the appropriate way of integrating identity information to the rest of the fusion process constitutes the other important context. In this paper, we report our experience for a wide area surveillance system from identification fusion perspective based on the prototype system developed in Turkish Navy Research Center Command.
Author
Coordination; System Identification; Surveillance; Prototypes

20040068026 NATO Consultation, Command, and Control Agency, The Hague, Netherlands
The Integrated Data Environment: A New Tool for Interoperability and Effective Data Integration for Command and Control
Wilkes, Jon; Military Data and Information Fusion; March 2004, pp. 3-1 - 3-7; In English; See also 20040068014; Copyright; Avail: CASI; A02, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This paper describes an ongoing effort at NC3A to provide one integrated database which contains data from a number of different sources. Initially, these sources are legacy NATO systems. Later, other systems, including messaging interfaces of a wide variety, and national systems, will be added. A common data model is used as the lingua franca between systems.

A COTS product has been identified that creates translator boxes to provide interfaces to and from the legacy systems.
Author
Data Bases; Data Integration; Interoperability

20040068027 Forschungsgesellschaft fuer Angewandte Naturwissenschaften e.V, Wachtberg-Werthhoven, Germany
A Knowledge-Based Approach to Information Fusion for the Support of Military Intelligence
Biermann, Joachim; Military Data and Information Fusion; March 2004, pp. 7-1 - 7-12; In English; See also 20040068014; Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Intelligence cells have to process and evaluate current information to deduce timely and most reliable an appropriate picture of the battlespace. The presented approach of knowledge based information fusion is focussing on the heuristic human evaluation process. Military information processing is modelled as a context dependent and template-based heuristic reasoning process and the real task is modelled by a closed world representation. The developed method of information fusion is basically independent from a specific military scenario. It is based on the assumption that forces are organized in a structured manner and that they operate in a military reasonable and typical way. Respective rules and doctrines can be used as matching templates for knowledge based reasoning. By this approach, the analysis and fusion of incomplete and imperfect information of military reports and background knowledge can be supported substantially in an automated system.
Author
Knowledge Based Systems; Intelligence; Information Theory; Multisensor Fusion

20040068030 Lockheed Martin Canada, Montreal, Quebec, Canada
Using a Priori Databases for Identity Estimation through Evidential Reasoning in Realistic Scenarios
Valin, Pierre; Bosse, Eloi; Military Data and Information Fusion; March 2004, pp. 12-1 - 12-12; In English; See also 20040068014; Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Canadian defence companies and Government Research and Development (R&D) laboratories have long ago recognized the necessity to develop comprehensive a priori databases containing all the possible attributes that can be inferred by measurements coming from a given sensor suite. In order to maintain this document at a NATO unclassified level, a small portion of an existing (consisting of more than 2200 platforms) database is presented, which nevertheless contains all the salient features needed for refining the identity (ID) of any target by the fusion of sensor information. In addition, only the information gathered from unclassified sources such as Jane s and Periscope is presented. This a priori Platform DataBase (PDB) contains all the possible naval and air targets, military or commercial, that can be encountered in realistic scenarios, and all the attributes that can be measured by any sensor belonging to any own-platform of the Canadian Forces (CF), ensuring its possible common use throughout the CF. Also presented and explained are all the attributes and all the correlations between platforms that are appropriate to Situation and Threat Assessment (STA or higher-level fusion), and which are present in the larger database. This paper focuses on only one own-platform of the CF in relevant scenarios, the maritime surveillance aircraft CP-140 Aurora (a Canadian version of the US's P3-C with S2-B avionics) in its present operational status, and also with an anticipated upgraded sensor suite. Validation and benchmarking of the chosen evidential reasoning scheme for identity estimation, is performed through several simulated scenarios that make use of DRDC-Valcartier Concept Analysis and Simulation Environment for Automatic Target Tracking and Identification (CASE-ATTI) sensor module. Two missions have received special consideration because they make full use of all the CP-140 sensors: 1) Maritime Air Area Operations (MAAO) involving a mix of commercial merchant ships and enemy line combatant ships performing exercises, and 2) Direct Fleet Support (DFS) involving fleets of Canadian and American ships on a NATO mission, that are imaged with the Aurora s imaging sensors.
Author
Automatic Control; Tracking (Position); Information Systems; Imaging Techniques; Data Bases

20040068033 Defence Science and Technology Organisation, Edinburgh, Australia
Multi-Sensor Kinematic and Attribute Tracking Using a Bayesian Belief Network Framework
Krieg, Mark L.; Military Data and Information Fusion; March 2004, pp. 15-1 - 15-8; In English; See also 20040068014; Copyright; Avail: CASI; A02, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Situational awareness plays a major role in many military and civilian operations. Apart from the identity, type, location and dynamics of targets of interest, the situational picture may also provide other target information, such as weapons state, fuel status and intent. Many legacy systems incorporate an automatic tracking capability, with identification, situational

assessment and decision-making being left to the operators. The automation of many of these functions is the focus of much research and development. A necessary prerequisite for updating the state of a target is the correct association of measurements or other information to the track. The ability of Bayesian belief networks (BBNs) to model the uncertain relationships between continuous and discrete variables make them excellent candidates for incorporating both kinematic and attribute information in the association process. A BBN model for a single scan data association problem is presented and used to develop a global nearest neighbors solution using both kinematic and attribute information. Monte Carlo simulations demonstrate the benefit of using attribute information in the association process.
Author
Automatic Control; Belief Networks; Decision Making; Multisensor Applications

20040068037 Thales Communications, Colombes, France
The Case for Using Semantic Nets as a Convergence Format for Symbolic Information Fusion
Rohmer, Jean; Military Data and Information Fusion; March 2004, pp. 20-1 - 20-11; In English; See also 20040068014; Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We explore how various information formats can be merged into an unique semantic space, using the Semantic Nets formalism. We show that this formalism can then be transformed and reworked to perform classical data analysis computations, which will help in the fusion and discovery process. We advocate for using semantic nets to get sense from heterogeneous information's, in particular texts, as a step towards what could be called "Litteratus Calculus".
Keywords: Symbolic Information Fusion, Semantic Nets, Data Analysis, Text Mining, Text Understanding, Automatic Classification.
Author
Classifications; Formalism; Format

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COMPUTER SYSTEMS

Includes computer networks and distributed processing systems. For information systems see *82 Documentation and Information Science*. For computer systems applied to specific applications, see the associated category.

20040062458 Swedish Defence Research Establishment, Stockholm, Sweden
Object Recognition with a Differential Invariant Method
Hafstroem, A.; Mar. 2003; In English
Report No.(s): PB2004-104151; FOI-R-0894-SE; No Copyright; Avail: National Technical Information Service (NTIS)

This report is a master's thesis in computer vision at the Department of Autonomous Systems at the Swedish Defense Research Agency (FOI). The problem under study is that of funding and recognizing predefined objects in a picture by means of a differential invariant method, as well as finding from what position the object is seen. The method should be able to identify an arbitrary number of copies of such objects. The master's thesis comprises construction and evaluation of such algorithms for object recognition. The method may be useful in a control loop for vehicle navigation.
NTIS
Weapon Systems; Computer Vision; Navigation

20040066100 NASA Ames Research Center, Moffett Field, CA, USA
Multi-Agent Methods for the Configuration of Random Nanocomputers
Lawson, John W.; [2004]; 1 pp.; In English; APS March Meeting, March 2004, Montreal, Canada; No Copyright; Avail: Other Sources; Abstract Only

As computational devices continue to shrink, the cost of manufacturing such devices is expected to grow exponentially. One alternative to the costly, detailed design and assembly of conventional computers is to place the nano-electronic components randomly on a chip. The price for such a trivial assembly process is that the resulting chip would not be programmable by conventional means. In this work, we show that such random nanocomputers can be adaptively programmed using multi-agent methods. This is accomplished through the optimization of an associated high dimensional error function. By representing each of the independent variables as a reinforcement learning agent, we are able to achieve convergence must faster than with other methods, including simulated annealing. Standard combinational logic circuits such as adders and multipliers are implemented in a straightforward manner. In addition, we show that the intrinsic flexibility of these adaptive

methods allows the random computers to be reconfigured easily, making them reusable. Recovery from faults is also demonstrated.
Author
Nanotechnology; Computers; Methodology; Configuration Management; Manufacturing

20040068021 DMR Consulting, Sainte-Foy, Canada
A Lessons Learned Knowledge Warehouse to Support the Army Knowledge Management Command-Centric
Champoux, Pierrette; Trudel, Martin; Thibault, Gaetan; Military Data and Information Fusion; March 2004, pp. 22-1 - 22-20; In English; See also 20040068014; Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Canadian Army Lessons Learned Knowledge Warehouse (ALLKW) is at the heart of the environmental Knowledge Management (KM) strategy to support the Canadian Land Force Operational Model centered on Command. This paper presents the Army Lessons Learned System and Process (ALLP) that is part of the approach for gathering observations and comments from operations and exercises in order to support lesson elicitation, action identification as well as proper follow-up. Along with the description of the LL Processes, a focus will be made on how the current system could be improved in order to facilitate its integration within the Intelligence, Surveillance, Target Acquisition and Reconnaissance (ISTAR) Information-Centric Workspace Processes, in particular the interaction and use of such a system with the Data Fusion Processes and System.
Author
Management Planning; Target Acquisition; Multisensor Fusion; Environment Management; Surveillance

20040068038 T-SOFT Ltd., Prague, Czech Republic
Web-Based Countrywide Resources Planning System with the Centralized Support of National Mapping Center
Pejcoch, Jaroslav; Duda, Jan; Military Data and Information Fusion; March 2004, pp. 25-1 - 25-7; In English; See also 20040068014; Copyright; Avail: CASI; A02, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The paper discusses a specific area of the information gathering and processing at the boundary between military and civilian usage. Crisis management is important for both areas, increasingly in the current situation of asymmetric threat and terrorist activities. The availability of resources is one of a key needs for the crisis management. The system ARGIS, described here, represents a part of the information support of the countrywide crisis management system, providing the function of an information pump to the responsible staff at various command level in the country. The system is based on a loose reporting structure, based mainly on the rules defined by the legislation and on the activities of the bodies acting in the crisis management. The ARGIS users have a detailed country maps available as a service of a State mapping centre . All the services of the system are supplied as web-based application, with no specific requirements to the users (except a security ones). The base of the system has been in operation since the year 2001.
Author
Data Processing; Management Methods; Management Systems; User Requirements

20040068039 Lockheed Martin Canada, Montreal, Quebec, Canada
Analysis of Adaptive Data Fusion Approaches within LM Canada's Technology Demonstrator
Shahbazian, Elisa; Baril, Louise; Michaud, Guy; Menard, Eric; Turgeon, Daniel; Military Data and Information Fusion; March 2004, pp. 21-1 - 21-8; In English; See also 20040068014; Copyright; Avail: CASI; A02, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Lockheed Martin Canada (LM Canada) has developed a Technology Demonstration environment, which over the last decade has been used to demonstrate initial proof-of-concept and then analyse various approaches for enhancing overall Data Fusion system performance for applications to Canada s defence programs. It has a blackboard-based architecture that permits mix of rule-based and algorithmic approaches, specifically useful in the implementation of higher-level fusion capabilities. Various aspects of these efforts, such as fusion architectures, algorithms and information sharing strategies between multiple collaborating platforms have been presented previously [1,2]. This paper presents currently on-going efforts towards the analyses of concepts for level 4 fusion, i.e. methods for adapting the fusion processes based on the tactical and environmental factors.
Author
Applications Programs (Computers); Multisensor Fusion; Proving

63
CYBERNETICS, ARTIFICIAL INTELLIGENCE AND ROBOTICS

Includes feedback and control theory, information theory, machine learning, and expert systems. For related information see also *54 Man/System Technology and Life Support*.

20040062361 NASA Langley Research Center, Hampton, VA, USA
Experiences with Probabilistic Analysis Applied to Controlled Systems
Kenny, Sean P.; Giesy, Daniel P.; [2004]; 16 pp.; In English; 45th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference, 19-22 Apr. 2004, Palm Springs, CA, USA
Report No.(s): AIAA Paper 2004-1987; No Copyright; Avail: CASI; A03, Hardcopy

This paper presents a semi-analytic method for computing frequency dependent means, variances, and failure probabilities for arbitrarily large-order closed-loop dynamical systems possessing a single uncertain parameter or with multiple highly correlated uncertain parameters. The approach will be shown to not suffer from the same computational challenges associated with computing failure probabilities using conventional FORM/SORM techniques. The approach is demonstrated by computing the probabilistic frequency domain performance of an optimal feed-forward disturbance rejection scheme.
Author
Control Systems Design; Probability Theory; Dynamical Systems; Feedback Control; Numerical Analysis; Methodology

20040065775 NASA Langley Research Center, Hampton, VA, USA
Formal Verification of a Conflict Resolution and Recovery Algorithm
Maddalon, Jeffrey; Butler, Ricky; Geser, Alfons; Munoz, Cesar; April 2004; 82 pp.; In English
Report No.(s): NASA/TP-2004-213015; L-18323; No Copyright; Avail: CASI; A05, Hardcopy

New air traffic management concepts distribute the duty of traffic separation among system participants. As a consequence, these concepts have a greater dependency and rely heavily on on-board software and hardware systems. One example of a new on-board capability in a distributed air traffic management system is air traffic conflict detection and resolution (CD&R). Traditional methods for safety assessment such as human-in-the-loop simulations, testing, and flight experiments may not be sufficient for this highly distributed system as the set of possible scenarios is too large to have a reasonable coverage. This paper proposes a new method for the safety assessment of avionics systems that makes use of formal methods to drive the development of critical systems. As a case study of this approach, the mechanical veri.cation of an algorithm for air traffic conflict resolution and recovery called RR3D is presented. The RR3D algorithm uses a geometric optimization technique to provide a choice of resolution and recovery maneuvers. If the aircraft adheres to these maneuvers, they will bring the aircraft out of conflict and the aircraft will follow a conflict-free path to its original destination. Veri.cation of RR3D is carried out using the Prototype Verification System (PVS).
Author
Air Traffic Control; Safety; Avionics; Computer Programs; Program Verification (Computers)

20040065982 NASA Ames Research Center, Moffett Field, CA, USA
Strategies for Global Optimization of Temporal Preferences
Morris, Paul; Morris, Robert; Khatib, Lina; Ramakrishnan, Sailesh; January 2004; 6 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

A temporal reasoning problem can often be naturally characterized as a collection of constraints with associated local preferences for times that make up the admissible values for those constraints. Globally preferred solutions to such problems emerge as a result of well-defined operations that compose and order temporal assignments. The overall objective of this work is a characterization of different notions of global preference, and to identify tractable sub-classes of temporal reasoning problems incorporating these notions. This paper extends previous results by refining the class of useful notions of global temporal preference that are associated with problems that admit of tractable solution techniques. This paper also answers the hitherto open question of whether problems that seek solutions that are globally preferred from a Utilitarian criterion for global preference can be found tractably.
Author
Optimization; Problem Solving; Optimal Control

20040066084 QSS Group, Inc., Moffett Field, CA, USA
Combining Model-driven and Schema-based Program Synthesis
Denney, Ewen; Whittle, John; January 2004; 7 pp.; In English; UMSS 2004, 21 - 24 Jun. 2004, Las Vegas, NV, USA; No Copyright; Avail: CASI; A02, Hardcopy

We describe ongoing work which aims to extend the schema-based program synthesis paradigm with explicit models. In this context, schemas can be considered as model-to-model transformations. The combination of schemas with explicit models offers a number of advantages, namely, that building synthesis systems becomes much easier since the models can be used in verification and in adaptation of the synthesis systems. We illustrate our approach using an example from signal processing.
Author
Signal Processing; Mathematical Models; Algorithms; Computer Systems Programs

20040066107 NASA Ames Research Center, Moffett Field, CA, USA
Overcoming Communication Restrictions in Collectives
Tumer, Kagan; Agogino, Adrian K.; [2004]; 6 pp.; In English; Joint Conference on Neural Networks, 26-30 Jul. 2004, Budapest, Hungary; No Copyright; Avail: CASI; A02, Hardcopy

Many large distributed system are characterized by having a large number of components (eg., agents, neurons) whose actions and interactions determine a %orld utility which rates the performance of the overall system. Such collectives are often subject to communication restrictions, making it difficult for components which try to optimize their own private utilities, to take actions that also help optimize the world utility. In this article we address that coordination problem and derive four utility functions which present different compromises between how aligned a component s private utility is with the world utility and how readily that component can determine the actions that optimize its utility. The results show that the utility functions specifically derived to operate under communication restrictions outperform both traditional methods and previous collective-based methods by up to 75%.
Author
Distributed Parameter Systems; Coordination; Artificial Intelligence; Telecommunication

20040067874 Saint Thomas Univ., Houston, TX, USA
Knowledge Management in Aerospace: Education and Training Issues
Dykman, C. A.; Lunar and Planetary Science XXXV: Education; 2004; 1 pp.; In English; See also 20040067870; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This paper addresses the issues involved in education and training as it relates to the concept of Knowledge Management in Aerospace. Let us assume that everyone is in agreement about the value of Knowledge Management in Aerospace. What does this really mean for those working in the field? How do we communicate this concept of Knowledge Management to those working in the organizations and generating the knowledge? Knowledge Management is not just a technical discipline. It is not something that involves only computers and data warehouses. Knowledge Management involves humans. This human element is what can take the pieces of information and turn them into knowledge for an organization.
Derived from text
Education; Data Management; Aerospace Industry

20040067953 Swedish Defence Research Establishment, Stockholm, Sweden
Optimal Motion Control of a Ground Vehicle
Anisi, D. A.; Jul. 2003; In English
Report No.(s): PB2004-104158; FOI-R-0961-SE; No Copyright; Avail: National Technical Information Service (NTIS)

The main objective is to investigate how the Pontryagin Maximum Principle, a tool from the area of Optimal Control, can be used in order to find appropriate control laws for steering a mobile platform between two prescribed points in the state space. Any possible ambition to design an autonomous system, consisting of one single or a group of cooperating vehicles, boils down to being able to plan the motion of the system. Thus, path planning is a most fundamental issue for designing an Unmanned Ground Vehicle (UGV). This work is hence a brick in a modularized project at FOI, aiming at designing a control system, consisting of multiple UGVs. This report presents results on how to generate time-optimal as well as feasible paths interconnecting two given states-feasible in the sense that it has to obey both the kinematics-and numerical limitations-since in autonomous robot applications, because of the partially unknown environment and unexpected events, the ability to perform path re-planning on-line is of key importance. In addition, the problem of generating nearly time-optimal, but nevertheless

smoother, more flexible and pliable paths for a ground vehicle is considered. As will be illustrated, such paths raise the robustness with respect to any possible uncertainties in the environment.
NTIS
Pontryagin Principle; Optimal Control; Maximum Principle; Robot Dynamics; Unmanned Ground Vehicles

64
NUMERICAL ANALYSIS

Includes iteration, differential and difference equations, and numerical approximation.

20040065766 Sandia National Labs., Albuquerque, NM, USA
Computational Investigations of the Chesapeake Bay Impact Structure
Crawford, D. A.; Barnouin-Jha, O. S.; Lunar and Planetary Science XXXV: Impacts: Modeling and Observations; 2004; 2 pp.; In English; See also 20040065753
Contract(s)/Grant(s): DE-AC04-94-AL-85000; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Chesapeake Bay Impact Structure is a buried 35 Ma complex marine impact crater that formed in a target of water, sediments and crystalline basement. Its center is close to the town of Cape Charles, Virginia near the southern tip of the Delmarva peninsula. The crater can be described as having an "inverted sombrero" shape of a 38 km wide inner basin surrounded by a 24 km flat-floored annular trough. The outer margin of the annular trough consists of a slumped terrace zone surrounded by a approx. 35 km wide fracture zone[1,2]. Simulations of seismic data from the inner basin appear to indicate a 5-15 km wide central uplift[3].
Derived from text
Craters; Fracturing; Sediments; Chesapeake Bay (Us)

20040065826 Institut Univ. de Technologie, Bourges, France
Comparative Survey of Ultrasound Images Compression Methods Dedicated to a Tele-Echography Robotic System
Delgorge, C.; Vieyres, P.; Poisson, G.; Rosenberger, C.; Arbeille, P.; October 25, 2001; 5 pp.; In English; 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, Istanbul, Turkey; Original contains color illustrations
Report No.(s): AD-A410658; No Copyright; Avail: CASI; A01, Hardcopy

This paper proposes an evaluation of various compression techniques, for ultrasound images transmission, within a telemedicine project. For the purpose of this work, we selected seven compression methods : Fourier Transform, Discrete Cosine Transform, Wavelets, Quadtrees Transform, Fractals, Histogram Thresholding, and Run Length Coding. Preliminary results obtained on echographic images show that the method based upon the wavelet transform seems to give the best compromise between coding performance and image quality, measured thanks to mean square error and coding time.
DTIC
Image Resolution; Ultrasonics; Data Compression

20040066037 Panjab Univ., Chandigarh, India
Numerical Simulations of the Production of Extinct Radionuclides and ProtoCAIs by Magnetic Flaring Associated with Protosun
Sahijpal, S.; Soni, P.; Lunar and Planetary Science XXXV: Meteorites; 2004; 2 pp.; In English; See also 20040066033; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

X-ray flare observations of low mass protostars in the Orion nebula cluster obtained by Chandra X-ray satellite provides detailed characterization of magnetic flaring in protostars going through T Tauri phase. Present work involves numerical simulations of irradiation production of extinct radionuclides, Ca-41, Cl-36, Al-26, Be-10 and Mn-53, and thermal processing of protoCAIs in the X-wind model formulation using the X-ray flare observations.
Author
Numerical Analysis; Extinction; Radioactive Isotopes; X Rays; Protostars

20040068017 State Univ. of New York, Buffalo, NY, USA
On the Scientific Foundations of Level 2 Fusion
Llinas, James; Military Data and Information Fusion; March 2004, pp. KN2-1 - KN2-3; In English; See also 20040068014; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This Keynote speech will actually address two focal topics: (1) certain suggestions for extensions and modifications of the well-known "JDL'Data Fusion process model, and (2) perspectives on an overarching approach toward developing first Theories and then Algorithms for Level 2 Data Fusion.
Author
Algorithms; Distributed Processing

20040068031 Defence Research and Development Canada, Val-Belair, Quebec, Canada
Analysing an Identity Information Fusion Algorithm Based on Evidence Theory
Jousselme, Anne-Laure; Bosse, Eloi; Jouan, Alexandre; Military Data and Information Fusion; March 2004, pp. 13-1 - 13-13; In English; See also 20040068014; Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In this paper, we analyse an identification algorithm in the evidence theory framework. The identification algorithm is composed of four main steps: (1) sensor reports are transformed into initial Basic Probability Assignments, (2) the successive BPAs are combined through Dempster s rule, (3) the resulting BPAs are approximated to avoid algorithm explosion, and (4) in parallel to step (3) a decision is taken on the identification/classification of an object from a database based on the maximum of pignistic probability criterion. The identification algorithm is applied to a Direct Fleet Support scenario where ESM reports are fused to identify six targets among a possibility of 142 in the database. As a basis for the analysis, we observe the behaviour of (1) the pignistic probability of the singletons of the database, used as decision rule, (2) the distance between a BPA and a solution (ground truth), (3) the distance between an approximated BPA and a non-approximated one, and (4) the non-specificity of the BPA.
Author
Algorithms; Probability Theory; Ground Truth; Classifications; Targets

65
STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; time series analysis; and stochastic processes.

20040067885 Lawrence Livermore National Lab., Livermore, CA
Multivariate Clustering of Large-Scale Simulation Data
Eliassi-Rad, T.; Critchlow, T. J.; Mar. 04, 2003; In English
Report No.(s): DE2003-15004528; UCRL-JC-151860; No Copyright; Avail: National Technical Information Service (NTIS)

Simulations of complex scientific phenomena involve the execution of massively parallel computer programs. These simulation programs generate large-scale data sets over the spatiotemporal space. Modeling such massive data sets is an essential step in helping scientists discover new information from their computer simulations. In this paper, we present a simple but effective multivariate clustering algorithm for large-scale scientific simulation data sets. Our algorithm utilizes the cosine similarity measure to cluster the field variables in a data set. Field variables include all variables except the spatial (x, y, z) and temporal (time) variables. The exclusion of the spatial space is important since 'similar' characteristics could be located (spatially) far from each other. To scale our multivariate clustering algorithm for large-scale data sets, we take advantage of the geometrical properties of the cosine similarity measure.
NTIS
Algorithms; Cluster Analysis; Computerized Simulation; Data Simulation

66
SYSTEMS ANALYSIS AND OPERATIONS RESEARCH

Includes mathematical modeling of systems; network analysis; mathematical programming; decision theory; and game theory.

20040065772 NASA Langley Research Center, Hampton, VA, USA
A Numerical Simulation and Statistical Modeling of High Intensity Radiated Fields Experiment Data
Smith, Laura J.; March 2004; 29 pp.; In English
Contract(s)/Grant(s): L-18356
Report No.(s): NASA/TM-2004-213005; No Copyright; Avail: CASI; A03, Hardcopy

Tests are conducted on a quad-redundant fault tolerant flight control computer to establish upset characteristics of an avionics system in an electromagnetic field. A numerical simulation and statistical model are described in this work to analyze the open loop experiment data collected in the reverberation chamber at NASA LaRC as a part of an effort to examine the effects of electromagnetic interference on fly-by-wire aircraft control systems. By comparing thousands of simulation and model outputs, the models that best describe the data are first identified and then a systematic statistical analysis is performed on the data. All of these efforts are combined which culminate in an extrapolation of values that are in turn used to support previous efforts used in evaluating the data.
Author
Electromagnetic Fields; Statistical Analysis; Radiation Distribution; Direct Numerical Simulation; Electromagnetic Interference

67
THEORETICAL MATHEMATICS

Includes algebra, functional analysis, geometry, topology, set theory, group theory and number theory.

20040068034 Physics and Electronics Lab. TNO, The Hague, Netherlands
A Bayesian Network for Combat Identification
vanGosliga, Sicco Pier; Jansen, Henk; Military Data and Information Fusion; March 2004, pp. 14-1 - 14-11; In English; See also 20040068014; Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This paper reports the results of an investigation at TNO Physics and Electronics Laboratory for the Royal Dutch Navy on how a Bayesian network can be used to introduce more transparency in decision aid as to the level of confidence of the information that is used. To assess the feasibility of a Bayesian approach to new decision support system concepts, we have chosen to use the identification process of air contacts aboard navy frigates as a case study. The identification process is a time intensive and mind consuming process that is critical to anticipate an air attack. Wrong decisions may have fatal consequences and for example: identifying a neutral aircraft as an hostile aircraft may cost the lives of many people and may cause undesired political instability. Vice versa, mistakenly taking a hostile aircraft for a friendly one will give opponents the tactical advantages of a surprise attack. Typically a list of identification criteria is used by air defense personnel to discriminate hostile aircraft from neutral and friendly aircraft. These predefined criteria may change from mission to mission but will always follow a strict scheme of "if-then-else" clauses. Although identification involves reasoning with uncertain information, current procedures do not make this uncertainty explicit. Embedding Bayesian inference techniques in decision support systems would enable us to reason with uncertainty in a scientifically sound and consistent manner. Bayesian networks can express the likelihood of a hypothesis such as the identity of air contact being hostile as an explicit value, even when information about a contact is uncertain and incomplete. Making this uncertainty explicit, enables navy personnel to know how much confidence it should have the probability of hypotheses that are based on it.
Derived from text
Bayes Theorem; Decision Support Systems; Air Defense; Probability Theory; Identifying

70
PHYSICS (GENERAL)

Includes general research topics related to mechanics, kinetics, magnetism, and electrodynamics. For specific areas of physics see *categories 71 through 77*. For related instrumentation see *35 Instrumentation and Photography*; for geophysics, astrophysics, or solar physics see *46 Geophysics, 90 Astrophysics*, or *92 Solar Physics*.

20040062451 Westinghouse Savannah River Co., Aiken, SC, USA
Examination of 304L Stainless Steel to 6061-T6 Aluminum Inertia Welded Transition Joints after Irradiation in a Spallation Neutron Spectrum
Dunn, K. A.; Louthan, M. R.; Mickalonis, J. I.; Maloy, S.; James, M. R.; 1999; 20 pp.; In English
Report No.(s): DE2004-754464; WSRC-TR-99-00493; No Copyright; Avail: Department of Energy Information Bridge

The Savannah River Technology Center (SRTC) designed and fabricated tritium target/blanket assemblies which were irradiated for six months at the Los Alamos Neutron Science Center (LANSCE). Cooling water was supplied to the assemblies through 1 inch diameter 304L Stainless Steel (SS) tubing. To attach the 304L SS tubing to the modules a 304L SS to 6061-T6 Aluminum (Al) inertia welded transition joint was used. These SS/Al inertia weld transition joints simulate expected transition joints in the Accelerator Production of Tritium (APT) Target/Blanket where as many as a thousand SS/Al weld transition joints will be used. Materials compatibility between the 304L SS and the 6061-T6 Al in the spallation neutron environment is a major concern as well as the corrosion associated with the cooling water flowing through the piping. The irradiated inertia weld examination will be discussed.
NTIS
Aluminum; Stainless Steels; Radiation Effects

20040062452 Du Pont de Nemours (E. I.) and Co., Aiken, SC, USA
Ion Chamber Compensation Tests
1960; 18 pp.; In English
Report No.(s): DE2004-808271; DPSP-60-2258; No Copyright; Avail: Department of Energy Information Bridge

The purpose of this report is to present the results of a series of tests performed to determine the need for gamma compensation of the ion chambers used to monitor the neutron flux in the 100 Area reactors.
NTIS
Ionization Chambers; Performance Tests

20040062470 Lawrence Livermore National Lab., Livermore, CA
Modeling the Use of Self-Focused Beams to Overcome the Effects of Target Emissions in Advanced Hydrodynamic Radiography Machines
Lauer, E. J.; May 01, 2001; 24 pp.; In English
Report No.(s): DE2004-15006181; UCRL-ID-143423; No Copyright; Avail: Department of Energy Information Bridge

In the machines being developed for advanced hydrodynamic radiography, an electron beam of several kA current and 20 Mev particle energy is focused to less than a millimeter diameter onto a high atomic number target to produce bremstrahlung X-rays. Several pulses occur during a period of about 2(micro)s. A plasma plume is predicted to move upstream from the target. If the final focus onto the target is in vacuum, then the plasma from an early pulse may neutralize the self-electric field of a later pulse causing over-focusing. Also positive ions may be accelerated upstream by the self-electric field of a beam focused onto a conducting target in vacuum. The ions neutralize part of the self-electric field and so cause a time varying change of focusing.
NTIS
Target Recognition; Radiography

20040062478 Lawrence Livermore National Lab., Livermore, CA
Review of Experimental Capture Gamma Spectra for Neutrons above 10 MeV
Dietrich, F. S.; May 22, 2000; 16 pp.; In English
Report No.(s): DE2004-15006437; UCRL-ID-139091; No Copyright; Avail: Department of Energy Information Bridge

In this section we review the available data on gamma spectra following radiative capture of neutrons above 10 MeV. A few measurements below that energy are included. An important source for references to this topic is the CINDA compilation maintained by the IAEA in cooperation with three other major data centers. An additional useful source is the review article by Weller and Roberson, which treats capture reactions with neutrons, protons, and alpha particles. The following discussion

refers only to data that are easily accessible through readily-available journals, reports, or the EXFOR database. Most of the reported measurements were made for the purpose of determining cross sections for discrete states at the high energy end of the gamma spectra which are resolvable or nearly so. In only a few cases have cross sections been measured over a wide range of gamma energies. These measurements are first reviewed below, followed by a review of more detailed measurements such as angular distributions and analyzing powers. Neutron capture on hydrogen isotopes have not been included with the exception of a fairly recent measurement on deuterium; see CINDA for references to this specialized topic.
NTIS
Neutrons; Alpha Particles

20040062480 Lawrence Livermore National Lab., Livermore, CA
SSPX Thermistor System
Thomassen, K. I.; Nov. 29, 2000; 10 pp.; In English
Report No.(s): DE2004-15006440; UCRL-ID-141672; No Copyright; Avail: Department of Energy Information Bridge
No abstract available
Thermistors; Temperature Measuring Instruments; Upgrading

20040062497 Lawrence Livermore National Lab., Livermore, CA
EBIT in the Magnetic Trapping Mode: Mass Spectrometry, Atomic Lifetime Measurements, and Charge Transfer Reactions of Highly Charged Atomic Ions
Schweikhard, L.; Beiersdorfer, P.; Trabert, E.; Jul. 10, 2001; 14 pp.; In English
Report No.(s): DE2004-15006512; UCRL-JC-143990; No Copyright; Avail: Department of Energy Information Bridge
Although it may sound like a contradiction in terms, the electron beam ion trap (EBIT) works as an ion trap even when the electron beam is switched off. We present various experiments that exploit the 'magnetic trapping mode' for investigations of ion confinement, charge exchange processes, atomic lifetime and ion mass measurements.
NTIS
Ions; Charge Transfer

20040066093 Lawrence Livermore National Lab., Livermore, CA
2001 Report on the Next Linear Collider
Gronberg, J.; Briedenbach, M.; Burke, D.; Corlett, J.; Dombeck, T.; Jun. 01, 2001; 164 pp.; In English
Report No.(s): DE2004-15006933; UCRL-JC-144077; No Copyright; Avail: Department of Energy Information Bridge
Recent studies in elementary particle physics have made the need for an e(sup+)e(sup-) linear collider able to reach energies of 500 GeV and above with high luminosity more compelling than ever. Observations and measurements completed in the last five years at the SLC (SLAC), LEP (CERN), and the Tevatron (FNAL) can be explained only by the existence of at least one particle or interaction that has not yet been directly observed in experiment. The Higgs boson of the Standard Model could be that particle. The data point strongly to a mass for the Higgs boson that is just beyond the reach of existing colliders. This brings great urgency and excitement to the potential for discovery at the upgraded Tevatron early in this decade, and almost assures that later experiments at the LHC will find new physics.
NTIS
Particle Accelerators; Particle Interactions; Luminosity; Higgs Bosons

20040067882 Lawrence Livermore National Lab., Livermore, CA
Large-Scale Computations Leading to a First-Principles Approach to Nuclear Structure
Ormand, W. E.; Navratil, P.; Aug. 18, 2003; In English
Report No.(s): DE2003-15004531; UCRL-JC-155124; No Copyright; Avail: National Technical Information Service (NTIS)
The authors report on large-scale applications of the ab initio, no-core shell model wither the primary goal of achieving an accurate description of nuclear structure from the fundamental inter-nucleon interactions. In particular, we show that realistic two-nucleon interactions are inadequate to describe the low-lying structure of (sup 10)B, and that realistic three-nucleon interactions are essential.
NTIS
Nuclear Structure; Scale Models; Computation

20040067918 Fermi National Accelerator Lab., Batavia, IL, USA
Quarkonium: New Developments
Quigg, C.; Mar. 2004; In English
Report No.(s): DE2004-822217; FERMILAB-CONF-04/033-T; No Copyright; Avail: National Technical Information Service (NTIS)
No abstract available
Quarks; Mesons

20040067921 Lawrence Livermore National Lab., Livermore, CA
Reconnection in NIMROD: Model, Predictions, Remedies
Fowler, T. K.; Bulmer, R. H.; Cohen, B. I.; Hua, D. D.; Jun. 25, 2003; In English
Report No.(s): DE2003-15004545; UCRL-ID-154060; No Copyright; Avail: National Technical Information Service (NTIS)
It is shown that in NIMROD the formation of closed current configurations, occurring only after the voltage is turned off, is due to the faster resistive decay of nonsymmetric modes compared to the symmetric projection of the 3D steady state achieved by gun injection. Implementing Spitzer resistivity is required to make a definitive comparison with experiment, using two experimental signatures of the model discussed in the paper. If there are serious disagreements, it is suggested that a phenomenological hyper-resistivity be added to the n = 0 component of Ohms law, similar to hyper-resistive Corsica models that appear to fit experiments. Hyper-resistivity might capture physics at small scale missed by NIMROD. Encouraging results would motivate coupling NIMROD to SPICE with edge physics inspired by UEDGE, as a tool for experimental data analysis.
NTIS
Electric Potential; Electrical Resistivity; Ohms Law

20040067943 Lawrence Livermore National Lab., Livermore, CA
General Constraints on Cross Sections Deduced from Surrogate Reactions
Younes, W.; Aug. 14, 2003; In English
Report No.(s): DE2003-15004554; UCRL-ID-155152; No Copyright; Avail: National Technical Information Service (NTIS)
Cross sections that cannot be measured in the laboratory, e.g. because the target lifetime is too short, can be inferred indirectly from a different reaction forming the same compound system, but with a more accessible beam/target combination (the 'surrogate-reaction' technique). The reactions share the same compound system and a common decay mechanism, but they involve different formation processes. Therefore, an implicit constraint is imposed on the inferred cross section deduced from the measured surrogate-reaction data, through the common decay mechanism. In this paper, the mathematical consequences of this implicit constraint are investigated.
NTIS
Decay Rates; Beams (Radiation); Uranium 235; Radiative Lifetime

20040068119 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
Test of the Equivalence Principle in an Einstein Elevator
Shapiro, Irwin I.; Glashow, S.; Lorenzini, E. C.; Cosmo, M. L.; Cheimets, P.; Finkelstein, N.; Schneps, M.; April 2004; 183 pp.; In English
Contract(s)/Grant(s): NAG8-1780; No Copyright; Avail: CASI; A09, Hardcopy
The scientific goal of the experiment is to test the equality of gravitational and inertial mass (i.e., to test the Principle of Equivalence) by measuring the independence of the rate of fall of bodies from the composition of the falling body. The measurement is accomplished by measuring the relative displacement (or equivalently acceleration) of two falling bodies of different materials which are the proof masses of a differential accelerometer. The goal of the experiment is to measure the Eoetvoes ratio sigma g/g (differential acceleration/common acceleration) with an accuracy goal of several parts in 10(exp 15). The estimated accuracy is about two orders of magnitude better than the present state of the art. The main goal of the study to be carried out under this grant is part of the flight definition of the experiment and laboratory testing of key components. The project involves an international cooperation in which the responsibility of the US side is the flight definition of the experimental facility while the responsibility of the non-US partners is the flight definition and laboratory prototyping of the differential acceleration detector.In summary, the experiment to be designed is for taking differential acceleration measurements with a high-sensitivity detector (the sensor) during free fall conditions lasting up to 30 s in a disturbance-free acceleration environment. The experiment strategy consists in letting the sensor free fall inside a few meters long (in the

vertical direction) evacuated capsule that is falling simultaneously in the rarefied atmosphere after release from a helium balloon flying at a stratospheric altitude.
Author
Equivalence; Proving; Experiment Design; Experimentation; Acceleration (Physics); Relativity

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ACOUSTICS

Includes sound generation, transmission, and attenuation. For noise pollution see *45 Environment Pollution*. For aircraft noise see also *02 Aerodynamics* and *07 Aircraft Propulsion and Power*.

20040062476 Lawrence Livermore National Lab., Livermore, CA
Sequential Model-Based Detection in a Shallow Ocean Acoustic Environment
Candy, J. V.; Mar. 26, 2002; 12 pp.; In English
Report No.(s): DE2004-15006119; UCRL-JC-146891; No Copyright; Avail: Department of Energy Information Bridge
A model-based detection scheme is developed to passively monitor an ocean acoustic environment along with its associated variations. The technique employs an embedded model-based processor and a reference model in a sequential likelihood detection scheme. The monitor is therefore called a sequential reference detector. The underlying theory for the design is developed and discussed in detail.
NTIS
Acoustics; Shallow Water

20040065977 NASA Langley Research Center, Hampton, VA, USA
The Airframe Noise Reduction Challenge
Lockhard, David P.; Lilley, Geoffrey M.; April 2004; 31 pp.; In English
Contract(s)/Grant(s): 781-10-10
Report No.(s): NASA/TM-2004-213013; L-18346; No Copyright; Avail: CASI; A03, Hardcopy
The NASA goal of reducing external aircraft noise by 10 dB in the near-term presents the acoustics community with an enormous challenge. This report identifies technologies with the greatest potential to reduce airframe noise. Acoustic and aerodynamic effects will be discussed, along with the likelihood of industry accepting and implementing the different technologies. We investigate the lower bound, defined as noise generated by an aircraft modified with a virtual retrofit capable of eliminating all noise associated with the high lift system and landing gear. However, the airframe noise of an aircraft in this 'clean' configuration would only be about 8 dB quieter on approach than current civil transports. To achieve the NASA goal of 10 dB noise reduction will require that additional noise sources be addressed. Research shows that energy in the turbulent boundary layer of a wing is scattered as it crosses trailing edge. Noise generated by scattering is the dominant noise mechanism on an aircraft flying in the clean configuration. Eliminating scattering would require changes to much of the aircraft, and practical reduction devices have yet to receive serious attention. Evidence suggests that to meet NASA goals in civil aviation noise reduction, we need to employ emerging technologies and improve landing procedures; modified landing patterns and zoning restrictions could help alleviate aircraft noise in communities close to airports.
Author
Aeroacoustics; Airframes; Aircraft Noise; Noise Reduction

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OPTICS

Includes light phenomena and the theory of optical devices; for specific optical devices see also *35 Instrumentation and Photography*. For lasers see *36 Lasers and Masers*.

20040062469 Lawrence Livermore National Lab., Livermore, CA
Long Wavelength GaN Blue Laser (400-490nm) Development Final Report 2000 for LLNL Project
Meyer, G.; DenBaars, S. P.; Abare, A.; Sink, K.; Kozodoy, P.; Oct. 26, 2000; 14 pp.; In English
Report No.(s): DE2004-15006164; UCRL-ID-141153; No Copyright; Avail: Department of Energy Information Bridge
No abstract available
Atmospheric Pressure; Lasers

20040062519 Commissariat a l'Energie Atomique, Gif-sur-Yvette, France
Evaluation of a Compact Spectrograph/Detection System for a LIBS Instrument for In-Situ and Stand-Off Detection
Salle, B.; Cremers, D. A.; Benelli, K.; Busse, J.; Wiens, R. C.; Maurice, S.; Walters, R.; Lunar and Planetary Science XXXV: Missions and Instruments: Hopes and Hope Fulfilled; 2004; 2 pp.; In English; See also 20040062499; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Laser-induced breakdown spectroscopy (LIBS) is a method of determining the elemental composition of a material at in-situ or stand-off distances. The information content of the plasma is high. For this reason, LIBS is being developed for instruments to planet surfaces. Each laser plasma generates a light signal containing a high density of information regarding the elemental components of the target material. The useful spectral range of the emitted light extends from the vacuum ultraviolet (!120 nm) out to 850 nm. Within these extremes are strong emission features from all elements useful to identify the element in the target and also to perform quantitative analysis. The detection system (spectrograph and detector) used to process the plasma light determines the quality and quantity of the data gathered. The processing of the collected plasma light by the spectrograph and detector includes: (1) spectral dispersion of the light, (2) recording the spectrally resolved light signal and (3) converting the photonic information to digital form. The characteristics of these two components are crucial to the performance of a LIBS instrument.
Derived from text
Evaluation; Spectrographs; Chemical Composition; In Situ Measurement

20040065821 California Inst. of Tech., Pasadena, CA, USA
Mass Spectrometer Calibration of Cassini Cosmic Dust Analyzer for Methane Ice Via Laser Ablation
Willis, M. J.; Ahrens, T. J.; Shen, A. H.; Beauchamp, J. L.; Lunar and Planetary Science XXXV: Dust: Theory and Experiments; 2004; 2 pp.; In English; See also 20040065816; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Cosmic Dust Analyzer (CDA) instrument aboard the Cassini spacecraft contains a time-of-flight mass spectrometer which will study the composition of dust particles in the vicinity of Saturn. Dust particles impacting on the CDA instrument s Chemical Analyzer Target generate ionized material which is accelerated via an electric field to a multiplier, with the arrival time of ion species at the multiplier being determined by their mass. The response of CDA to impacts of iron and carbon particles has been determined by experiment. However, no calibration data exists for particles consisting of planetary ices (e.g. CH4, NH3, H2O), which are expected to be encountered in the Saturnian system. We present results of experimental work in which laser ablation of a methane-coated mineral target is used to simulate the impact of methane ice particles onto the CDA instrument. Laser ablation was previously used to calibrate CDA for minerals.
Derived from text
Mass Spectrometers; Calibrating; Cosmic Dust; Analyzers; Methane; Ice; Laser Ablation

20040065860 Carnegie Institution of Washington, Washington, DC, USA
High Resolution Confocal Raman Imaging of an IDP
Fries, M.; Nittler, L.; Steele, A.; Toporski, Jan; Lunar and Planetary Science XXXV: Big Dust, Little Dust, and Aerogel; 2004; 1 pp.; In English; See also 20040065855; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Interplanetary dust particles (IDPs) and their included carbon constitute some of the most primitive solar system materials available. Identifying and characterizing the composition of IDP carbon phases is a task well suited to Raman spectroscopy, but resolution of sub-micron detail in IDP carbon has until recently been beyond the capability of available spectrometers. A confocal Raman imager capable of producing ca. 300 nm-resolution spectral maps is used here to examine the carbon phase distribution in an IDP.
Author
Interplanetary Dust; Raman Spectroscopy; Imaging Techniques

20040066052 Open Univ., Milton Keynes, UK
A Miniature UV-VIS Spectrometer for the Surface of Mars
Patel, M. R.; Towner, M. C.; Zarnecki, J. C.; Leese, M. R.; Davies, A.; Husbands, A.; Lunar and Planetary Science XXXV: Mars; 2004; 2 pp.; In English; See also 20040066050; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A miniature spectrometer (approx. 100 g) is in the process of development for future surface missions to Mars, aimed at measuring the UV-VIS spectrum encountered at the martian surface. Responsivity of the unit covers the wavelength range 200-800 nm, with a resolution of 1.5 nm. Great uncertainty lies in the derivation of optical properties of suspended dust in the martian atmosphere at UV wavelengths required for accurate modelling of the transfer of UV to the surface. This instrument will provide surface spectra ranging from the UV to visible, thus allowing the derivation of optical properties across a wide region of wavelength. Presented here are initial results from laboratory experiments, verifying the concept of the spectrometer for its development as part of the ExoMars mission to Mars.
Author
Miniaturization; Ultraviolet Spectrometers; Optical Properties; Mars Surface

20040066089 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
Wavelengths, f-Values, and Cross Sections in the UV Spectra of Astrophysical Atoms, Ions, and Molecules
Crane, Phil, Technical Monitor; Raymond, John C.; Parkinson, W. H.; February 2004; 2 pp.; In English
Contract(s)/Grant(s): NAG5-12668; No Copyright; Avail: CASI; A01, Hardcopy
Contents include the following: Improved UV wavelengths, energy levels, and f-values for iron group ions. Update of Kurucz database of wavelengths and f-values. Publication of improved UV photodissociation cross sections for H2O. UV photoabsorption cross sections for CO bands. Service Activities and Data Outreach.
CASI
Wavelengths; Cross Sections; Ultraviolet Spectra; Energy Levels

20040067852 Lawrence Livermore National Lab., Livermore, CA
National Ignition Facility High-Energy Ultraviolet Laser System
Moses, E. I.; Sep. 15, 2003; 16 pp.; In English
Report No.(s): DE2004-15006529; UCRL-JC-155383; No Copyright; Avail: Department of Energy Information Bridge
The National Ignition Facility (NIF), currently under construction at the Lawrence Livermore National Laboratory, is a stadium-sized facility containing a 192-beam, 1 .8 Megajoule, 500-Terawatt, ultraviolet laser system together with a 10-meter diameter target chamber with room for nearly 100 experimental diagnostics. When completed, NIF will be the world's largest and most energetic laser experimental system, providing an international center to study inertial confinement fusion and the physics of matter at extreme energy densities and pressures. NIF's 192 energetic laser beams will compress fusion targets to conditions required for thermonuclear burn, liberating more energy than required to initiate the fusion reactions. Other NIF experiments will allow the study of physical processes at temperatures approaching 10(sup 8) K and 10(sup 11) Bar, conditions that exist naturally only in the interior of stars, planets and in nuclear weapons. NIF is now entering the first phases of its laser commissioning program. The first four beams of the NIF laser system have generated 106 kilojoules of infrared light and over 10 kJ at the third harmonic (351 nm). NIF's target experimental systems are also being installed in preparation for experiments to begin in late 2003. This paper provides a detailed look the NIF laser systems, the significant laser and optical systems breakthroughs that were developed, the results of recent laser commissioning shots, and plans for commissioning diagnostics for experiments on NIF.
NTIS
Flux Density; Lasers; Inertial Confinement Fusion

20040067922 Lawrence Livermore National Lab., Livermore, CA
Edge Detection to Isolate Motion in Adaptive Optics Systems
Chan, C.; Jul. 11, 2003; In English
Report No.(s): DE2003-15004551; UCRL-ID-154782; No Copyright; Avail: National Technical Information Service (NTIS)
The purpose of the edge detection is to differentiate between edges that remain constant in a scene from those that move. The tracking of moving edges is done by using a reference mask generated by comparing the set of edges in each subsequent frame in time to the current reference mask. At initialization, the reference mask is set to be the edges in the first frame. As time goes on, the edges that move are removed from the reference mask, while those that don't are left behind. Only the edges that are consistent in both the current frame and the reference mask are maintained in the updated reference. This prevents the edges of moving objects from being stored in the reference mask. By iteratively updating the reference mask, the algorithm identifies the static sections of the scenes.
NTIS
Edge Detection; Adaptive Optics; Image Processing; Optical Tracking

20040067945 Lawrence Livermore National Lab., Livermore, CA

Characterization and Operation of a Liquid Crystal Adaptive Optics Phoropter

Awwal, A.; Bauman, B.; Gavel, D.; Olivier, S. S.; Jones, S.; Feb. 05, 2003; In English

Report No.(s): DE2003-15004705; UCRL-JC-151638; No Copyright; Avail: National Technical Information Service (NTIS)

Adaptive optics (AO), a mature technology developed for astronomy to compensate for the effects of atmospheric turbulence, can also be used to correct the aberrations of the eye. The classic phoropter is used by ophthalmologists and optometrists to estimate and correct the lower-order aberrations of the eye, defocus and astigmatism, in order to derive a vision correction prescription for their patients. An adaptive optics phoropter measures and corrects the aberrations in the human eye using adaptive optics techniques, which are capable of dealing with both the standard low-order aberrations and higher-order aberrations, including coma and spherical aberration. High-order aberrations have been shown to degrade visual performance for clinical subjects in initial investigations. An adaptive optics phoropter has been designed and constructed based on a Shack-Hartmann sensor to measure the aberrations of the eye, and a liquid crystal spatial light modulator to compensate for them. This system should produce near diffraction-limited optical image quality at the retina, which will enable investigation of the psychophysical limits of human vision. This paper describes the characterization and operation of the AO phoropter with results from human subject testing.

NTIS

Crystal Optics; Ophthalmology; Eye (Anatomy); Liquid Crystals

20040068063 NASA Marshall Space Flight Center, Huntsville, AL, USA

Lessons Learned During Cryogenic Optical Testing of the Advanced Mirror System Demonstrators (AMSDs)

Hadaway, James; Reardon, Patrick; Geary, Joseph; Robinson, Brian; Stahl, Philip; Eng, Ron; Kegley, Jeff; 2004; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

Optical testing in a cryogenic environment presents a host of challenges above and beyond those encountered during room temperature testing. The Advanced Mirror System Demonstrators (AMSDs) are 1.4 m diameter, ultra light-weight (<20 kg/mA2), off-axis parabolic segments. They are required to have 250 nm PV & 50 nm RMS surface figure error or less at 35 K. An optical testing system, consisting of an Instantaneous Phase Interferometer (PI), a diffractive null corrector (DNC), and an Absolute Distance Meter (ADM), was used to measure the surface figure & radius-of-curvature of these mirrors at the operational temperature within the X-Ray Calibration Facility (XRCF) at Marshall Space Flight Center (MSFC). The Ah4SD program was designed to improve the technology related to the design, fabrication, & testing of such mirrors in support of NASA s James Webb Space Telescope (JWST). This paper will describe the lessons learned during preparation & cryogenic testing of the AMSDs.

Author

Optical Properties; Cryogenics; Mirrors; Calibrating

20040068071 National Center for Atmospheric Research, Boulder, CO, USA

Kepler Ground-Based Photometry Proof-of-Concept

Brown, Timothy M.; Latham, D.; Howell, S.; Everett, M.; April 19, 2004; 22 pp.; In English

Contract(s)/Grant(s): NAG2-1650; No Copyright; Avail: CASI; A03, Hardcopy

We report on our efforts to evaluate the feasibility of using the 4-Shooter CCD camera on the 48-inch reflector at the Whipple Observatory to carry out a multi-band photometric survey of the Kepler target region. We also include recommendations for future work. We were assigned 36 nights with the &hooter during 2003 for this feasibility study. Most of the time during the first two dozen nights was dedicated to the development of procedures, test exposures, and a reconnaissance across the Kepler field. The final 12 nights in September and October 2003 were used for "production" observing in the middle of the Kepler field using the full complement of seven filters (SDSS u, g, r, i, z, plus our special Gred and D51 intermediate-band filters). Nine of these 12 nights were clear and photometric, and production observations were obtained at 109 pointings, corresponding to 14.6 square degrees.

Derived from text

Evaluation; Feasibility Analysis; CCD Cameras; Targets; Surveys

20040068080 Denver Univ., Denver, CO, USA

Measuring Aerosol Size Distributions from the NASA DC-8 in SOLVE II

Reeves, Michael; [2003]; 12 pp.; In English

Contract(s)/Grant(s): NAG2-1578; No Copyright; Avail: CASI; A03, Hardcopy

The University of Denver Focused Cavity Aerosol Spectrometer (FCAS 11) and Nucleation-Mode Aerosol Size Spectrometer (N-MASS) were successfully integrated and flown aboard NASA s DC-8 for the second SAGE I11 Ozone Loss and Validation Experiment (SOLVE 11). Both instruments performed well during SOLVE, with virtually complete data coverage for all mission and test flights. The few exceptions to this were the occasional simultaneous zero-check for the instruments, and some data loss for channel 4 of the N-MASS. The only consequence of the latter is reduced resolution in the 15 to 60 nm range for the affected size distributions.
Author
Aerosols; Size Distribution; Ozone

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PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

20040062487 Lawrence Livermore National Lab., Livermore, CA
Ablation-Front Rayleigh-Taylor Dispersion Curve in Indirect Drive
Budil, K. S.; Lasinski, B.; Edwards, M. J.; Wan, A. S.; Remington, B. A.; Nov. 17, 2000; 22 pp.; In English
Report No.(s): DE2004-15006505; UCRL-JC-139581; No Copyright; Avail: Department of Energy Information Bridge

The Rayleigh-Taylor (RT) instability, which occurs when a lower-density fluid accelerates a higher-density layer, is common in nature. At an ablation front a sharp reduction in the growth rate of the instability at short wave-lengths can occur, in marked contrast to the classical case where growth rates are highest at the shortest wavelengths. Theoretical and numerical investigations of the ablative RT instability are numerous and differ considerably on the level of stabilization expected. We present here the results of a series of laser experiments designed to probe the roll-over and cutoff region of the ablation-front RT dispersion curve in indirect drive. Aluminum foils with imposed sinusoidal perturbations ranging in wavelength from 10 to 70 pm were ablatively accelerated with a radiation drive generated in a gold cylindrical hohlraum. A strong shock wave compresses the package followed by an(approx)2 ns period of roughly constant acceleration and the experiment is diagnosed via face-on radiography. Perturbations with wavelengths(ge) 20(micro)m experienced substantial growth during the acceleration phase while shorter wavelengths showed a sharp drop off in overall growth. These experimental results compared favorably to calculations with a 2-D radiation-hydrodynamics code, however, the growth is significantly affected by the rippled shock launched by the drive.
NTIS
Ablation; Probes

20040062493 Lawrence Livermore National Lab., Livermore, CA
Relative X-Ray Backlighter Intensity Comparison of Ti and Ti/SC Combination Foils Driven in Double-Sided and Single-Sided Laser Configuration
Bullock, A. B.; Landen, O. L.; Bradley, D. K.; Jun. 05, 2000; 24 pp.; In English
Report No.(s): DE2004-15006503; UCRL-JC-139282; No Copyright; Avail: Department of Energy Information Bridge

Use of multiple backlighter foils and/or double-sided laser interaction geometry with backlit imaging can result in improved backlighter efficiency. An experimental comparison of backlighter intensity for Ti foils and Ti/Sc combination foils in both the one-sided and double-sided laser-interaction configuration is presented. Spectrally-integrated framing camera images show intensity contributions of front and rear backlighter surfaces for both foil types. Analysis of time-resolved x-ray spectra collected from foil targets show the relative contribution of Ti and Sc 2-1 He-like resonance lines to the total backlighter intensity.
NTIS
Electromagnetic Interactions; Imaging Techniques; X Ray Spectra

20040066095 NASA Marshall Space Flight Center, Huntsville, AL, USA
Flow In Streamer Boundaries, and Streamer Stability
Suess, S. T.; Nerney, S.; [2004]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

Streamers can extend to many solar radii but the closed field regions, or helmets, reach no higher than 2-4 solar radii. The brightness boundary defining streamers is therefore a boundary between different flow regimes rather than between static plasma and expanding solar wind. It is reasonable to assume that this boundary divides fast coronal hole wind from slow wind.

Flow inside this boundary can be studied using MHD models and is a type of stagnation flow. We describe such a model that is essentially analytic and show examples of flow solutions within the context and assumptions of the model. The flow affects the stability of the underlying helmet, which can be subject to a leakage out of the cusp that is similar to the small mass releases observed with the SOHO/LASCO coronagraph. It can also cause the helmet to be susceptible to being carried away in a coronal mass ejection. The model therefore also offers a way to study streamer stability.
Author
Magnetohydrodynamics; Flow Stability; Coronagraphs; Stability; Boundaries

20040066105 Lawrence Livermore National Lab., Livermore, CA
Instrumentation for Studying Binder Burnout in an Immobilized Plutonium Ceramic Wasteform
Mitchell, M.; Herman, C.; Pugh, D.; Apr. 21, 2000; 14 pp.; In English
Report No.(s): DE2004-15006857; UCRL-JC-137218; No Copyright; Avail: Department of Energy Information Bridge
The Plutonium Immobilization Program produces a ceramic wasteform that utilizes organic binders. Several techniques and instruments were developed to study binder burnout on full size ceramic samples in a production environment. This approach provides a method for developing process parameters on production scale to optimize throughput, product quality, offgas behavior, and plant emissions. These instruments allow for offgas analysis, large-scale TGA, product quality observation, and thermal modeling. Using these tools, results from lab-scale techniques such as laser dilametry studies and traditional TGA/DTA analysis can be integrated. Often, the sintering step of a ceramification process is the limiting process step that controls the production throughput. Therefore, optimization of sintering behavior is important for overall process success. Furthermore, the capabilities of this instrumentation allows better understanding of plant emissions of key gases: volatile organic compounds (VOCs), volatile inorganics including some halide compounds, NO(sub x), SO(sub x), carbon dioxide, and carbon monoxide.
NTIS
Ceramics; Thermogravimetry; Volatile Organic Compounds

20040067878 Lawrence Livermore National Lab., Livermore, CA
Multilayer Dielectric Gratings for Petawatt-Class Laser Systems
Britten, J. A.; Molander, W.; Komashko, A. M.; Barty, C. P. J.; Dec. 03, 2003; 14 pp.; In English
Report No.(s): DE2004-15006527; UCRL-CONF-154956; No Copyright; Avail: Department of Energy Information Bridge
Existing Petawatt class lasers today based on Nd:glass architectures operating at nominally 500 J, 0.5 ps use meter-scale aperture, gold-overcoated master photoresist gratings to compress the amplified chirped pulse. Many lasers operating in the greater than lkJ, greater than Ips regime are in the planning stages around the world. These will require multilayer dielectric diffraction gratings to handle larger peak powers than can be accommodated with gold gratings. Models of the electric field distribution in the solid material of these gratings suggest that high aspect-ratio structures used at high incidence angles will have better laser damage resistance. New tooling for transfer etching these submicron-grating patterns and for nondestructive critical-dimension measurement of these features on meter-scale substrates will be described.
NTIS
Dielectrics; Gratings (Spectra); Lasers

20040067879 Lawrence Livermore National Lab., Livermore, CA
Enhanced Performance of Large 3 Omega Optics Using UV and IR Lasers
Prasad, R. R.; Bruere, J. R.; Peterson, J. E.; Halpin, J. M.; Borden, M. R.; Nov. 01, 2003; In English
Report No.(s): DE2003-15006275; UCRL-CONF-155395; No Copyright; Avail: National Technical Information Service (NTIS)
We have developed techniques using small-beam raster scanning to laser-condition fused silica optics to increase their damage threshold. Further, we showed that CO2 lasers could be used to mitigate and stabilize damage sites while still on the order of a few tens of microns in size, thereby greatly increasing the lifetime of an optic. We recently activated the Phoenix pre-production facility to condition and mitigate optics as large as 43 cm x 43 cm. Several full-scale optics have been processed in Phoenix. The optics were first photographed using a damage mapping system to identify scratches, digs, or other potential sites for initiation of laser damage. We then condition the optic, raster scanning with the excimer laser. The first scan is performed at a low fluence. A damage map is then acquired and any new damage sites or any sites that have grown in size are mitigated using the CO2 laser. The process is repeated at successively higher fluences until a factor of 1.7 above the

nominal operating fluence is reached. After conditioning, optics were tested in a large beam 3 (omega) laser and showed no damage at fluences of 8 J/cm(sup 2) average.
NTIS
Excimer Lasers; Laser Damage

20040067928 Princeton Univ., NJ
Measuring the Plasma Density of a Ferroelectric Plasma Source in an Expanding Plasma
Dunaevsky, A.; Fisch, N. J.; Jan. 2004; 36 pp.; In English
Report No.(s): DE2004-821515; PPPL-3915; No Copyright; Avail: Department of Energy Information Bridge
The initial density and electron temperature at the surface of a ferroelectric plasma source were deduced from floating probe measurements in an expanding plasma. The method exploits negative charging of the floating probe capacitance by fast flows before the expanding plasma reaches the probe. The temporal profiles of the plasma density can be obtained from the voltage traces of the discharge of the charged probe capacitance by the ion current from the expanding plasma. The temporal profiles of the plasma density, at two different distances from the surface of the ferroelectric plasma source, could be further fitted by using the density profiles for the expanding plasma. This gives the initial values of the plasma density and electron temperature at the surface.
NTIS
Plasma Density; Ferroelectricity; Electric Potential

20040067929 Princeton Univ., NJ
Collisional Transport in a Low Aspect Ratio Tokamak-Beyond the Drift Kinetic Formalism
Gates, D. A.; White, R. B.; Jan. 2004; In English
Report No.(s): DE2004-821516; PPPL-3917; No Copyright; Avail: National Technical Information Service (NTIS)
Calculations of collisional thermal and particle diffusivities in toroidal magnetic plasma confinement devices order the toroidal gyroradius to be small relative to the poloidal gyroradius. This ordering is central to what is usually referred to as neoclassical transport theory. This ordering is incorrect at low aspect ratio, where it can often be the case that the toroidal gyroradius is larger than the poloidal gyroradius. We calculate the correction to the particle and thermal diffusivities at low aspect ratio by comparing the diffusivities as determined by a full orbit code (which we refer to as omni-classical diffusion) with those from a gyroaveraged orbit code (neoclassical diffusion). In typical low aspect ratio devices the omni-classical diffusion can be up to 2.5 times the calculated neoclassical value.
NTIS
Tokamak Devices; Plasma Control

20040067930 Princeton Univ., NJ
Measurement of the Magnetic Field in a Spherical Torus Plasma via Electron Bernstein Wave Emission Harmonic Overlap
Jones, B.; Taylor, G.; Efthimion, P. C.; Munsat, T.; Jan. 2004; 28 pp.; In English
Report No.(s): DE2004-821517; PPPL-3918; No Copyright; Avail: Department of Energy Information Bridge
Measurement of the magnetic field in a spherical torus by observation of harmonic overlap frequencies in the electron Bernstein wave (EBW) spectrum has been previously suggested. EBW mode conversion to X-mode radiation has been studied in the Current Drive Experiment-Upgrade spherical torus, with emission measured at blackbody levels. Sharp transitions in the thermally emitted EBW spectrum have been observed for the first two harmonic overlaps. These transition frequencies are determined by the magnetic field and electron density at the mode conversion layer in accordance with hot-plasma wave theory. Prospects of extending this measurement to higher harmonics, necessary in order to determine the magnetic field profile, and high beta equilibria are discussed for this proposed magnetic field diagnostic.
NTIS
Magnetic Fields; Harmonics; Electron Spectroscopy

20040067931 Princeton Univ., NJ
Cumulant-Based Analysis of Nonlinear Magnetospheric Dynamics
Johnson, J. R.; Wing, S.; Jan. 2004; In English
Report No.(s): DE2004-821518; PPPL-3919; No Copyright; Avail: National Technical Information Service (NTIS)
Understanding magnetospheric dynamics and predicting future behavior of the magnetosphere is of great practical interest

because it could potentially help to avert catastrophic loss of power and communications. In order to build good predictive models it is necessary to understand the most critical nonlinear dependencies among observed plasma and electromagnetic field variables in the coupled solar wind/magnetosphere system. In this work, we apply a cumulant-based information dynamical measure to characterize the nonlinear dynamics underlying the time evolution of the D. and K. geomagnetic indices, given solar wind magnetic field and plasma input. We examine the underlying dynamics of the system, the temporal statistical dependencies, the degree of nonlinearity, and the rate of information loss.
NTIS
Magnetic Fields; Nonlinearity; Velocity Distribution; Wind Velocity

20040067935 Princeton Univ., NJ
Resistive Drift Waves in a Bumpy Torus
Lewandowski, J. L. V.; Jan. 2004; 40 pp.; In English
Report No.(s): DE2004-821469; PPPL-3911; No Copyright; Avail: Department of Energy Information Bridge
A computational study of resistive drift waves in the edge plasma of a bumpy torus is presented. The magnetohydrodynamic equilibrium is obtained from a three-dimensional local equilibrium model. The use of a local magnetohydrodynamic equilibrium model allows for a computationally efficient systematic study of the impact of the magnetic field structure on drift wave stability.
NTIS
Plasmas (Physics); Magnetohydrodynamics

20040067936 Princeton Univ., NJ
Double-Kink Fishbone Instability Caused by Circulating Energetic Ions
Kolesnichenko, Y. I.; Lutsenko, V. V.; Marchendko, V. S.; White, R. B.; Jan. 2004; In English
Report No.(s): DE2004-821513; PPPL-3913; No Copyright; Avail: National Technical Information Service (NTIS)
The destabilization of double kink modes by the circulating energetic ions in tokamaks with the plasma current having an off-axis maximum is studied. It is shown that the high-frequency fishbone instability (Energetic Particle Mode (EPM)) and the low-frequency (diamagnetic) fishbones are possible for such an equilibrium, their poloidal and toroidal mode numbers being not necessarily equal to unity. A new kind of the EPM instability, 'doublet fishbones,' is predicted. This instability is characterized by two frequencies; it can occur in a plasma with a non-monotonic radial profile of the energetic ions when the particle orbit width is less than the width of the region where the mode is localized.
NTIS
Magnetohydrodynamic Stability; Ions; Destabilization; Diamagnetism

20040067937 Princeton Univ., NJ
Simulation of Optical and Synthetic Imaging using Microwave Reflectometry
Kramer, G. J.; Nazikian, R.; Valeo, E.; Jan. 2004; In English
Report No.(s): DE2004-821514; PPPL-3914; No Copyright; Avail: National Technical Information Service (NTIS)
Two-dimensional full-wave time-dependent simulations in full plasma geometry are presented which show that conventional reflectometry (without a lens) can be used to synthetically image density fluctuations in fusion plasmas under conditions where the parallel correlation length greatly exceeds the poloidal correlation length of the turbulence. The advantage of synthetic imaging is that the image can be produced without the need for a large lens of high optical quality, and each frequency that is launched can be independently imaged. A particularly simple arrangement, consisting of a single receiver located at the midpoint of a microwave beam propagating along the plasma midplane is shown to suffice for imaging purposes.
NTIS
Plasma Density; Microwave Equipment; Turbulence

76
SOLID-STATE PHYSICS

Includes condensed matter physics, crystallography, and superconductivity. For related information see also *33 Electronics and Electrical Engineering*; and *36 Lasers and Masers*.

20040062448 Lawrence Livermore National Lab., Livermore, CA
Magnetic Random Access Memory(MRAM) Device Development
Cerjan, C.; Law, B. P.; Jan. 18, 2000; 12 pp.; In English
Report No.(s): DE2004-15006522; UCRL-ID-137342; No Copyright; Avail: Department of Energy Information Bridge

The recent discovery of materials that have anomalous magneto-resistive properties has generated renewed commercial interest in metal-based fast memory storage as an alternative to the currently used semiconductor-based devices. One particularly promising ternary alloy, fabricated at LLNL, appeared to have exceptional field response. This proposal extended the investigation of this class of materials by examining the scaling properties of test structures made from this material that could definitively verify the preliminary observations of high field sensitivity. Although the expected scaling was observed, technical issues, such as excessive oxidation, prevented a definitive assessment of the effect. Despite the difficulties encountered, several test structures demonstrated superior performance in a 'spin-valve' configuration that might have applications for very high density recording heads.
NTIS
Magnetoresistivity; Semiconductor Devices; Memory (Computers)

20040062481 Lawrence Livermore National Lab., Livermore, CA
Initial Dislocation Structure and Dynamic Dislocation Multiplication in Mo Single Crystals
Hsiung, L. M.; Lassila, D. H.; Mar. 22, 2000; 12 pp.; In English
Report No.(s): DE2004-15006500; UCRL-JC-138788; No Copyright; Avail: Department of Energy Information Bridge

Initial dislocation structure in annealed high-purity Mo single crystals and deformation substructure in a crystal subjected to 1% compression have been examined and studied in order to investigate dislocation multiplication mechanisms in the early stages of plastic deformation. The initial dislocation density is in a range of 10(sup 6)(approx) 10(sup 7) cm(sup -2), and the dislocation structure is found to contain many grown-in super-jogs along dislocation lines. The dislocation density increases to a range of 10(sup 8)(approx) 10(sup 9) cm(sup -2), and the average jog height is also found to increase after compressing for a total strain of 1%. It is proposed that the preexisting jogs screw dislocations can act as (multiple) dislocation multiplication sources when deformed under quasi-static conditions. Both the jog height and length of link segment (between jogs) can increase by stress-induced jog coalescence, which takes place via the lateral migration (drift) of super-jogs driven by unbalanced line-tension partials acting on link segments of unequal lengths. Applied shear stress begins to push each link segment to precede dislocation multiplication when link length and jog height are greater than critical lengths. This dynamic dislocation multiplication source is subsequently verified by direct simulations of dislocation dynamics under stress to be crucial in the early stages of plastic deformation in Mo single crystals.
NTIS
Molybdenum; Crystals; Deformation; Single Crystals; Plastic Deformation

20040065049 Morgan State Univ., Baltimore, MD, USA
Anomalous Spectra of High-Ca Pyroxenes: Correlation Between Ir and Moessbauer Patterns
Hoffman, E. J.; Black, R. L.; Bickraj, K. L.; Cloutis, E. A.; Lunar and Planetary Science XXXV: Mars: Remote Sensing and Terrestrial Analogs; 2004; 2 pp.; In English; See also 20040065031; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

For both near-infrared reflectance (NIR) and M ssbauer spectroscopy of high-Ca pyroxenes interpretation has been complicated by anomalous results not yet amenable to easy interpretation. Both methods have sometimes seemed to show Fe2+ in the M2 octahedral site, where Ca2+ is known to be. In some cases samples of almost identical composition give contrasting NIR results. We are comparing NIR and M ssbauer spectra for such matched sets in the hope of elucidating these paradoxes. In a similar attempt for angrite titanian pyroxenes fassaites) the M ssbauer spectra suggested Fe2+ distributions, normal or anomalous, in agreement with NIR results. The presence of olivine, however, complicated the interpretation considerably. Here we present results using 8 matched sets containing a total of 21 different terrestrial high-Ca pyroxenes.
Author
Pyroxenes; Spectroscopy; Mossbauer Effect; Paradoxes

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SOCIAL AND INFORMATION SCIENCES (GENERAL)

Includes general research topics related to sociology; educational programs and curricula. For specific topics in these areas see *categories 81 through 85*.

20040065832 Defence Science and Technology Organisation, Edinburgh, Australia
Historical Analysis of Population Reactions to Stimuli: A Case Study of East Timor
Dexter, Patricia; February 2004; 48 pp.; In English
Report No.(s): DSTO-TR-1553; DODA-AR-013-033; Copyright; Avail: Other Sources

This report provides a baseline study of the reaction of populations to imposed stimuli in a regional urban environment, which is likely to be encountered by Australian Military forces, from a fact-based perspective with no attempt to understand the cultural or sociological behaviours. The intent is to attempt to idenify probable generic causes of the population reactions over a large time period and determine if there are links or trends in these causes over that time period. This may provide valuable insights to the reaction of this population and provides a basic dataset for input to training and wargaming as well as any future trend impact analysis. Additionally we determine the utility of this form of analysis for providing qualitative data on urban populations. This report highhghts several lessons of relevance to urban environments. Of interest is the importance the Timorese memory appears to play as a source for causes of new events. This report also shows for the Timorese population that the stimulus for an insurgence needs to be applied to areas where there is a sufficient density of the population for the event to have an effect. Therefore dispersing or isolating the population in an urban environment may be a mechanism for preventing or minimising significant events - although this could be construed as a negative action in itself. This baseline study has identified a series of trends which have been consistent over the last 400 years as contributory causes of events in East Timor.
Author
Cities; Military Operations

81
ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

20040065845 Toronto Univ., Ontario, Canada
Undergraduate Students: An Untapped Resource for Planetary Researchers
Antonenko, I.; Lunar and Planetary Science XXXV: Undergraduate Education and Research Programs, Facilities, and Information Access; 2004; 2 pp.; In English; See also 20040065834; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The planetary community appears to be blessed with an "embarrassment of riches". On the one hand, vast quantities of planetary data, of all kinds, are available to the research community. Furthermore, this store of data is constantly increasing, with each new successful mission. On the other hand, funds for data analysis never quite seem to be sufficient to address this vast store of data. One possible solution to this delema is to tap into the large pool of university undergraduate students, who are often eager to participate in research endeavours, but are severely underutilized in this capacity. Programs where undergraduate students assist researchers in their planetary studies have been successfully conducted in the past. Such programs, however, are often large-scale projects that require a serious investment in personnel time, equipment, and money to initiate and run. The average member of the planetary community may not have access to the funds and resources necessary for such large-scale projects. Therefore, a more modest approach is recommended here; one that utilizes existing university infrastructure and resources, to get undergraduates conducting research, one or two students at a time.
Author
Planetary Meteorology; Planetary Environments; Data Acquisition

20040068029 Forschungsgesellschaft fuer Angewandte Naturwissenschaften e.V, Wachtberg-Werthhoven, Germany
A Man-in-the-Loop Support Concept for Military Ambush Threat: Assessment Based on Reconnaissance Reports
Lorenz, Frank P.; Biermann, Joachim; Military Data and Information Fusion; March 2004, pp. 9-1 - 9-13; In English; See also 20040068014; Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

On all levels of the military command hierarchy there is a general and strong demand for support by automated processing

of reconnaissance reports. This is especially required for information processing and situation assessment, which aims at the inference and deduction process on the base of report information to the greatest possible extend by analysis components. Developments for computer based decision support significantly expands the capability of tactical situation display programs. Regarding this general background, some methodical preconditions for the improvement of computer support are characterized. The central aspect is the role of the information context for an appropriate perception of the situation by the analysis of reports. This is illustrated by a specific military example of an ambush attack situation, which has the proprietary feature of disguised preparation. The example is representing an unconventional type of military operations, which are complex in prearrangement and typically clandestine in accomplishment. Their timely recognition by HUMINT information is a task, which is mandatory dependent on expertise. Our concept for the threat assessment is therefore developed on a two-stage man-in-the-loop procedure still dependent on this expertise. Its benefit lies in the ruthless incorporation of absent, but possibly significant situation context information on a trial-and-error base. The major ideas were tested by an ability assessment tool for ambush attacks. The results are discussed. Keywords: Knowledge-Based Information Fusion, Situation Assessment, Intelligence Preparation of the Battlefield (IPB), Command and Control, Military Scenario Simulation, Operations Other Than War (OOTW).
Author
Data Processing; Control Simulation; Command and Control; Information

82
DOCUMENTATION AND INFORMATION SCIENCE

Includes information management; information storage and retrieval technology; technical writing; graphic arts; and micrography. For computer program documentation see *61 Computer Programming and Software*.

20040062474 National Science Foundation, Washington, DC
Assessment of Advanced Technologies for Loss Estimation (CD-ROM with Search/Retrieval Software)
Dec. 2000; In English
Report No.(s): PB2004-500126; MCEER-00-SP02; No Copyright; Avail: National Technical Information Service (NTIS)

The Assessment of Advanced Technologies for Loss Estimation describes the current state of advanced airborne and space borne remote sensing and ground based technologies applicable to earthquake hazard mitigation. The advanced technologies discussed in this report include sensors; instruments and their platforms such as aircraft, unmanned aerial vehicles and satellites; data; data storage and delivery systems; image processing visualization; display capabilities; and telecommunications. The benefits of using these new technologies in loss estimation include: The development of innovative procedures for assessing the seismic hazard potential of large urban regions; Alternative approaches for developing regional damage or vulnerability models for building and lifelines; Cost effect procedure for creating building and lifeline inventories; and Rapid loss estimation and model calibration methodologies for post earthquake damage assessment. The report reviews three advanced technologies in detail: Seismological monitoring systems, the Global Positioning Systems (GPS) and remote sensing. The CD-ROM contains many links to internet sites, numerous references to additional resources on the topic, two LiDAR fly-through and recommendations for future research, and information about the Multidisciplinary Center for Earthquake Engineering Research (MCEER), including a brochure.
NTIS
Earthquakes; Technology Assessment; Aerial Reconnaissance

20040062477 Lawrence Livermore National Lab., Livermore, CA
Minatom of Russia Situation and Crisis Center and the Automated Federal Information System for Nuclear Material Control and Accounting
Berchik, V. P.; Kasumova, L. A.; Babcock, R. A.; Heinberg, C. L.; Tynan, D. M.; Jun. 25, 2001; 14 pp.; In English
Report No.(s): DE2004-15006188; UCRL-JC-144260; No Copyright; Avail: Department of Energy Information Bridge

Under the Situation and Crisis Center (SCC) management, the Information Analytical Center (IAC) of the Ministry of Atomic Energy (Minatom) of Russia was created to oversee the operation of the Federal Nuclear Material Control and Accounting Information System (FIS). During 2000, the FIS achieved an important milestone in its development: the basic functions of the information system were implemented. This includes placing into operation the collecting and processing of nuclear material control and accounting information from the enterprises reporting to the FIS. The FIS began working with 14 Russian enterprises to develop and implement full-function reporting (i.e., reporting inventory and inventory changes including closeout and reconciliation between the FIS and enterprises). In 2001, the system will expand to include

enterprise-level inventory information for all enterprises using nuclear materials in Russia. For this reason, at the end of 2000 through the beginning of 2001, five separate training sessions were held for over 100 enterprise personnel responsible for preparation and transfer of the reports to the FIS.
NTIS
Information Systems; Nuclear Electric Power Generation; Information Management

20040065773 NASA Langley Research Center, Hampton, VA, USA
Evaluating the Effectiveness of the 2002-2003 NASA CONNECT(TM) Program
Pinelli, Thomas E.; Lambert, Matthew A.; Williams, Amy C.; April 2004; 117 pp.; In English
Report No.(s): NASA/TM-2004-213011; No Copyright; Avail: CASI; A06, Hardcopy

NASA CONNECT is a research-, inquiry-, and standards-based, integrated mathematics, science, and technology series of 30-minute instructional distance learning (television and web-based) programs for students in grades 6 8. Respondents who evaluated the programs in the 2002 2003 NASA CONNECT series reported that (1) they used the programs in the series; (2) the goals and objectives for the series were met; (3) the programs were aligned with the national mathematics, science, and technology standards; (4) the program content was developmentally appropriate for grade level; and (5) the programs in the series enhanced and enriched the teaching of mathematics, science, and technology.
Author
NASA Programs; Technologies; Research and Development; Surveys

20040065844 City Univ. of New York, Brooklyn, NY, USA
On-Line Education, Web- and Virtual-Classes in an Urban University: A Preliminary Overview
Nehru, C. E.; Lunar and Planetary Science XXXV: Undergraduate Education and Research Programs, Facilities, and Information Access; 2004; 2 pp.; In English; See also 20040065834; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

On-line education, Virtual- classes and Web-based education, are fast becoming the norm of the day in many educational institutions across the USA and elsewhere. They are not new to educational innovations. A recent visit to an Australian school in Alice Springs, Northern Territory, Australia was quite revealing in the origins of such an education and its methodology and prompted the current research interest. Alternative technological methods of teaching and learning (1850 to 1950), such as distance-learning, using telegraph and radio, and correspondence courses through the mail, have been known for almost two centuries. After World War II their use increased considerably in the UK, Australia and USA. Increased number of students in the 80s looking to acquire degrees and technological advancements (Internet revolution) have resulted in a wide range of educational offerings. The detailed time-line of the development of this subject and its history are dealt with in a Web site of Open University. Old Dominion University in Virginia was a national leader in technology-administered distance learning through TELETECHNET. A current list of universities and organizations offering Web-based courses is given in. Francek and LeBlanc list the best Earth Science Web Sites and also explained some assessment criteria.
Derived from text
Education; Internets; On-Line Systems; Organizations; Telegraph Systems; Websites

20040066009 Moscow State Univ. for Geodesy and Cartography, Moscow, Russia
Database Structure Development for Space Surveying Results by Moon 'Zond' Program
Kurpichev, A. V.; Lunar and Planetary Science XXXV: Moon and Mercury; 2004; 2 pp.; In English; See also 20040066002; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

More than 10 years ago, the specialized database (DB) on planetary researches - Planetary Data System (PDS) has been created in America. It comprises the data by results of all space programs conducted by the country. Besides the information from other countries participating in space researches was presented in the system. To the information stored in PDS, access through Internet global network is organized.
Derived from text
Data Bases; Moon; Zond Space Probes; Data Systems

20040068014 Research and Technology Organization, Neuilly-sur-Seine, France
Military Data and Information Fusion
March 2004; 328 pp.; In English; In French; Military Data and Information Fusion, 20-22 Oct. 2003, Prague, Czechoslovakia; See also 20040068015 - 20040068040
Report No.(s): RTO-MP-IST-040; AC/323(IST-040)TP/23; Copyright; Avail: CASI; C01, CD-ROM; A15, Hardcopy

This volume contains two Keynote Addresses, 24 papers, and a summary of the final panel discussion presented at the Information Systems Technology Panel (IST) symposium held in Prague, Czech Republic, from 20th to 22nd October 2003. The papers presented covered the following headings: 1) Military Requirements and Experiences; 2) Fusion System Concepts I; 3) Fusion System Concepts II; 4) Fusion Methods; 5) Fusion Methods for Classification and Identification; 6) Semantic Approach to Information Fusion; 7) Applications and Lessons Learned; 8) Applications.
Author
Information Systems; Multisensor Fusion; Military Operations; Communication Networks; Decision Making

20040068015 Norwegian Defence Research Establishment, Kjeller, Norway
Set Classification of Military Targets
Korsnes, Reinert; Hansen, Bjorn Jervell; Military Data and Information Fusion; March 2004, pp. 16-1 - 16-8; In English; See also 20040068014; Copyright; Avail: CASI; A02, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The present study shows by example the potential amount of information available in a set of observations of targets where there are known relations between these targets. Known relations between objects significantly reduces the set of possible explanations behind a set of observations. The application here is classification of military targets. Cost functions and interaction with decision makers extend the feasibility of the present approach meaningfully to treat many observations and possible targets behind these.
Author
Classifications; Costs; Targets; Information Theory

20040068019 Defence Research and Development Canada, Val-Belair, Quebec, Canada
Introducing the Canadian Information Centric Workspace Concept
Thibault, Gaetan; LeMay, Francois; Military Data and Information Fusion; March 2004, pp. 5-1 - 5-14; In English; See also 20040068014; Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Intelligence, Surveillance, Target Acquisition and Reconnaissance (ISTAR) is an evolving information operations (IO) concept in the Canadian Land Force. ISTAR provides the commander with a system to collect and process required information for producing intelligence on the threat and knowledge on the environment during operations, as well as knowledge needed to identify, acquire and engage targets. The various processes used to collect and analyze the information are the result of numerous individual systems some of which have only been recently introduced in the field while many others are still in development as a result of advances in the information age. This compendium of systems makes ISTAR a System of systems , as opposed to a single system. This paper presents the new Canadian information centric workspace concept that provides a more coherent information management approach to better support the Commander in both its tactical intelligence and operations activities at brigade level. The info-centric workspace concept aims at offering a seamless collaborative environment enabling the ISTAR staff to perform their tasks using different applications / services through a standardized Human Computer Interface (HCI).
Author
Information Management; Surveillance; Target Acquisition; Human-Computer Interface; Intelligence

20040068024 Air Force Research Lab., Rome, NY, USA
Defensive Planning for Combined Forces
Griffith, David A.; Military Data and Information Fusion; March 2004, pp. 1-1 - 1-10; In English; See also 20040068014; Copyright; Avail: CASI; A02, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This paper is based on the experience gained by personnel of the Information Directorate of the US Air Force Research Laboratory s Rome, NY Research Site, during the development, validation, testing and fielding OF the Joint Defensive Planner (JDP) in the USAF Theater Battle Management Core Systems (TBMCS). JDP was used, for the past three years, in its successive developmental spirals, by the US/NE/GE Extended Air Defense Task Force during the Joint Project Optic Windmill (JPOW) exercises in NATO. JDP is currently being evaluated by personnel of the UK (UK) Joint Force Air Command HQ and the UK Air Warfare Centre for potential use in UK Systems. How this all came about is the essence of this paper that addresses many of the topics associated with this Symposium.
Author
Management Systems; Windpowered Generators; Warfare

20040068028 Defence Science and Technology Organisation, Edinburgh, Australia

Information Fusion and Extraction Priorities for Australia's Information Capability

Oxenham, Martin; Percival, John; Price, Richard; Lambert, Dale; Military Data and Information Fusion; March 2004, pp. 8-1 - 8-20; In English; See also 20040068014; Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Commonwealth of Australia's strategic policy on defence recognises the need for Australia to further develop and enhance its information capability. While this is mainly a reflection of the uptake of information technology by the military (the Revolution in Military Affairs), in more recent times it has also been in response to the global threats of terrorism and the utilisation of weapons of mass destruction or long-range ballistic missiles by rogue states. The areas which have been identified as being of primary importance for fostering Australia s emerging information capability are intelligence and surveillance capabilities, communications, information warfare, command and headquarters systems, and logistics and business applications. To meet the challenges that the development and enhancement of this information capability raise, advanced information processing techniques for fusing and extracting data or information are required. In this paper, a holistic model for integrating the relevant technologies of data fusion and data mining is proposed and several of the current information fusion and extraction initiatives at Australia s Defence Science and Technology Organisation supporting intelligence, surveillance, and command and control are outlined.

Author

Command and Control; Information Systems; Surveillance; Telecommunication; Data Processing

20040068040 MEDAV G.m.b.H., Uttenreuth, Germany

The Visualisation of Diverse Intelligence

Kolb, Hans-Joachim; Towsey, Michael; Maetschke, Stefan; Uebler, Ulla; Military Data and Information Fusion; March 2004, pp. 23-1 - 23-14; In English; See also 20040068014; Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

At last years' NATO workshop 'Massive Military Data Fusion' in Norway 2002, among others, it was agreed that there is an increasing need for visualisation of data. This need is a increased by obtaining more data coming from more sensors and different sources. In the intelligence context, the fusion of information is a multi-layer process. First, raw data are collected and filtered and brought to archives. The analysis of the data is the most time consuming process, since it can be automated only in a limited range. Thus, there is a need for a 'human-in-the-loop'. For humans, the best way to analyze amounts of data is their pattern recognition abilities, thus using powerful algorithms of visualization. In this paper, we will present our approaches to visualization in different levels. First, we will describe data modelling in the intelligence context, presenting our approach of the MEDAV archive as data model and the stages at which visualization is a powerful means. In the following section, we define approaches to visualization, and further on, show our approaches to visualization for different information retrieval tasks.

Author

Multisensor Fusion; Scientific Visualization

20040068062 NASA Ames Research Center, Moffett Field, CA, USA

Inductive System Health Monitoring

Iverson, David L.; 2004; 7 pp.; In English; International Conference on Artificial Intelligence, 21-24 Jun. 2004, Las Vegas, NV, USA; No Copyright; Avail: CASI; A02, Hardcopy

The Inductive Monitoring System (IMS) software was developed to provide a technique to automatically produce health monitoring knowledge bases for systems that are either difficult to model (simulate) with a computer or which require computer models that are too complex to use for real time monitoring. IMS uses nominal data sets collected either directly from the system or from simulations to build a knowledge base that can be used to detect anomalous behavior in the system. Machine learning and data mining techniques are used to characterize typical system behavior by extracting general classes of nominal data from archived data sets. IMS is able to monitor the system by comparing real time operational data with these classes. We present a description of learning and monitoring method used by IMS and summarize some recent IMS results.

Author

Systems Health Monitoring; Computer Programs; Knowledge Bases (Artificial Intelligence)

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TECHNOLOGY UTILIZATION AND SURFACE TRANSPORTATION

Includes aerospace technology transfer; urban technology; surface and mass transportation. For related information see also *03 Air Transportation and Safety, 16 Space Transportation and Safety*, and *44 Energy Production and Conversion*. For specific technology transfer applications see also the category where the subject is treated.

20040067946 Fluor Daniel Hanford, Inc., Richland, WA, USA
Plutonium Finishing Plant Stabilization and Packaging Project
Gerber, M. S.; Jackson, G. J.; Jan. 2004; 36 pp.; In English
Report No.(s): DE2004-821208; HNF-19612-FP-REV-0; No Copyright; Avail: Department of Energy Information Bridge

Fluor Hanford is pleased to submit the Plutonium Finishing Plant (PFP) Stabilization and Packaging Project (SPP) for consideration by the Project Management Institute as Project of the Year for 2004. The SPP thermally stabilized and/or packaged nearly 18 metric tons (MT) of plutonium and plutonium-bearing materials left in PFP facilities from 40 years of nuclear weapons production and experimentation. The stabilization of the plutonium-bearing materials substantially reduced the radiological risk to the environment and security concerns regarding the potential for terrorists to acquire the non-stabilized plutonium products for nefarious purposes. The work was done In older facilities which were never designed for the long-term storage of plutonium, and required working with materials that were extremely radioactive, hazardous, pyrophoric, and in some cases completely unique. In some Instances, one-of-a-kind processes and equipment were designed, installed, and started up. The SPP was completed ahead of schedule, substantially beating all Interim progress milestone dates set by the Defense Nuclear Facilities Safety Board (DNFSB) and in the Hanford Site's Federal Facility Agreement and Consent Order (Tri-Party Agreement or TPA), and finished $1-million under budget.
NTIS
Plutonium; Radioactive Materials; Oxides

89
ASTRONOMY

Includes observations of celestial bodies; astronomical instruments and techniques; radio, gamma-ray, x-ray, ultraviolet, and infrared astronomy; and astrometry.

20040062491 Lawrence Livermore National Lab., Livermore, CA
Combining Evolutionary Algorithms With Oblique Decision Trees to Detect Bent Double Galaxies
Cantu-Paz, E.; Kamath, C.; Jun. 22, 2000; 16 pp.; In English
Report No.(s): DE2004-15006501; UCRL-JC-138979; No Copyright; Avail: Department of Energy Information Bridge

Decision trees have long been popular in classification as they use simple and easy-to-understand tests at each node. Most variants of decision trees test a single attribute at a node, leading to axis-parallel trees, where the test results in a hyperplane which is parallel to one of the dimensions in the attribute space. These trees can be rather large and inaccurate in cases where the concept to be learnt is best approximated by oblique hyperplanes. In such cases, it may be more appropriate to use an oblique decision tree, where the decision at each node is a linear combination of the attributes. Oblique decision trees have not gained wide popularity in part due to the complexity of constructing good oblique splits and the tendency of existing splitting algorithms to get stuck in local minima. Several alternatives have been proposed to handle these problems including randomization in conjunction with deterministic hill climbing and the use of simulated annealing. In this paper, they use evolutionary algorithms (EAs) to determine the split. EAs are well suited for this problem because of their global search properties, their tolerance to noisy fitness evaluations, and their scalability to large dimensional search spaces. They demonstrate the technique on a practical problem from astronomy, namely, the classification of galaxies with a bent-double morphology, and describe their experiences with several split evaluation criteria.
NTIS
Algorithms; Cosmic Ray Showers; Galaxies

20040062498 Lawrence Livermore National Lab., Livermore, CA
Keck Adaptive Optics Observations of the TW Hydrae Association Members
Macintosh, B.; Max, C.; Zuckerman, B.; Becklin, E.; Kaisler, D.; May 30, 2001; 12 pp.; In English
Report No.(s): DE2004-15006513; UCRL-JC-144124; No Copyright; Avail: Department of Energy Information Bridge

Adaptive optics (AO) on 8-10 m telescopes is an enormously powerful tool for studying young nearby stars. It is

especially useful for searching for companions. Using AO on the 10-m W.M. Keck II telescope we have measured the position of the brown dwarf companion to TWA5 and resolved the primary into an 0. 055(double(underline)prime) double. Over the next several years follow-up astrometry should permit an accurate determination of the masses of these young stars. We have also re-observed the candidate extrasolar planet TWAGB, but measurements of its motion relative to TWA6A are inconclusive. We are carrying out a search for new planetary or brown dwarf companions to TWA stars and, if current giant planet models are correct, are currently capable of detecting a 1 Jupiter-mass companion at(approx) 1. 0(double(underline)prime) and a 5 Jupiter-mass companion at(approx) 0.5(double(underline)prime) around a typical TWA member.
NTIS
Adaptive Optics; Astrometry; Detection; Gas Giant Planets

20040065806 Lunar and Planetary Inst., Houston, TX, USA
Lunar and Planetary Science XXXV: Early Solar System Chronology
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040065807 - 20040065815
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The following topics were presented in this report: Iron Isotopic Fractionation During Vacuum Evaporation of Molten W?stite and Solar Compositions; Mg Isotope Ratio Zonation in CAIs - New Constraints on CAI Evolution; Sm-Nd Systematics of Chondrites; AMS Measurement of Mg-24(He-3,p)Al-26 Cross Section, Implications for the Al-26 Production in the Early Solar System; On Early Solar System Chronology: Implications of an Initially Heterogeneous Distribution of Short-lived Radionuclides; Revisiting Extraterrestrial U Isotope Ratios; Helium-Shell Nucleosynthesis and Extinct Radioactivities; High Spatial Resolution Ion Microprobe Measurements Refine Chronology of Orgueil Carbonate Formation; and Calibration of the Galactic Cosmic Ray Flux.
CASI
Solar System; Isotopes; Chronology; Galactic Cosmic Rays

20040065813 Paris XI Univ., Orsay, France
On Early Solar System Chronology: Implications of an Initially Heterogeneous Distribution of Short-lived Radionuclides
Gounelle, M.; Russell, S. S.; Lunar and Planetary Science XXXV: Early Solar System Chronology; 2004; 2 pp.; In English; See also 20040065806; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Elucidating the chronology of early processes in the Solar System is one of the major goals of planetary sciences. Determining timescales for the formation of the earliest solids (such as chondrules and Calcium-Aluminium-rich Inclusions -C AIs), as well as asteroidal and planetary metamorphism and differentiation is especially important, in that this provides a powerful way of linking meteorite laboratory data with astronomical observations. Short-lived radionuclieds (SR's) can be used as chronometers only if their initial spatial distribution is homogeneous, then any differences in SR abundances can be straightforwardly interpretedas a time difference. At present the initial spatial distribution of SR in the Solar System is poorly known. Despite uncertainties in the origin and distribution of SR, most chronological studies using these isotopes have assumed, for simplicity, that they are initially homogeneously distributed on both a coarse and fine spatial scale. There are however hints in the data that this may not be the case. For example, CAI's and chondrules contain different abundances of the stable isotopes of oxygen and thus it is not inconceivable that other isotopic systems may also show differences between these two types of components. Recently have argued for a contemporaneous formation of CAI's and chondrules. If SR's are heterogeneously distributed between the CAI and chondrule formation regions, a simple early Solar System chronology is impossible to build. Because there is at the moment no definitive evidence for spatial homogeneity of SR's and because there are some inconsistencies between 53Mn and 26Al chronologies assuming an homogeneous distribution, we wish to explore the possibility of building an early Solar System chronology based on short-lived radionuclides heterogeneously spatially distributed within the accretion disk.
Author
Chronology; Heterogeneity; Radioactive Isotopes; Solar System; Meteoritic Composition; Spatial Distribution; Accretion Disks

20040065843 Brown Univ., Providence, RI, USA
RELAB (Reflectance Experiment Laboratory): A NASA Multiuser Spectroscopy Facility
Pieters, Carle M.; Hiroi, Takahiro; Lunar and Planetary Science XXXV: Undergraduate Education and Research Programs,

Facilities, and Information Access; 2004; 2 pp.; In English; See also 20040065834; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Spectroscopic analysis of planetary surfaces is a central component of remote sensing in solar system exploration. A host of sensors, of increasing sophistication, are included on both orbital and in-situ platforms. The wavelength range of useful data extends from the visible through the mid-infrared. The RELAB (Reflectance Experiment Laboratory) facility at Brown University provides a mechanism for researchers to obtain high quality laboratory spectra of geologic materials for use in compositional and/or geologic applications. NASA supports the RELAB as a multiuser spectroscopy facility and laboratory time can be made available at no charge to investigators funded by NASA programs. A multiuser open facility is the most cost-effective way to meet the needs of the science community and data analysis objectives.

Author

Spectroscopic Analysis; Remote Sensing; Space Exploration; Planetary Surfaces; Spectroscopy

20040065861 Museum of Natural History, London, UK

Preservation of Micrometeoroid Remains on Solar Cells Returned from Orbit

Kearsley, A. T.; Graham, G. A.; Chater, R. J.; McPhail, D. S.; Lord, P.; Drolshagen, G.; McDonnell, J. A. M.; Taylor, E. A.; Lunar and Planetary Science XXXV: Big Dust, Little Dust, and Aerogel; 2004; 2 pp.; In English; See also 20040065855; Original contains color and black and white illustrations

Contract(s)/Grant(s): ESA-13308/98/NL/MV; ESA-16283/02/GD/ESTEC; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Spacecraft surfaces returned from low Earth orbit (LEO) reveal traces of damage by small particles moving at hypervelocity [1]. The large surface area (c. 60 square metres) of solar cells returned from the Hubble Space Telescope (HST) has provided numerous impact features. Analytical scanning electron microscopy has proven highly successful in locating and characterising residue from the impacting particle in the majority of the craters examined [2]. In this study we report on solar cells returned from LEO at the end of HST Service Missions SM-1 (1993) and SM-3B (2002). The most numerous impact features are small sub-circular or oval craters (fig. 1). Craters of greater than 30 m diameter usually contain micrometeoroid residue of variable quantity and quality, dependant upon the preservation of the central melt pit (the frozen base of the transient crater). Very small craters (<30 m) usually contain space debris residue.

Author

Space Debris; Scanning Electron Microscopy; Hubble Space Telescope; Micrometeoroids; Solar Cells; Low Earth Orbits

20040065990 NASA Marshall Space Flight Center, Huntsville, AL, USA

First Observation of Jupiter by XMM-Newton

Branduardi-Raymont, G.; Elsner, R. F.; Gladstone, G. R.; Ramsay, G.; Rodriquez, P.; Soria, R.; Waite, J. H., Jr.; [2004]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

We present the first X-ray observation of Jupiter by XMM-Newton. Images taken with the EPIC cameras show prominent emission, essentially all confined to the 0.2-2.0 keV band, from the planet s auroral spots; their spectra can be modelled with a combination of unresolved emission lines of highly ionised oxygen (OW and O W) , and a pseudo-continuum which may also be due to the superposition of many weak lines. A 2.8 enhancement in the RGS spectrum at 21-22 A (-0.57 keV) is consistent with an O W identification. Our spectral analysis supports the hypothesis that Jupiter s auroral emissions originate from the capture and acceleration of solar wind ions in the planet s magnetosphere, followed by X-ray production by charge exchange. The X-ray flux of the North spot is modulated at Jupiter s rotation period. We do not detect evidence for the -45 min X-ray oscillations observed by C W r u more than two years earlier. Emission from the equatorial regions of the planet s disk is also observed. Its spectrum is consistent with that of scattered solar X-rays.

Author

Spectrum Analysis; Planetary Magnetospheres; Auroras; Solar X-Rays; Solar Wind; Xmm-Newton Telescope

20040066031 Impact, Bloomfield, IN, USA

The Great Permian Extinction Debate

Marusek, J. A.; Lunar and Planetary Science XXXV: Impacts; 2004; 2 pp.; In English; See also 20040066027; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The cataclysm that brought the Permian Period to an end was caused by a cluster of comet/asteroid impacts over a short geological timeframe, 5-8 million years. Several impacts were of sufficient size to rupture through the Earth s crust, producing deep impact effects including large fractures in the ocean floor along the tectonic plate joints. The resulting undersea

vulcanization released massive quantities of acidic gases. Oceanic gas scrubbing led to acidification of the ocean. The impacts also focused destruction on the opposite side of the Earth creating fractures at continent/ocean seams. The resulting Emeishan & Siberian Traps generated prolonged periods of surface flood vulcanization inducing extensive acid rainfall. These two processes targeted evolutionary weaknesses within marine and terrestrial life forms, culminating in a massive die-off at the end of the Permian Period.
Author
Extinction; Geology; Tectonics; Asteroids; Cometary Collisions

20040066073 California Univ., Berkeley, CA, USA
High Resolution Spectroscopy of X-ray Quasars: Searching for the X-ray Absorption from the Warm-Hot Intergalactic Medium
Fang, Taotao; Canizares, Claude R.; Marshall, Herman L.; [2004]; 35 pp.; In English
Contract(s)/Grant(s): NAG5-10008; No Copyright; Avail: CASI; A03, Hardcopy

We present a survey of six low to moderate redshift quasars with Chandra and XMM-Newton. The primary goal is to search for the narrow X-ray absorption lines produced by highly ionized metals in the Warm-Hot Intergalactic Medium. All the X-ray spectra can be well fitted by a power law with neutral hydrogen absorption. Only one feature is detected at above 3-sigma level in all the spectra, which is consistent with statistic fluctuation. We discuss the implications in our understanding of the baryon content of the universe. We also discuss the implication of the non-detection of the local (z approx. 0) X-ray absorption.
Author
Astronomical Spectroscopy; X Ray Astronomy; Quasars; X Ray Absorption; Intergalactic Media

20040066098 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
Evolution of Pre-Main Sequence Accretion Disks
Hartmann, Lee W.; April 2004; 9 pp.; In English
Contract(s)/Grant(s): NAG5-9670; No Copyright; Avail: CASI; A02, Hardcopy

The aim of this project is to develop a comprehensive global picture of the physical conditions in, and evolutionary timescales of, pre-main sequence accretion disks. The results of this work will help constrain the initial conditions for planet formation. To this end we are developing much larger samples of 3-10 Myr-old stars to provide better empirical constraints on protoplanetary disk evolution; measuring disk accretion rates in these systems; and constructing detailed model disk structures consistent with observations to infer physical conditions such as grain growth in protoplanetary disks.
Author
Accretion Disks; Pre-Main Sequence Stars

20040067887 Main Astronomical Observatory, Kiev, Ukraine
Use of an Orbital Phase Curve of Extrasolar Planet for Specification of its Mass
Vidmachenko, A. P.; Krushevskaya, V. N.; Lunar and Planetary Science XXXV: Origin of Planetary Systems; 2004; 2 pp.; In English; See also 20040067886; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We have made calculations of relative change of integral brightness of a planet rotating around a central star. The relative change of its visible (lambda = 550 nm) brightness is given depending on an orbital phase angle in the assumption that the inclination of a planetary orbit plane to a perpendicular to a picture plane varies in limits from i = 20 deg up to i = 80 deg. For comparison similar dependence in lambda = 890 nm is put there. As shown in our work, the spectral and astrometric methods allow with the characteristics of the central star and with a value of extrasolar giant-planet rotating period (EGP) to determine only lower limit of planet mass to within a sine of an inclination angle of an EGP orbit plane to a picture plane. Derived from text
Extrasolar Planets; Planet Detection; Planetary Mass; Astronomical Photometry

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ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.

20040062402 Massachusetts General Hospital, Boston, MA, USA
Revised Production Rates for Na-22 and Mn-54 in Meteorites Using Cross Sections Measured for Neutron-induced Reactions
Sisterson, J. M.; Kim, K. J.; Reedy, R. C.; Lunar and Planetary Science XXXV: Isotopes in Meteorites; 2004; 2 pp.; In English; See also 20040062400
Contract(s)/Grant(s): W-7405-eng-36; NAG5-10538; NAG5-12918; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The interactions of galactic cosmic rays (GCR) with extraterrestrial bodies produce small amounts of radionuclides and stable isotopes. The production rates of many relatively short-lived radionuclides, including 2.6-year Na-22 and 312-day Mn-54, have been measured in several meteorites collected very soon after they fell. Theoretical models used to calculate production rates for comparison with the measured values rely on input data containing good cross section measurements for all relevant reactions. Most GCR particles are protons, but secondary neutrons make most cosmogenic nuclides. Calculated production rates using only cross sections for proton-induced reactions do not agree well with measurements. One possible explanation is that the contribution to the production rate from reactions initiated by secondary neutrons produced in primary GCR interactions should be included explicitly. This, however, is difficult to do because so few of the relevant cross sections for neutron-induced reactions have been measured.
Derived from text
Manganese Isotopes; Sodium 22; Meteorites; Cosmology

20040062492 Lawrence Livermore National Lab., Livermore, CA
Interaction of Supernova Blast Waves with Interstellar Clouds: Experiments on the Omega Laser
Klein, R. I.; Robey, H. F.; Perry, T. S.; Kane, J. O.; Greenough, J. A.; Aug. 17, 2001; 12 pp.; In English
Report No.(s): DE2004-15006510; UCRL-JC-143853; No Copyright; Avail: Department of Energy Information Bridge

The interaction of strong shock waves, such as those generated by the explosion of supernovae with interstellar clouds, is a problem of fundamental importance in understanding the evolution and the dynamics of the interstellar medium (ISM) as it is disrupted by shock waves. The physics of this essential interaction is critical to understanding the evolution of the ISM, the mixing of interstellar clouds with the ISM and the viability of this mechanism for triggered star formation. Here we present the results of a series of new OMEGA laser experiments investigating the evolution of a high density sphere embedded in a low density medium after the interaction of a strong shock wave, thereby emulating the supernova shock-cloud interaction. The interaction is viewed from two orthogonal directions enabling visualization of the both the initial distortion of the sphere into a vortex ring as well as the onset of an azimuthal instability that ultimately results in the three-dimensional breakup of the ring. These studies augment previous studies on the NOVA laser by enabling the full three-dimensional topology of the interaction to be understood. We show that the experimental results for the vortex ring are in remarkable agreement with the incompressible theory of Widnall. Implications for mixing in the ISM are discussed.
NTIS
Supernovae; Molecular Clouds

20040065815 Max-Planck-Inst. fuer Chemie, Mainz, Germany
Revisiting Extraterrestrial U Isotope Ratios
Friedrich, J. M.; Ott, U.; Lugmair, G. W.; Lunar and Planetary Science XXXV: Early Solar System Chronology; 2004; 2 pp.; In English; See also 20040065806; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The current isotopic composition of U in solar system materials is the result of actinide production during late stage (r-process) nucleosynthesis, timescale(s) of actinide integration into the solar nebula, and the presence or absence of actinide fractionation during formation and early evolution of these solar system components. To date, aside from one suggestive anomaly within a Kohar (L3) chondrule, all reliable searches for isotopic anomalies in extraterrestrial U have shown no statistically significant deviations from the normal value of U-238/U-235 = 137.88. Deviations in U-238/U-235 ratios could likely be caused by the incorporation of the r-process nuclide Cm-247 and its decay to U-235 (Cm-247 to Pu-243 to Am-239 to Np-239 to Pu-239 to U-235, T(sub 1/2) approx. = 1.56 10(exp 7) y) within meteoritic components. The absence or presence

(and magnitude) of isotopic anomalies in U-238/U-235 ratios are important for models of late stage nucleosynthesis, cosmochronology, and Pb-Pb dating. We have begun U isotope measurements to (re)examine extraterrestrial materials and the possibility of statistically significant variations of U-238/U-235 ratios.
Author
Plutonium Isotopes; Solar System; Extraterrestrial Matter; Americium Isotopes; Curium Isotopes

20040065818 Osservatorio Astronomico, Catania, Italy
Comparative Effects of 10.2 eV Photon and 200 keV Proton Irradiation on Condensed CO
Loeffler, M. J.; Baratta, G. A.; Palumbo, M. E.; Strazzulla, G.; Baragiola, R. A.; Lunar and Planetary Science XXXV: Dust: Theory and Experiments; 2004; 1 pp.; In English; See also 20040065816; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The existence of solid CO2 in interstellar ice grains - expected from the abundance of condensed CO - was confirmed by the Infrared Space Observatory (ISO) [1]. The small abundance of gas phase CO2 suggests that CO2 ice is produced in situ from condensed CO by oxidation with atomic oxygen originating from impact dissociation of CO, radiation processing of other oxygen containing molecules, or incident on the grain from the gas phase [2]. The comparison of ISO observations with laboratory infrared spectra reveals that CO can exist both in apolar ices and water ice mixtures. Here we address the relative efficiency of CO2 synthesis from pure CO ice by 200 keV proton and Lyman- (10.2 eV) photons. This topic has been researched recently by Gerakines et al. [3], who reported that CO2 synthesis by Lyman-alpha is more efficient than by 800 keV protons. This is a striking result for two reasons. First, the ionization channel is energetically unavailable in the case of Lyman- photolysis of CO ions and a previous observation gave an extremely small cross section for CO2.
Derived from text
Carbon Dioxide; Cosmic Dust; Oxidation; Lyman Alpha Radiation; Gas Dissociation; Photons

20040065823 Muenster Univ., Germany
Experimental Study of the Radiation Pressure Forces on Isolated Micron-size Dust Particles
Krauss, O.; Wurm, G.; Lunar and Planetary Science XXXV: Dust: Theory and Experiments; 2004; 2 pp.; In English; See also 20040065816; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Dust particles in circumstellar disks as well as in planetary systems are subject to the radiative forces of the central star. The radiation pressure can have a significant effect on the dynamical evolution of the dust grains in such a system, depending on the particle properties and on the characteristics of the radiation field. The most straight forward effect of radiation pressure is its radial force component on dust particles opposing the stars gravitational attraction. However, the non-radial components of motion of dust grains can also be affected, leading to a damping or acceleration in their orbital direction. This can be due to the Poynting-Robertson effect or the transversal components of the radiation pressure force, which can reach considerably high values for irregularly shaped particles.
Derived from text
Experimentation; Radiation Pressure; Dust; Radiation Effects; Microparticles

20040065911 Lunar and Planetary Inst., Houston, TX, USA
Lunar and Planetary Science XXXV: Interplanetary Dust and Aerogel
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040065912 - 20040065924
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

Contents include the following: Isotopically Primitive Interplanetary Dust Particles of Cometary Origin: Evidence from Nitrogen Isotopic Compositions. The Solar Nebula s First Accretionary Particles (FAPs) Are They Preserved in Collected Interplanetary Dust Samples? On the Origin of GEMS. An Analytical SuperSTEM for Extraterrestrial Materials Research. Sub-Micrometer Scale Minor Element Mapping in Interplanetary Dust Particles: A Test for Stratospheric Contamination. First Report of Taenite in an Asteroidal Interplanetary Dust Particle: Flash-heating Simulates Nebular Dust Evolution. FTIR Analyses of IDPs: Comparison with the InfraRed Spectra of the Interstellar Medium. Mineralogical Study of Hydrated IDPs: X-Ray Diffraction and Transmission Electron Microscopy. Focused Ion Beam Recovery and Analysis of Interplanetary Dust Particles (IDPs) and Stardust Analogues. Technique for Concentration of Carbonaceous Material from Aerogel Collectors Using HF-Vapor Etching. Synchrotron X-Ray Analysis of Captured Particle Residue in Aerogel. In-Situ Analyses of Earth

Orbital Grains Trapped in Aerogel, Using Synchrotron X-Ray Microfluorescence Techniques. Igneous Rims on Micrometeorites and the Sizes of Chondrules in Main Belt Asteroids.
CASI
Meteoritic Composition; Nitrogen; Extraterrestrial Matter; Interplanetary Dust; X Ray Analysis

20040067891 University of Southern Georgia, Statesboro, GA, USA
Gravitational Frequencies of Extra-Solar Planets
Grubert, John Peter; Lunar and Planetary Science XXXV: Origin of Planetary Systems; 2004; 2 pp.; In English; See also 20040067886; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In an abstract presented last year it was shown that there is a gravitational pulse in space, which varies in the Solar System between 1.5 Hz and 1.8 Hz. This frequency causes the planets and their moons to vibrate in such a way as to create resonant or quantum orbits. It was also shown that the planets are all upheld in stable orbits caused by the gravitational radiation emitted by both the Sun and Jupiter. In fact, without the stabilizing influence of at least one Jupiter sized planet, stable planetary systems are probably not possible. This paper looks at eleven extra-solar planetary systems, two with three Jupiter sized planets, and the remainder with two. Present techniques that study the 'wobble' of stars caused by planets orbiting around them can only detect very large Jupiter sized planets, even though small Earth type planets may also exist. Although the data being used is limited to a few Jupiter sized planets, it nevertheless gives useful results that verify that the theory applied previously on our own solar system is applicable to other star systems. In addition, the gravitational frequency of space inside very large planets is shown to increase with their mass, and become constant at about 1.95 Hz for planets greater than five times the mass of Jupiter. This data together with paradigms concerning the specific energy of space then allows the value of Hubble's constant to be verified in a new way.
Author
Gravitational Waves; Extrasolar Planets; Planetary Systems; Frequencies

20040067892 Padua Univ., Italy
'Jumping Jupiters' in Binary Star Systems
Marzari, F.; Weidenschilling, S. J.; Granata, V.; Barbieri, M.; Lunar and Planetary Science XXXV: Origin of Planetary Systems; 2004; 2 pp.; In English; See also 20040067886; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Dynamical evolution of multiple-planet systems after their growth may lead to stable configurations after the hyperbolic ejection of one or more planets. The surviving planet (or at least one of the surviving planets) at the end of the 'Jumping Jupiter' phase, is moved closer to the star in an orbit with a significant eccentricity. We study the outcomes of such evolution in binary star systems where the companion star can significantly perturb the orbits of the planetary system. Our current paradigm for planetary formation is centered on the formation of a single star surrounded by a disk of gas and dust, roughly a few hundred AU in size. However, about 2/3 of solar mass stars are part of binary star systems and both numerical simulations and observations (HR4796A and L1551) suggest that protoplanetary disks around one or both the components of young binary star systems can form as well. The growth of planets within such disks can give origin to a multiple-planet system. Extrasolar planets around binary stars have been already detected in systems where the separation between the stars is larger than some hundreds of AU. The first extrasolar planet in a relatively close stellar binary system has been recently discovered in the gamma Cephei system. The origin and evolution of planets in binary systems with separation less than 50 AU has far-reaching implications since these systems represent more than 50% of all binary systems. We investigate the dynamical evolution and final state of a system of three Jupiter-mass planets that form around the component of a binary star system with separation less than 50 AU. In a dense protoplanetary disk both the conventional core accretion model or disk instability may lead to the the formation of planets with comparable masses and similar radial spacings. During the final stage of accretion, the stability of the system is affected by the mutual gravitational interactions and the dynamical evolution becomes chaotic with large changes in the orbital elements of the planets. In single star systems the sequence of close encounters among the planets determine the final configuration of the system. The situation is more complex for a system containing a companion star and the Jumping Jupiter phase is strongly affected by the gravitational perturbations of the secondary star.
Author
Astronomical Models; Extrasolar Planets; Binary Stars; Solar System Evolution

20040067920 Fermi National Accelerator Lab., Batavia, IL, USA, Chicago Univ., Chicago, IL, USA
Coherent Phase Argument for Inflation
Dodelson, S.; Sep. 2003; In English
Report No.(s): DE2004-822091; FERMILAB-CONF-03/450-A; No Copyright; Avail: National Technical Information Service (NTIS)

Cosmologists have developed a phenomenally successful picture of structure in the universe based on the idea that the universe expanded exponentially in its earliest moments. There are three pieces of evidence for this exponential expansion--inflation--from observations of anisotropies in the cosmic microwave background. First, the shape of the primordial spectrum is very similar to that predicted by generic inflation models. Second, the angular scale at which the first acoustic peak appears is consistent with the flat universe predicted by inflation. Here the author describes the third piece of evidence, perhaps the most convincing of all: the phase coherence needed to account for the clear peak/trough structure observed by the WMAP satellite and its predecessors. The author also discusses alternatives to inflation that have been proposed recently and explain how they produce coherent phases.
NTIS
Cosmology; Anisotropy; Spectra

20040068114 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
VLA Imaging of Protoplanetary Environments
Wilner, David J.; April 2004; 9 pp.; In English
Contract(s)/Grant(s): NAG5-8195; No Copyright; Avail: CASI; A02, Hardcopy

We summarize the major accomplishments of our program to use high angular resolution observations at millimeter wavelengths to probe the structure of protoplanetary disks in nearby regions of star formation. The primary facilities used in this work were the Very Large Array (VLA) of the National Radio Astronomy Observatories (NRAO) located in New Mexico, and the recently upgraded Australia Telescope Compact Array (ATCA), located in Australia (to access sources in the far southern sky). We used these facilities to image thermal emission from dust particles in disks at long millimeter wavelengths, where the emission is optically thin and probes the full disk volume, including the inner regions of planet formation that remain opaque at shorter wavelengths. The best resolution obtained with the VLA is comparable to the size scales of the orbits of giant planets in our Solar System (< 10 AU).
Derived from text
Imaging Techniques; Planetary Evolution; Protoplanetary Disks; Solar System Evolution

20040068115 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
Influence of Coronal Abundance Variations
Gurman, Joseph, Technical Monitor; DeLuca, E. E.; April 2004; 2 pp.; In English
Contract(s)/Grant(s): NAG5-10872; No Copyright; Avail: CASI; A01, Hardcopy

During the past year we have developed the multispecies code to include large scale flows and shown how those solutions compare with the observations of long lived loops. The time-dependent aspects of this work are under development. We will extend the steady flow investigations to study the effect these flows have on coronal structure as observed with TRACE. Coronal observations derive from heavy-ion emission; thus, we focus on the extent to which flow may modify coronal abundances by examining the heavy-ion abundance stratification within long-lived loops. We discuss the magnitudes of the physical effects modeled and compare simulated results with TRACE observations. These results can have a profound effect on the interpretation of TRACE observations. We will also apply the potential field matching programs developed by Aad Van Ballegooijen and Harvard undergraduate, Ellen Lee, to loops modeled for this project. Having the best possible understanding of the geometric properties of the loops is important for accurate modeling.
Derived from text
Abundance; Solar Corona; Solar Physics

91
LUNAR AND PLANETARY SCIENCE AND EXPLORATION

Includes planetology; selenology; meteorites; comets; and manned and unmanned planetary and lunar flights. For spacecraft design or space stations see *18 Spacecraft Design, Testing and Performance*.

20040055319 Geological Survey, Flagstaff, AZ, USA
Origin of Chaos Terrain
Geissler, Paul E.; Workshop on Europa's Icy Shell: Past, Present, and Future; 2004, pp. 30-31; In English; See also 20040055312; No Copyright; Avail: CASI; A01, Hardcopy

A NASA press conference in April, 1997 heralded the "discovery of an ocean on Europa" based upon the initial interpretation of crustal fragments within Conamara Chaos as ice "rafts" that had floated on a near-surface layer of liquid water. Although later imaging and more detailed analyses turned up a variety of surface features that were likely formed by diverse mechanisms, subsequent Galileo data provided ample confirmation that Europa's ice shell has been disrupted many times by large bodies of near-surface liquid water. This talk will review the characteristics of chaos terrain, the photogeological evidence for ice rafting, and the implications of liquid water near the surface of Europa.
Derived from text
Europa; Oceans; Liquid Surfaces; Crusts

20040058061 European Space Research and Technology Centre, Noordwijk, Netherlands
ESA's SMART-1 Mission to the Moon: Goals, Status and First Results
Foing, B. H.; Racca, G. D.; Marini, A.; Grande, M.; Huovelin, J.; Josset, J.-L.; Keller, H. U.; Nathues, A.; Heather, D.; Koschny, D., et al.; Lunar and Planetary Science XXXV: Lunar Remote Sensing: Seeing the Big Picture; 2004; 2 pp.; In English; See also 20040058060; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

SMART-1 is the first in the program of ESA's Small Missions for Advanced Research and Technology. Its objective is to demonstrate Solar Electric Primary Propulsion (SEP) for future Cornerstones (such as Bepi-Colombo) and to test new technologies for spacecraft and instruments. The spacecraft has been launched on 27 Sept. 2003, as an Ariane-5 auxiliary passenger and injected in GTO Geostationary Transfer Orbit. Thanks to the successful electric propulsion navigation, the spacecraft has left the inner radiation belts at the beginning of January 2004. We shall report at LPSC2004 on the first commissioning and results from the spacecraft and the instruments. After a cruise with primary SEP, the SMART-1 mission is to orbit the Moon for a nominal period of six months, with possible extension. The spacecraft will carry out a complete program of scientific observations during the cruise and in lunar orbit.
Author
European Space Agency; Lunar Satellites; Transfer Orbits; Lunar Orbits

20040062360 Lunar and Planetary Inst., Houston, TX, USA
Lunar and Planetary Science XXXV
2004; In English; Thirty-Fifth Lunar and Planetary Science Conference, 15-19 Mar. 2004, Houston, TX, USA
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The 35th Lunar and Planetary Science Conference covered topics on Mars, planetary origins, planetary analog studies, education,chondrite studies, and meteorite composition. Over 1000 reports were presented at the conference in over 100 sessions. Each session, and presentations,was processed separately for the database.
CASI
Meteoritic Composition; Mars Surface; Mineralogy; Chondrites

20040062364 Lunar and Planetary Inst., Houston, TX, USA
Lunar and Planetary Science XXXV: Lunar Sample Analysis
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040062365 - 20040062371
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The titles in this section include: 1) Global Mixing as a Mechanism for Compositional Anomalies of Agglutinitic Glasses;

2) Electron Microscopy of Apollo 12 Glass Spherules; 3) 40Ar-39Ar Geochronology on Apollo 12 Regolith; 4) LSCC Apollo and Luna Soil Analyses: Update of Soil Evolution Model; 5) Planetary Regolith Microstructure: An Unexpected Opposition Effect Result; 6) Infrared Spectroscopy on a Microscopic Scale: Investigating the Technique of Microspectroscopy and Its Application to a Lunar Breccia; 7) The Most Reduced Rock from the Moon - Apollo 14 Basalt 14053: Extreme Reduction Entirely from a Re-Heating Event.
CASI
Lunar Rocks; Lunar Soil; Chemical Analysis; Lunar Composition

20040062365 Tennessee Univ., Knoxville, TN, USA
The Most Reduced Rock from the Moon - Apollo 14 Basalt 14053: Extreme Reduction Entirely from a Re-Heating Event
Patchen, A. P.; Taylor, L. A.; Lunar and Planetary Science XXXV: Lunar Sample Analysis; 2004; 2 pp.; In English; See also 20040062364; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

With the return of the Apollo 14 rocks and soil, the Preliminary Examination Team reported that the majority of the rocks were breccias. Only four rocks were believed to be basaltic: a) 14310, and its smaller-sized pair, 14073, later became the type specimens for 'melt rocks,' a somewhat surprising finding at the time, but logical in retrospect; and b) 14053 and its smaller pair, 14072, are unique among lunar rocks, in that they possess evidence for being the most reduced of all lunar basalts. It is the origin of these unusual rocks that is addressed herein. Basalt 14053 is a fine-grained, holocrystalline, equigranular hi-Al mare-type basalt. Based upon the disturbed Sm-Nd and well-defined Rb-Sr age of 3.92 +/- 0.04 Ga, Snyder & Taylor speculated that the hi-Al Apollo 14 basalts actually had an impact-melt origin. Likewise, unique reduction features also led to questions about its origin. We have revisited these unusual features as they relate to the origin of 14053 textures and chemistry.
Author
Lunar Rocks; Basalt; Samples

20040062366 Arizona Univ., Tucson, AZ, USA
Ar-40 - Ar-39 Geochronology on Apollo 12 Regolith
Barra, F.; Swindle, T. D.; Korotev, R. L.; Jolliff, B. L.; Zeigler, R. A.; Olson, E.; Lunar and Planetary Science XXXV: Lunar Sample Analysis; 2004; 2 pp.; In English; See also 20040062364
Contract(s)/Grant(s): NAG5-12059; NAG5-4172; NAG5-10485; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Apollo 12 landing site in Oceanus Procellarum is located about 400 km south of the rim of Copernicus. The geochemical and petrographical characterization of the Apollo 12 lunar samples have been extensively studied. The site is characterized by a high proportion of nonmare material with KREEP composition and mare basalts low in Th. Recent studies have focused on the geochemistry of the nonmare material and on inferring the origin of these materials. Previous geochronological investigations of Apollo 12 mare basalts have yielded ages ranging from 3.1 to 3.3 Ga. On the other hand, nonmare materials have yielded older ages between 3.8 to 4.0 Ga; with the sole exception of a single lunar granite fragment from sample 12033. This granite sample has an Ar-40 - Ar-39 age of 800 +/- 15 Ma. This resetting age has been interpreted as the age of the Copernicus crater since a ray from this crater crosses the landing site. Here we present new 40Ar-39Ar geochronological data on three samples of nonmare material from the Apollo 12 regolith in order to further constrain the age and source of this material.
Author
Argon Isotopes; Geochronology; Regolith; Geochemistry; Kreep; Lunar Geology

20040062367 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Planetary Regolith Microstructure: An Unexpected Opposition Effect Result
Nelson, R. M.; Hapke, B. W.; Smythe, W. D.; Hale, A. S.; Piatek, J. L.; Lunar and Planetary Science XXXV: Lunar Sample Analysis; 2004; 2 pp.; In English; See also 20040062364; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Opposition Effect (OE) is the non-linear increase in the intensity of light scattered from a surface as phase angle approaches 0 deg. It is seen in laboratory experiments and in remote sensing observations of planetary surfaces. Understanding the OE is a requirement to fitting photometric models which will produce meaningful results about regolith texture. Our

previous laboratory studies are consistent with the hypothesis that the OE in particulate materials is due to two processes, Shadow Hiding (SHOE) and Coherent Backscattering (CBOE). SHOE arises because, as phase angle approaches zero, shadows cast by regolith grains on other grains become invisible to the observer. CBOE results from constructive interference between rays traveling the same path but in opposite directions. In this study we measured the angular scattering properties of 9 mixtures of Aluminum Oxide and Boron Carbide powders of the same particle diameter (25 microns). The reflectance of the materials ranged from 7% (pure B4C) to 91% (pure Al2O3). Along with the reflectance phase curve we measured the circular polarization ratio (CPR) - the ratio of the intensity of the light returned with the same helicity as the incident light to that with the opposite helicity. An increase in CPR with decreasing phase angle indicates increased multiple scattering and is consistent with CBOE (Hapke, 1993). Popular conceptions of CBOE (Belskaya et al, 2003) hold that materials of higher albedo would exhibit increased multiple scattering and that the contribution of CBOE to the OE would increase as albedo increases. Remarkably, we find the highest albedo samples did not have the strongest CBOE opposition peaks. Instead, the maximum CBOE contribution is observed in samples with reflectance between 15 and 40%.
Derived from text
Regolith; Microstructure; Light Scattering; Aluminum Oxides; Boron Carbides

20040062368 Brown Univ., Providence, RI, USA
Infrared Spectroscopy on a Microscopic Scale: Investigating the Technique of Microspectroscopy and Its Application to a Lunar Breccia
Klima, R. L.; Pieters, C. M.; Lunar and Planetary Science XXXV: Lunar Sample Analysis; 2004; 2 pp.; In English; See also 20040062364; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In this study, we explore the capabilities and limitations of IR microspectroscopy, and use IR microspectroscopy to investigate compositional changes in a lunar breccia. Plagioclase is recognized as the dominant mineral, though more spectral variability is evident than in the bulk measurement of the same sample.
Author
Infrared Spectroscopy; Microanalysis; Breccia; Lunar Rocks

20040062369 California Univ., Berkeley, CA, USA
Electron Microscopy of Apollo 12 Glass Spherules
Levine, J.; Muller, R. A.; Renne, P. R.; Lunar and Planetary Science XXXV: Lunar Sample Analysis; 2004; 2 pp.; In English; See also 20040062364; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We are continuing our investigation of the meteoroid bombardment history of the Moon, recorded in the formation ages of impact-generated glass spherules in the lunar regolith. We earlier reported the ages, measured by the Ar-40/Ar-39 isochron technique, of 155 spherules from sample 14163, returned by the Apollo 14 mission to the Fra Mauro formation. From the distribution of ages, we identified an increase in the rate of spherule production by a factor of 3.7 +/- 1.2 in the last 400 Myr. We presently seek to determine whether this indicates an increase in the meteoroid bombardment of the Moon, or whether it is the result of a local change at the Apollo 14 landing site. We chose spherules from a regolith sample mixed by a recent impact (sample 12023,151 comes from the rim of Sharp Crater in the Procellarum Basin, visited by the Apollo 12 mission), whose ages we therefore believe are representative of the impact history of the Moon. Details of our sample selection are in. Improving our technique from, we have thoroughly documented each spherule in advance of the radioisotopic dating experiment. We used the scanning electron microscope to image our 179 spherules, each greater than 180 micron in diameter. Elemental analyses were made on 2-5 spots that appeared representative of most of the surface of each spherule and less than or = 5 small grains welded to the surface. Here we report the results of this electron microscopy, favoring an impact origin for nearly every spherule.
Author
Electron Microscopy; Apollo 12 Flight; Lunar Rocks; Meteoroids; Moon

20040062370 NASA Johnson Space Center, Houston, TX, USA
LSCC Apollo and Luna Soil Analyses: Update of Soil Evolution Model
Pieters, C. M.; Taylor, L. A.; McKay, D. S.; Morris, R. V.; Keller, L. P.; Lunar and Planetary Science XXXV: Lunar Sample Analysis; 2004; 2 pp.; In English; See also 20040062364; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Lunar Soil Characterization Consortium (LSCC) has obtained samples of Luna 16, 20 and 24 soils. Although these particular samples encountered contamination during processing, preliminary results are consistent with previous integrated analyses and expand the soil data to three additional sites.
Author
Lunar Soil; Characterization; Contamination; Data Acquisition

20040062371 Kharkov Univ., Kharkov, Ukraine
Global Mixing as a Mechanism for Compositional Anomalies of Agglutinitic Glasses
Starukhina, L. V.; Shkuratov, Y. G.; Lunar and Planetary Science XXXV: Lunar Sample Analysis; 2004; 2 pp.; In English; See also 20040062364
Contract(s)/Grant(s): INTAS-2000-0792; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Agglutinitic glasses, the most space-weathered portion of the lunar soils, were shown to have chemical composition different from the bulk samples. Mare agglutinitic glasses turned out to be Al-enriched and depleted of Fe, Ti, and Cr, whereas highland ones are depleted of Al and enriched in Fe, Ti, and Cr. Thus the contents of these elements in agglutinitic glasses turned out to be on the mare-highland mixing line. The same minerals can hardly be supposed to enter preferentially highland glasses and do not enter those of maria. This suggests a global mixing process that affects predominantly the particles most exposed to the cosmic environment, i. e. agglutinates. Here we simulate the compositional evolution of the lunar regolith taking different mechanisms of global mixing into account.
Author
Agglutination; Mixing; Anomalies; Lunar Soil; Regolith; Highlands

20040062375 Lunar and Planetary Inst., Houston, TX, USA
Lunar and Planetary Science XXXV: Lunar Rocks from Outer Space
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040062376 - 20040062385
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The following topics were discussed: Mineralogy and Petrology of Unbrecciated Lunar Basaltic Meteorite LAP 02205; LAP02205 Lunar Meteorite: Lunar Mare Basalt with Similarities to the Apollo 12 Ilmenite Basalt; Mineral Chemistry of LaPaz Ice Field 02205 - A New Lunar Basalt; Petrography of Lunar Meteorite LAP 02205, a New Low-Ti Basalt Possibly Launch Paired with NWA 032; KREEP-rich Basaltic Magmatism: Diversity of Composition and Consistency of Age; Mineralogy of Yamato 983885 Lunar Polymict Breccia with Alkali-rich and Mg-rich Rocks; Ar-Ar Studies of Dhofar Clast-rich Feldspathic Highland Meteorites: 025, 026, 280, 303; Can Granulite Metamorphic Conditions Reset 40Ar-39Ar Ages in Lunar Rocks? [#1009] A Ferroan Gabbronorite Clast in Lunar Meteorite ALHA81005: Major and Trace Element Composition, and Origin; Petrography of Lunar Meteorite PCA02007, a New Feldspathic Regolith Breccia; and Troilite Formed by Sulfurization: A Crystal Structure of Synthetic Analogue
Derived from text
Metamorphism (Geology); Lunar Rocks; Crystal Structure; Petrography; Mineralogy; Meteorites; Basalt; Breccia

20040062376 Japan Aerospace Exploration Agency, Ibaraki, Japan
Mineralogy of Yamato 983885 Lunar Polymict Breccia with Alkali-rich and Mg-rich Rocks
Arai, T.; Otsuki, M.; Ishii, T.; Mikouchi, T.; Lunar and Planetary Science XXXV: Lunar Rocks from Outer Space; 2004; 2 pp.; In English; See also 20040062375; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Yamato (Y) 983885 is a lunar meteorite recently found in Antarctica. Kaiden and Kojima [1] reported preliminary results for the petrography and oxygen isotopic composition, and verified the lunar origin. This rock is a polymict regolith breccia with a variety of crustal components, such as alkali-rich rocks, Mg-rich rocks, and mare basalts. We studied this new lunar meteorite with mineralogical technique to understand the petrogenesis and source region on the Moon.
Derived from text
Basalt; Breccia; Crusts; Mineralogy; Isotopes; Petrography

20040062377 Tokyo Univ., Hongo, Japan

LAP02205 Lunar Meteorite: Lunar Mare Basalt with Similarities to the Apollo 12 Ilmenite Basalt

Mikouchi, T.; Chokai, J.; Arai, T.; Koizumi, E.; Monkawa, A.; Miyamoto, M.; Lunar and Planetary Science XXXV: Lunar Rocks from Outer Space; 2004; 2 pp.; In English; See also 20040062375; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

LAP02205 is a new lunar meteorite recovered from the Antarctica. Although most lunar meteorites are brecciated, LAP02205 is a crystalline rock showing a basaltic texture, thus offering useful information to understand crystallization of lunar mare basalt. In this abstract, we present initial results of our ongoing petrological and mineralogical study of this meteorite and discuss its relationship to other lunar meteorites and Apollo samples.

Derived from text

Basalt; Ilmenite; Lunar Geology; Lunar Maria; Apollo 12 Flight; Mineralogy; Petrology

20040062378 Washington Univ., Saint Louis, MO, USA

Petrography of Lunar Meteorite PCA02007, a New Feldspathic Regolith Breccia

Zeigler, R. A.; Korotev, R. L.; Jolliff, B. L.; Lunar and Planetary Science XXXV: Lunar Rocks from Outer Space; 2004; 2 pp.; In English; See also 20040062375

Contract(s)/Grant(s): NAG5-10485; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

PCA 02007 is a 22.4 g lunar meteorite collected in 2003 near the Pecora Escarpment in Antarctica [1]. PCA is a feldspathic regolith breccia composed of mature regolith. It is compositionally and texturally similar to other feldspathic lunar meteorites (FLMs) [2] and may be launch paired with Yamato 791197 [3]. Here we present a petrographic description and compositions of mineral clasts, glass clasts, lithic clasts, and the bulk meteorite.

Derived from text

Petrography; Meteorites; Regolith; Minerals; Breccia

20040062379 Geological Survey of Czech Republic, Prague, Czech Republic

Troilite Formed by Sulfurization: A Crystal Structure of Synthetic Analogue

Skala, R.; Drabek, M.; Cisarova, I.; Lunar and Planetary Science XXXV: Lunar Rocks from Outer Space; 2004; 2 pp.; In English; See also 20040062375

Contract(s)/Grant(s): GACR-205/02/1101; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

While troilite represents a ubiquitous mineral in many meteorite groups, the terrestrial occurrences are rather scarce, limited to several localities worldwide. Troilite is frequently reported also from lunar rocks being the most common sulfide mineral there. Papike et al. note a secondary troilite formed in solid rocks by a process of sulfurization of native iron due to rapid temporary increase of partial pressure of sulfur during the high-temperature shock metamorphism. Here we report on the crystal structure of a synthetic analogue of such troilite which has been prepared by sulfurization process.

Derived from text

Troilite; Sulfur; Crystal Structure; Lunar Rocks

20040062380 New Mexico Univ., Albuquerque, NM, USA

KREEP-rich Basaltic Magmatism: Diversity of Composition and Consistency of Age

Shearer, C. K.; Borg, L.; Lunar and Planetary Science XXXV: Lunar Rocks from Outer Space; 2004; 2 pp.; In English; See also 20040062375; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The record of basaltic magmatism on the Moon indicates that mantle melting and basalt transport to the lunar crust occurred over a period of at least 3.4 billion years from 4.46 Ga [1] to 1.0 Ga [2,3]. These basalts exhibit a wide range of compositions and eruptive-emplacement styles that reflect mantle sources and the thermal and mechanical evolution of the lunar crust and mantle (i.e. thickening lithosphere, formation of large impact basins). Although the relationship among mare basalt compositions (e.g., TiO2) and time is ambiguous, KREEP-rich basaltic magmatism appears to dominate early periods of lunar basaltic magmatism [4]. Here we explore the: (1) age and petrologic relationships among KREEP-rich samples, (2) potential mantle sources for the KREEP-rich magmas, (3) mechanisms by which the KREEP signature was incorporated into

these rocks, and (4) processes that produced the KREEPy basaltic magmas.
Derived from text
Kreep; Basalt; Magma; Lunar Crust; Structural Basins; Melting

20040062381 Hawaii Univ., Honolulu, HI, USA
Can Granulite Metamorphic Conditions Reset Ar-40-Ar-39 Ages in Lunar Rocks?
Cohen, B. A.; Lunar and Planetary Science XXXV: Lunar Rocks from Outer Space; 2004; 2 pp.; In English; See also 20040062375; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Granulitic lithologies occur as hand samples, rake samples, and breccia clasts in all Apollo highlands sites, as well as in lunar highlands meteorites. Lunar granulites are extensively recrystallized, fine-grained cataclasites, impact melt rocks, or polymict fragmental breccias with chemistries similar to the bulk lunar highlands [1, 2], though their texture and composition varies [3, 4]. Their bulk composition is approximately anorthositic norite, with 70-80% modal plagioclase and a variety of mafic minerals. Granulitic textures arise during geologically rapid solid-state metamorphism at intermediate temperatures, probably in or near large (at least 30-90 km) impact craters [3]. The granulitic rocks and breccia clasts that have been dated fall into a relatively narrow range of ages, around 3.9-4.2 Ga. These degassing ages have been interpreted to result from a variety of geologic processes, including original mineral crystallization, metamorphism, excavation, and incorporation of clasts into breccias. It is not fully understood whether granulite ages should reflect the time of impact metamorphism, as do impact-melt rocks, or whether granulite metamorphism causes only incomplete degassing of Ar-40.
Derived from text
Argon Isotopes; Breccia; Degassing; Metamorphism (Geology); Mineralogy; Impact Melts

20040062382 NASA Johnson Space Center, Houston, TX, USA
Mineralogy and Petrology of Unbrecciated Lunar Basaltic Meteorite LAP 02205
Righter, K.; Brandon, A. D.; Norman, M. D.; Lunar and Planetary Science XXXV: Lunar Rocks from Outer Space; 2004; 2 pp.; In English; See also 20040062375; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

LAP 02205 is a 1.2 kg unbrecciated basalt found in the LaPaz icefield of Antarctica during the 2002-2003 ANSMET season [1]. It has been classified as a lunar basalt on the basis of pyroxene Fe/Mn ratios (approx. 60) and oxygen isotopes [1]; both are within previously defined compositional ranges for the Moon [2]. We have initiated a comprehensive study of the mineralogy, petrology and geochemistry of this new and unique meteorite. The results reported here will allow the comparison of this sample both to the other lunar basaltic meteorites (NWA 032, A881757, Y793169, Dho287A), as well as to lunar basalts in the Apollo and Luna collections.
Derived from text
Meteorites; Basalt; Petrology; Mineralogy; Geochemistry

20040062383 Washington Univ., Saint Louis, MO, USA
Petrography of Lunar Meteorite LAP 02205, a New Low-Ti Basalt Possibly Launch Paired with NWA 032
Jolliff, B. L.; Zeigler, R. A.; Korotev, R. L.; Lunar and Planetary Science XXXV: Lunar Rocks from Outer Space; 2004; 2 pp.; In English; See also 20040062375
Contract(s)/Grant(s): NAG5-10485; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Lunar meteorite LAP 02205 is a 1.23 kg basalt collected during the 2002 field season in the La- Paz ice field, Antarctica [1]. We present a petrographic description including mineral modes and compositions, and the major-element composition of the bulk meteorite. LAP 02205 is an Fe-rich, moderately low-Ti mare basalt that is similar in composition, mineralogy, and mineral chemistry to the NWA 032 basaltic lunar meteorite. LAP 02205 is yet another of the moderately low- Ti basaltic meteorites that are underrepresented among Apollo and Luna samples but that appear from remote sensing to be the most common basalt type on the Moon.
Derived from text
Meteorites; Petrography; Basalt; Chemical Composition; Mineralogy

20040062384 Coimbra Univ., Coimbra, Portugal

Ar-Ar Studies of Dhofar Clast-rich Feldspathic Highland Meteorites: 025, 026, 280, 303

Fernandes, V. A.; Anand, M.; Burgess, R.; Taylor, L. A.; Lunar and Planetary Science XXXV: Lunar Rocks from Outer Space; 2004; 2 pp.; In English; See also 20040062375; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A prominent feature of the lunar surface is its scarred surface. This feature is the result of bombardment of the Moon by objects of varying sizes after its formation. The region most affected, or that which shows a higher density of craters formed by these events, are the highlands (lunar anorthositic crust), with the maria showing comparatively lower density. This impact density contrast suggests that highlands are older than the less cratered maria surfaces. An important debate in lunar science is understanding the significance of the dominant impact age of approx. 3.9 Ga obtained from lunar highland rocks collected by Apollo and Luna missions, in relation to changes in the impact flux. Was it due to a cataclysmic event at 3.9 Ga which formed several of the largest basins in the lunar nearside (Imbrium, Crisium and Serenitatis) or was it due to a continuous decrease in the flux of impacting material in the vicinity of the Earth-Moon system since the beginning of the accretionary period (the heavy early lunar bombardment) that ended approx. 3.9 Ga? The aim of the present work is to acquire cooling ages from impact melts within feldspathic regolith lunar meteorites, to not only increase the number of such ages, but also to extend the geographical coverage of lunar highland rocks over the lunar surface.

Author

Argon; Lunar Surface; Regolith; Meteorites; Lunar Maria; Impact Melts; Cataclysmic Variables

20040062385 University Coll., London, UK

Mineral Chemistry of LaPaz Ice Field 02205: A New Lunar Basalt

Joy, K. H.; Crawford, I. A.; Russell, S. S.; Kearsley, A.; Lunar and Planetary Science XXXV: Lunar Rocks from Outer Space; 2004; 2 pp.; In English; See also 20040062375; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

LaPaz Ice Field 02205 (LAP 02205) is to date the heaviest lunar meteorite (1226.3g [1]) collected in the southern hemisphere, and is relatively free of terrestrial contamination, reflecting the relatively well-preserved nature of many Antarctic meteorites. Our thin section of the sample (approx. 1cm by approx. 0.7cm) is unbrecciated in nature and has a coarse-grained crystalline appearance (with phenocrysts up to ~1mm in size). The meteorite exhibits a sub-ophitic texture with elongate pyroxene crystals (53%) partially surrounding euhedral lath-shaped plagioclases (38%), rare olivines (trace), anhedral silica (2.2%), interstitial oxides (4.7%) (ilmenite and spinels), sulphides and trace metal FeNi. There is a significant amount (4.3%) of mesostasis which is dominated by incompatible element enriched glasses and sulphides. Point counting modal analysis of the section of LAP 02205 in combination with mineralogical observations it is compatible with a lunar mare basalt (Fig.1) [2]. The bulk composition (Table 1) Lap 02205 is quite similar to Luna 16 Al-rich basalt samples but with a higher Fe content.

Derived from text

Minerals; Basalt; Contamination; Meteorites; Olivine

20040062386 Lunar and Planetary Inst., Houston, TX, USA

Lunar and Planetary Science XXXV: Lunar Geophysics: Rockin' and a-Reelin'

2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar, 2004, Houston, TX, USA; See also 20040062387 - 20040062394

Contract(s)/Grant(s): NCC5-679

Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

This document contained the following topics: The Influence of Tidal, Despinning, and Magma Ocean Cooling Stresses on the Magnitude and Orientation of the Moon#s Early Global Stress Field; New Approach to Development of Moon Rotation Theory; Lunar Core and Tides; Lunar Interior Studies Using Lunar Prospector Line-of-Sight Acceleration Data; A First Crustal Thickness Map of the Moon with Apollo Seismic Data; New Events Discovered in the Apollo Lunar Seismic Data; More Far-Side Deep Moonquake Nests Discovered; and Manifestation of Gas-Dust Streams from Double Stars on Lunar Seismicity.

CASI

Seismology; Crusts; Rotation; Stress Distribution; Lunar Prospector; Moonquakes; Moon

20040062387 Alicante Univ., Spain

New Approach to Development of Moon Rotation Theory

Barkin, V.; Ferrandiz, J. M.; Lunar and Planetary Science XXXV: Lunar Geophysics: Rockin' and a-Reelin'; 2004; 2 pp.; In English; See also 20040062386

Contract(s)/Grant(s): MOE-SAB2000-0235; MOE-AYA2001-0787; MOE-ESP2001-4533; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The external shell of the Moon (its mantle) is considered as a non-spherical, rigid layer. Inner shell is liquidcore, which occupies ellipsodial cavity of the Moon. The motion of two-layer Moon is considered in gravitational fields of the Moon and Sun. For study, we use combination of two methods. First method was developed earlier and applied for study of interaction in the Earth core-mantle system due to Moon and Sun attraction and was applied in Earth rotation theory. Another method is an analytical method of construction of the resonant rotation motion of synchronous satellites and Mercury, considered as non-spherical rigid bodies. This method have been applied to construction of analytical theory of Moon rotation and here is modified this method with purpose to apply it to study of resonance rotation of two-layer Moon. Main resonant properties of the Moon motion are described by Cassini's law and studied by the famous scientists on the base of rigid and non-spherical Moon models. And here in first we have been obtained formulated these laws and their generalization for two-layer Moon model. New fine resonant effect was studied and perturbation of the the first and second order have been described in analytical form. Our purpose also was to obtain evaluations of period of free core nutation for some model of the Moon. Canonical equations of motion in Andoyer and Poincare variables were constructed for considered problem in form the more convenient for application of mentioned methods. Force function of considered mechanical system was constructed. Obtained results illustrate phenomena of core-mantle interaction of the Moon.

Author

Moon; Gravitational Fields; Equations of Motion; Synchronous Satellites; Lunar Orbits; Cassini Mission

20040062388 Texas Univ., Austin, TX, USA

More Far-Side Deep Moonquake Nests Discovered

Nakamura, Y.; Jackson, John A.; Jackson, Katherine G.; Lunar and Planetary Science XXXV: Lunar Geophysics: Rockin' and a-Reelin'; 2004; 2 pp.; In English; See also 20040062386

Contract(s)/Grant(s): NAG5-11619; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

As reported last year, we started to reanalyze the seismic data acquired from 1969 to 1977 with a network of stations established on the Moon during the Apollo mission. The reason for the reanalysis was because recent advances in computer technology make it possible to employ much more sophisticated analysis techniques than was possible previously. The primary objective of the reanalysis was to search for deep moonquakes on the far side of the Moon and, if found, to use them to infer the structure of the Moon's deep interior, including a possible central core. The first step was to identify any new deep moonquakes that escaped our earlier search by applying a combination of waveform cross-correlation and single-link cluster analysis, and then to see if any of them are from previously unknown nests of deep moonquakes. We positively identified 7245 deep moonquakes, more than a five-fold increase from the previous 1360. We also found at least 88 previously unknown deep-moonquake nests. The question was whether any of these newly discovered nets were on the far side of the Moon, and we now report that our analysis of the data indicates that some of them are indeed on the far side.

Author

Lunar Far Side; Moonquakes

20040062389 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Lunar Core and Tides

Williams, J. G.; Boggs, D. H.; Ratcliff, J. T.; Lunar and Planetary Science XXXV: Lunar Geophysics: Rockin' and a-Reelin'; 2004; 2 pp.; In English; See also 20040062386; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Variations in rotation and orientation of the Moon are sensitive to solid-body tidal dissipation, dissipation due to relative motion at the fluid-core/solid-mantle boundary, and tidal Love number k2 [1,2]. There is weaker sensitivity to flattening of the core-mantle boundary (CMB) [2,3,4] and fluid core moment of inertia [1]. Accurate Lunar Laser Ranging (LLR) measurements of the distance from observatories on the Earth to four retroreflector arrays on the Moon are sensitive to lunar rotation and orientation variations and tidal displacements. Past solutions using the LLR data have given results for dissipation due to solid-body tides and fluid core [1] plus Love number [1-5]. Detection of CMB flattening, which in the past has been

marginal but improving [3,4,5], now seems significant. Direct detection of the core moment has not yet been achieved. Derived from text

Lunar Core; Tides; Core-Mantle Boundary; Lunar Rotation

20040062390 Lancaster Univ., UK

The Influence of Tidal, Despinning, and Magma Ocean Cooling Stresses on the Magnitude and Orientation of the Moon's Early Global Stress Field

Scott, R. S.; Wilson, L.; Lunar and Planetary Science XXXV: Lunar Geophysics: Rockin' and a-Reelin'; 2004; 2 pp.; In English; See also 20040062386; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We address the influence tidal, despinning, and magma ocean cooling stresses have on the global stress field of a growing lunar crust. Surface extensional and strike-slip features are evident. Strikeslip faulting is shown to operate to great depths within the crust. Introduction: During its lifetime the Moon has been subjected to numerous sources of global, regional and local stresses that have shaped the surface we see today. Measurements of the stress field in the crust can provide useful information about the forces responsible for various tectonic processes. Global processes include reduction in planetary spin rate, changes in planetary volume due to thermal evolution, and tidal interactions with the Earth. Regional and local stresses appear to be influenced by volcanic and dynamic loading of the lithosphere, topographic variations, and the global processes mentioned previously. There is general consensus among most planetary scientists that the Moon accreted from the debris from a giant impact. According to this hypothesis the Moon was initially much closer to the Earth than now. As a consequence the initial dominant influence on the long term evolution of the Earth-Moon system was tidal exchange of angular momentum between the Earth s spin and the Moon s orbit, thus causing the lunar orbital distance to grow. Counter-intuitively, the effect of the growth in the lunar orbit is to increase the influence of tidally and de-spinning induced stresses on the Moon s overall global stress field. A further consequence of the Moon forming accretion process was the formation of a magma ocean. Solidification of this magma ocean resulted in the build up of global thermal stresses. Because linear stresses are additive, the magnitude and orientation of the Moon s early global stress field was dominated by the superposition of these three stress-inducing processes.

Author

Earth-Moon System; Moon; Magma; Stress Distribution; Angular Momentum; Lunar Orbits; Tides; Lunar Crust

20040062391 Graduate Univ. for Advanced Studies, Japan

Lunar Interior Studies Using Lunar Prospector Line-of-Sight Acceleration Data

Sugano, T.; Heki, K.; Lunar and Planetary Science XXXV: Lunar Geophysics: Rockin' and a-Reelin'; 2004; 2 pp.; In English; See also 20040062386; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Gravity field studies have been playing an important role in investigating physical properties, origin, and evolution of terrestrial planets and satellites. Information on the lunar gravity field has been provided by radio tracking data of lunar satellites. Several gravity field models, based on a spherical harmonic expansion, have been produced from the analysis of these tracking data. Recent two lunar satellites, the Clementine and the Lunar Prospector (LP) in 1990 s, dramatically improved the accuracy of the gravity field model. Among them, the LP was launched on January 7, 1998. After finishing the 1 year nominal mission at the 100 km altitude polar orbit, 6 months long extended mission was carried at the average height of 30 km. The highest resolution gravity model called LP165P was produced from the low altitude extended mission tracking data. Lunar gravity studies have a difficulty peculiar to the Moon, i.e., direct tracking data are available only at the lunar nearside because of synchronized spin and orbital motion of the Moon. The lack of farside data has been hindering us from making high resolution gravity anomaly map. The LP165P gravity anomaly map, obtained imposing artificial constraints to stabilize the estimation of spherical harmonic coefficients using only nearside tracking data. As a result the LP165P has many spurious linear features; the model is reliable only up to 110th degree/order at the nearside and 60th degree/order at the farside.

Author

Lunar Prospector; Gravitational Fields; Gravity Anomalies; Clementine Spacecraft; Polar Orbits; Line of Sight; Moon; Lithosphere

20040062392 Japan Aerospace Exploration Agency, Tokyo, Japan

A First Crustal Thickness Map of the Moon with Apollo Seismic Data

Chenet, H.; Lognonne, P.; Wieczorek, M. A.; Mizutani, H.; Lunar and Planetary Science XXXV: Lunar Geophysics: Rockin' and a-Reelin'; 2004; 2 pp.; In English; See also 20040062386; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The lunar crustal thickness determination is classically addressed with one of these two datasets: 1/ Seismology from the Apollo network, and 2/ Gravity-Topography from the Lunar Prospector and Clementine missions. Arrival times of the recorded seismic events at the four Apollo stations (1969-1977), allow to constrain the mean value of the crustal thickness as seen by the chosen data. Because of the low confidence of the arrival time readings in general, the artificial impacts represent a relatively large proportion of the data actually constraining the crustal structure in such studies, because their source parameters are known. These artificial impacts mostly constrain the Apollo 12 and 14 region. That is the main reason why the previous estimates of the crustal thickness with the Apollo seismic data are mostly considered as representing a mean value for the Apollo 12 and 14 sites or more generally for the Oceanus Procellarum region. The more important thing to remember at this point is the fact that these studies only give one and only value for the depth of the Lunar Moho, which represents a mean value for the sampled area. On the other hand, the use of topography and gravity data, given by Clementine and Lunar Prospector, allows to address the lateral variations of the crustal thickness because the coverage of these data is Moon-wide. But these two sets of data only constrain the relative variations and not the absolute ones because the inversion of the Bouguer anomaly is non-unique and requires the constraint of an anchoring point, which can only come from a seismic value. Hence, the relative values need to be calibrated following this local thickness, for the map to have a unique solution. See for instance for a complete explanation of the process. In terms of crustal seismology, the main result from the Apollo Era was the claim of a 60 km thick crust beneath the Apollo 12 and 14 region. This reference thickness has been widely used until now, but was recently reconsidered much thinner, respectively 38 3 km and 30 2.5 km. For the three studies, the artificial impacts around station 12 and 14 provide the majority of data. As a result, these estimates can be considered as three different regional averages in this area.
Author
Thickness; Monte Carlo Method; Seismology; Moon; Topography; Lunar Crust; Lunar Prospector; Clementine Spacecraft

20040062393 Scripps Institution of Oceanography, San Diego, CA, USA
New Events Discovered in the Apollo Lunar Seismic Data
Bulow, R. C.; Johnson, C. L.; Shearer, P. M.; Lunar and Planetary Science XXXV: Lunar Geophysics: Rockin' and a-Reelin'; 2004; 2 pp.; In English; See also 20040062386; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Apollo Passive Seismic Experiment (APSE) consisted of four seismic stations deployed on the lunar surface between 1969 and 1972. Data were recorded continuously from deployment until 1977. Lunar seismic events detected in the continuous time series have been previously classified into three types: deep moonquakes, shallow moonquakes, and impacts. Deep events are thought to be tidally triggered, and originate from distinct source regions that produce repeatable waveforms. Original classification was performed on a visual basis and took advantage of this repeatability. Our goal is to better constrain the properties of these deep event clusters. Modern processing of the event data refines the manner in which events are assigned to clusters. Application of these techniques to the continuous data may pick out previously unidentified events belonging to these clusters. This will permit improved source region location estimates.
Author
Seismology; Lunar Surface; Apollo Project; Moonquakes; Filtration; Data Processing

20040062394 Academy of Sciences (Russia), Moscow, Russia
Manifestation of Gas-Dust Streams from Double Stars on Lunar Seismicity
Khavroshkin, Oleg B.; Tsyplakov, Vladislav V.; Lunar and Planetary Science XXXV: Lunar Geophysics: Rockin' and a-Reelin'; 2004; 2 pp.; In English; See also 20040062386; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Information content of the Nakamura's Catalog of moonquakes is very rich: from solar-earth tides to clustering among the meteoroid streams. The histograms from meteoroid impacts seismic data revealed the seismic wave responses of the Moon to solar oscillations and the action on the lunar surface by dust-gas plasma of meteoroid streams. The time series of seismic events were generated as follows: on an axis of ordinates the peak amplitudes of events in standard units, on an abscissa seismogram durations of the same moonquakes and subsequent time intervals between them were put aside. Spectrum of the series of meteoroid streams disclosed time picks on orbital periods some planets and their satellites and solar oscillations. The research of peculiarities of histogram envelopes and comparative common analysis solar bursts data and mass meteoroid distribution are confirmed and revealed Forbush's effect for gas-dust plasma. Hidden astrophysical periodicities of lunar seismicity were obtained early from an analysis of time series.
Author
Moonquakes; Time Series Analysis; Periodic Variations; Meteoroid Concentration

20040062395 Lunar and Planetary Inst., Houston, TX, USA

Lunar and Planetary Science XXXV: Antarctic and Spherule Studies

2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040062396 - 20040062399

Contract(s)/Grant(s): NCC5-679

Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The session "Antarctic and Spherule Studies" included the following reports:In Situ Magnetic Identification and Classification of Meteorites in Antarctica; Pb, Nd and Sr Isotopes in Aerosols Extracted from Snow, Berkner Island, Antarctica; Olivine Textures and Compositions in BIT-58 Ablation Debris; and Extraterrestrial Spherules with Fe-Ni Core and Pt Group Nuggets in Pleistocene Sediment from Hungary.

Derived from text

Meteoritic Composition; Isotope Ratios

20040062396 Hungarian Geological Inst., Budapest, Hungary

Extraterrestrial Spherules with Fe-Ni Core and Pt Group Nuggets in Pleistocene Sediment from Hungary

Don, G.; Gal-Solymos, K.; Lunar and Planetary Science XXXV: Antarctic and Spherule Studies; 2004; 2 pp.; In English; See also 20040062395; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Magnetic spherules were collected and investigated from Pleistocene terrestrial sediment overlying Paleozoic granitic rocks in Southern Hungary. Some of them have characteristic feature suggested extraterrestrial origin: Ni-bearing crust, Ni-rich core and especially the platinum group nuggets with unique chemical composition. Their formation can be a meteorite ablation process.

Author

Chemical Composition; Iron; Nickel; Sediments; Meteorites; Ablation; Pleistocene Epoch

20040062397 Aix-Marseilles Univ., France

In Situ Magnetic Identification and Classification of Meteorites in Antarctica

Rochette, P.; Gattacceca, J.; Eisenlohr, P.; Folco, L.; Lunar and Planetary Science XXXV: Antarctic and Spherule Studies; 2004; 2 pp.; In English; See also 20040062395; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Magnetic susceptibility (chi) measurement is a rapid and sensitive way to discriminate meteorites from terrestrial rocks, as well as to partially classify them, based on laboratory measurements of more than 1500 different meteorites. Due to their large content in metal or magnetite, most classes of meteorites have their log chi (in 10(exp -9) qu m/kg) above 4. Among chondrites, only R, some CM and CV are in the log chi range 3 to 4. Among achondrites, HED, lunar and martian are in the log chi = 3 range. On the other hand, most sedimentary, metamorphic and plutonic terrestrial rocks have log chi well below 2, as exemplified by a collection of rocks from Victoria Land. Only volcanic rocks (like the basalts and dolerites of the Ferrar Volcanic Suite) reach the values of the rare weakly magnetic meteorites.

Derived from text

In Situ Measurement; Magnetic Permeability; Classifications; Meteorites; Antarctic Regions

20040062398 Case Western Reserve Univ., Cleveland, OH, USA

Olivine Textures and Compositions in BIT-58 Ablation Debris

Huwig, K. A.; Harvey, R. P.; Lunar and Planetary Science XXXV: Antarctic and Spherule Studies; 2004; 2 pp.; In English; See also 20040062395; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In 1995 a layer of dark, rounded particles was found during a systematic sampling of tephra layers in the East Antarctic ice sheet. Studies of a small sample of this debris layer (BIT-58) suggested it was the result of a single meteoritic event that occurred approximately 2.5-2.8 mya. Due to the small size of the initial sample, however, the cosmogenic nuclide data is questionable. The study determined that BIT-58 was most consistent with an H ordinary chondrite due to the major element data. However, cosmogenic data suggested an iron parent body, and trace element analyses provided mixed results [1]. In early 2003 more of the BIT-58 layer was collected and the current study was begun to define the mineralogy and chemistry of the

sample. A further goal was to produce a split of "clean" (no terrestrial debris) BIT-58 to eliminate possible contamination of age.
Author
Chondrites; Contamination; Debris; Ice; Iron; Hydrogen; Trace Elements; Meteorites

20040062399 Max-Planck-Inst. fuer Chemie, Mainz, Germany
Pb, Nd and Sr Isotopes in Aerosols Extracted from Snow, Berkner Island, Antarctica
Jagoutz, Emil; Bory, A.; Jotter, R.; Zartman, R.; Lunar and Planetary Science XXXV: Antarctic and Spherule Studies; 2004; 2 pp.; In English; See also 20040062395; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

There are several good reasons to investigate atmospheric dust from Antarctica. 1) About 90% of our collected meteorites continue to come from this continent. Many of these meteorites have suffered some degree of contamination (Dreibus et al, 1985), which is most likely derived from aerosols trapped in the Antarctic ice. 2) Antarctica is the cleanest terrestrial environment as regards to atmospheric particulate fallout, and so we might be able to monitor the influx of cosmic dust there. The ability to analyze snow samples on a scale permitting seasonal resolution of dust influx would be especially helpful. 3) By comparing the isotopic signature of dust trapped in the ice or snow with that of possible source regions, important information may be gained about transport directions, distances, and fluxes. Such data have far reaching implications for global atmospheric circulation, particularly if it is possible to illuminate historic changes as may be recorded in the ice core record (Grousset et al., 1992; Basile et al., 1997; Delmonte et al., in press). However, in order to understand the ice core record, it is first essential to study dust variations in recent snow samples.
Derived from text
Aerosols; Lead Isotopes; Neodymium Isotopes; Strontium Isotopes; Atmospheric Circulation; Contamination; Cosmic Dust; Meteorites

20040062400 Lunar and Planetary Inst., Houston, TX, USA
Lunar and Planetary Science XXXV: Isotopes in Meteorites
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040062401 - 20040062406
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The session"Isotopes in Meteorites" consisted of the following presentations:The Common Property of Isotopic Anomalies in Meteorites; Revised Production Rates for 22Na and 54Mn in Meteorites Using Cross Sections Measured for Neutron-induced Reactions; Modeling of 14C and 10Be Production Rates in Meteorites and Lunar Samples; Investigating Xenon Isotopic Fractionation During Rayleigh-type Distillation; The Mean Life Squared Relationship for Abundances of Extinct Radioactivities; and Magnesium Isotopic Fractionation of Forsterite During Evaporation from Different Crystallographic Surfaces.
Derived from text
Isotope Ratios; Meteoritic Composition

20040062401 National Museum of Natural History, Paris, France
The Common Property of Isotopic Anomalies in Meteorites
Robert, F.; Lunar and Planetary Science XXXV: Isotopes in Meteorites; 2004; 2 pp.; In English; See also 20040062400; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The aim of this work is to apply a numerical treatment proposed to account for the non-mass-dependent fractionation effect observed for oxygen isotopes during the synthesis of ozone to other chemical elements. A numerical protocol to calculate isotopic reaction rate ratios is proposed. This treatment yields non-mass-dependent isotopic effects in other chemical elements, qualitatively similar to those observed in some of the high temperature minerals found in the carbonaceous meteorites. This treatment may reflect the numerical consequences of an unrecognized quantum mechanical effect, linked to a property of chemical reactions involving indistinguishable isotopes.
Derived from text
Anomalies; Numerical Analysis; Fractionation; Chemical Reactions; Isotope Ratios; Chemical Composition

20040062403 Centre de Recherches Petrographiques et Geochimiques, Nancy, France

Investigating Xenon Isotopic Fractionation During Rayleigh-type Distillation

Marrocchi, Y.; Marty, B.; Lunar and Planetary Science XXXV: Isotopes in Meteorites; 2004; 2 pp.; In English; See also 20040062400; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Mechanism leading to the incorporation of noble gases in meteoritic matter remains poorly understood. The main carrier of meteoritic noble gases, known as "phase Q", is formed of carbonaceous material not fully characterized, resulting of acid attack of chondrites by HF/HCl. Study by has revealed that it is mainly composed by aromatic moieties linked by short aliphatic chains. Recent HRTEM observations of organic material in Orgeuil, Leoville and and Vigarano meteorites have shown the presence of curved and frequently twisted and intertwined graphene sheets, abundant carbon-black particles and hollow "sacs". The authors concluded that low temperature adsorption is the most probable way to incorporate noble gases onto meteoritic matter.

Derived from text

Xenon Isotopes; Molecular Structure; Meteoritic Composition; Carbonaceous Materials; Meteorites

20040062404 Arizona Univ., Tucson, AZ, USA

Modeling of C-14 and Be-10 Production Rates in Meteorites and Lunar Samples

Jull, A. J. T.; Kim, K. J.; McHargue, L. R.; Johnson, J. A.; Lunar and Planetary Science XXXV: Isotopes in Meteorites; 2004; 2 pp.; In English; See also 20040062400; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A limitation of using 5730 year C-14 for terrestrial ages is that shielding corrections may be required if the original meteoroid was very large or small. One way to make these depth estimates is by Ne-22/Ne-21 ratios. An excellent method is to use the production rate of the more long-lived radionuclide 1.5 Myr Be-10 to normalize the C-14 production rate. Since both of these radionuclides are produced by spallation reactions on oxygen, their production ratio in meteorites has been assumed to be constant. The assumption is that the exposure age of the meteorite is sufficiently long to saturate 10Be and that the C-14/Be-10 production ratio is reasonably constant. In the past, we have taken the production ratio C-14/Be-10 to be 2.5 plus or minus 0.1, based on a few irradiation experiments as well as observations of the C-14/Be-10 in recently-fallen meteorites. The utility of the C-14-Be-10 method was demonstrated for the large fall of the Gold Basin (Arizona) meteorites and for Frontier Mountain (Antarctica) meteorites. More recently, we have expanded these studies to other meteorites. This potentially allows correction of shielding effects, which might affect C-14 terrestrial age measurements. Samples from the large Gold Basin L4 find plot along a line of C-14 vs. Be-10 going through the origin, which is consistent with samples from the same object but varying amounts of shielding. Western Australian meteorites generally show lower shielding and higher Be-10 production in the range 13-18 dpm/kg Be-10. Only one sample (Mundrabilla 005) plots to the right of the production-rate line, which indicates saturated 14C but low 10Be. This should be consistent with a short exposure age and undersaturation of Be-10 for this meteorite. Recently, it has become apparent that there may be other meteorites where the C-14/Be-10 is not as well constrained. We have therefore undertaken a new set of modeling studies using the MCNPX code system to model the dependent of C-14 and Be-10 production as a function of depth and size of the meteoroid.

Derived from text

Beryllium Isotopes; Carbon 14; Lunar Geology; Lunar Rocks; Meteorites; Mathematical Models

20040062405 Tokyo Univ., Hongo, Japan

Magnesium Isotopic Fractionation of Forsterite During Evaporation from Different Crystallographic Surfaces

Yamada, M.; Tachibana, S.; Nagahara, H.; Ozawa, K.; Lunar and Planetary Science XXXV: Isotopes in Meteorites; 2004; 2 pp.; In English; See also 20040062400; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Chemical and isotopic fractionations are expected by evaporation of solid materials under low total pressure conditions in the early solar system. Kinetic isotopic fractionation inside evaporating solid is determined by the evaporation rate (v), diffusion rate (D), size of the solid (X) and isotopic fractionation factor (alpha). Forsterite (Mg2SiO4), one of the major minerals in meteorites, evaporates congruently, and the evaporation rate in vacuum shows anisotropy, which is fastest along the c-axis and slowest along the b-axis in the temperature range of 1500-1800 C. The different crystallographic surfaces of evaporation residues also show different microstructures. The Mg self-diffusion rate in forsterite is also anisotropic, which is fastest along the c-axis and slowest along the b-axis. Therefore, the isotopic fractionation factor (alpha) is also expected to show anisotropy. However, it has not been investigated systematically yet. In order to investigate anisotropy of for evaporation of forsterite, we have analyzed Mg isotopic compositions of surfaces of evaporation residues by an ion microprobe. Our

analytical approach is different from that in Wang et al., who measured the depth profile of isotopic compositions from the surface of an evaporation residue using ion microprobe to obtain and D along the a-axis of forsterite.
Derived from text
Crystallography; Evaporation; Forsterite; Magnesium Isotopes; Fractionation; Microstructure

20040062406 Washington Univ., Saint Louis, MO, USA
The Mean Life Squared Relationship for Abundances of Extinct Radioactivities
Lodders, K.; Cameron, A. G. W.; Lunar and Planetary Science XXXV: Isotopes in Meteorites; 2004; 2 pp.; In English; See also 20040062400
Contract(s)/Grant(s): NAG5-10553; NAG5-11153; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We discovered that the abundances of now extinct radioactivities (relative to stable reference isotopes) in meteorites vary as a function of their mean lifetimes squared. This relationship applies to chondrites, achondrites, and irons but to calcium-aluminum inclusions (CAIs). Certain meteorites contain excesses in isotopic abundances from the decay of radioactive isotopes with half-lives much less than the age of the solar system. These short-lived radioactivities are now extinct, but they were alive when meteorites assembled in the early solar system. The origin of these radioactivities and the processes which control their abundances in the solar nebula are still not well understood. Some clues may come from our finding that the meteoritic abundances of now extinct radioactivities (relative to stable reference isotopes) vary as a function of their mean lifetimes squared. This relationship applies to chondrites, achondrites, and irons, but not to CAIs. This points to at least two different processes establishing the abundances of short-lived isotopes found in the meteoritic record.
Derived from text
Abundance; Radioactive Isotopes; Mean Square Values; Aluminum; Calcium; Chondrites; Extinction; Half Life

20040062407 Lunar and Planetary Inst., Houston, TX, USA
Lunar and Planetary Science XXXV: Carbonaceous Chondrites
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040062408 - 20040062420
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The titles in this section include: 1) A Quantitative NMR Analysis of Phosphorus in Carbonaceous and Ordinary Chondrites; 2) An Infrared Study of the Matrices of CI1 and CM2 Chondrites; 3) A Study of the Morphology, Composition and Mineral Associations of Fe-Ni Sulphides in CM Carbonaceous Chondrites; 4) Aqueous Alteration Mineralogy in CM Carbonaceous Chondrites; 5) In Situ Location and Characterization of Carbon-bearing Phases in Carbonaceous; 6) Chondrites: Insights from Yamato 791198, a Weakly-altered CM2 Chondrite; 7) Unique Texture in EET 83389: Clues to Formation of Fine Grained Rims in CM Chondrites; 8) Amoeboid Olivine Aggregates in the NWA 760 CV3 Chondrite; 9) Petrologic Type of CV3 Chondrites as Revealed by Raman Spectroscopy of Organic Matter; 10) A First Look at Acfer 324: Evidence for Another CR 3 Chondrite? 11) Hydrogen Isotopic Composition of the Bencubbin Meteorite; 12) The Fountain Hills Meteorite: A New CBa Chondrite from Arizona; 13) Shock Effects in the Metal-rich Chondrites QUE 94411, Hammadah al Hamra 237 and Bencubbin; 14) Mineralogy and Petrology of Al-rich Objects in the CH Carbonaceous Chondrite North West Africa 739.
CASI
Carbonaceous Chondrites; Meteoritic Composition; Meteoritic Microstructures

20040062408 Arizona Univ., Tucson, AZ, USA
The Fountain Hills Meteorite: A New CB(a) Chondrite from Arizona
Lauretta, D. S.; Killgore, M.; Greenwood, R. C.; Verchovsky, A. B.; Franchi, I. A.; Lunar and Planetary Science XXXV: Carbonaceous Chondrites; 2004; 2 pp.; In English; See also 20040062407
Contract(s)/Grant(s): NAG5-11355; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The CR clan of meteorites has been established and a detailed review of these meteorites is presented. There are several kinds of carbonaceous chondrites included in this clan: Carbonaceous Renazzo-like (CR), Carbonaceous with High metal (CH), Carbonaceous Bencubbin-like (CB), and LEW 85332, a unique-metal rich meteorite. The CB chondrites are further

divided into two subgroups: CB(sub a) and CB(sub b). Here we describe a new member of the CR chondrite clan, Fountain Hills, a recent find with a total mass of approximately 60 g.
Derived from text
Carbonaceous Chondrites; Meteoritic Composition; Arizona; Planetary Geology

20040062409 Harper Coll., Palatine, IL, USA
A First Look at Acfer 324: Evidence for Another CR 3 Chondrite?
Sipiera, Paul P.; Lunar and Planetary Science XXXV: Carbonaceous Chondrites; 2004; 1 pp.; In English; See also 20040062407; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In October 2001 an exciting 69-gram stone meteorite fragment was found by Richard and Roland Pelisson, of SaharaMet, during a systematic search of the Acfer region of Algeria. Its precise location was at latitude 27 30.05 deg. N., longitude 3 52.19 deg. E. Although the meteorite s surface was coated with desert varnish, they immediately recognized the significance of this meteorite by the large number of protruding chondrules. Based on its resemblance to a conglomerate, it was suggested that it might be a CR-type chondrite. This theory was supported by the fact that several CR chondrites have been recovered in the immediate geographical area.
Author
Meteoritic Composition; Chondrites; Varnishes

20040062410 Grenoble-1 Univ., France
An Infrared Study of the Matrices of CI1 and CM2 Chondrites
Quirico, E.; Bonal, L.; Lunar and Planetary Science XXXV: Carbonaceous Chondrites; 2004; 2 pp.; In English; See also 20040062407; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We report some preliminary results from an infrared study of matrix grains from 3 CII (Allais, Ivuna, Orgueil) and 3 CM2 chondrites (Murchion, ColdBokkeveld, Murray). This study intends to provide new clues about the physical state and abundance of water within these objects, and to question the relevancy of the use of spectral data derived from terrestrial mineral for remote sensing of asteroidal or planetary surfaces.
Author
Infrared Radiation; Matrices (Mathematics); Chondrites; Water; Planetary Surfaces

20040062411 Museum of Natural History, London, UK
A Study of the Morphology, Composition and Mineral Associations of Fe-Ni Sulphides in CM Carbonaceous Chondrites
Bullock, E. S.; Gounelle, M.; Grady, M. M.; Russell, S. S.; Lunar and Planetary Science XXXV: Carbonaceous Chondrites; 2004; 2 pp.; In English; See also 20040062407; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The CM chondrites are a large group that show a wide range of aqueous alteration features [1]. Whilst a lot of attention has been paid to primary and secondary phases in the CMs, such as phyllosilicates [e.g. 2], carbonates [3], sulphates [4] and chondrule olivines and pyroxenes [e.g. 5], much less attention has been given to the opaque phases in these chondrites. The sulphides in particular are very interesting, as they might be products of sulphuration of metal grains by H2S in the nebula [6]. Previous studies [e.g. 7] have tended to concentrate on sulphides in particular CMs; only one study [8] has looked for differences between the CM sulphides. Our study looks at some of the CMs included in that study, plus an additional group of CMs, to assess whether the observations noted by [8] apply to these samples.
Derived from text
Carbonaceous Chondrites; Meteoritic Composition; Minerals; Olivine; Silicates

20040062412 Tokyo Univ., Hongo, Japan
Amoeboid Olivine Aggregates in the NWA 760 CV3 Chondrite
Komatsu, M.; Krot, A. N.; Mikouchi, T.; Tagai, T.; Miyamoto, M.; Keil, K.; Lunar and Planetary Science XXXV: Carbonaceous Chondrites; 2004; 2 pp.; In English; See also 20040062407; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Amoeboid olivine aggregates (AOAs) are important components of carbonaceous chondrites and have been interpreted

to represent solar nebular condensates that experienced high-temperature annealing, but largely escaped melting [1]. Their properties can be used as sensitive indicators of metamorphic or alteration processes [1,2], because they are generally composed of fine-grained minerals (forsterite, anorthite, spinel) that are easily modified during these processes [2]. In order to understand the alteration history of the CV3 chondrites, we performed mineralogical studies of AOAs in the recently discovered CV chondrite NWA 760 [3]. Here we report the preliminary results of the mineralogy and petrology of AOAs in this meteorite and compare them to those in other CV3 chondrites.
Derived from text
Carbonaceous Chondrites; Aggregates; Olivine; Metamorphism (Geology); High Temperature; Meteorites

20040062413 Washington Univ., Saint Louis, MO, USA
Unique Texture in EET 83389: Clues to Formation of Fine Grained Rims in CM Chondrites
Benedix, G. K.; Vicenzi, E. P.; Lunar and Planetary Science XXXV: Carbonaceous Chondrites; 2004; 2 pp.; In English; See also 20040062407; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

CM chondrites exhibit textural and mineralogical features intermediate to CI and CV/CO carbonaceous chondrites in the amount of aqueous alteration they have experienced. Unlike CI chondrites, CMs still have a significant anhydrous mineralogy (olivine and pyroxene) distributed throughout the hydrated phases. Evidence for aqueous alteration includes varying abundance of matrix, which is dominated by phyllosilicates such as serpentine, cronstedtite, and tochilinite. Other minerals indicating that water-rock interactions occurred are carbonates and sulfates. Texturally CM chondrites are characterized by chondrules and isolated anhydrous mineral grains surrounded by fine-grained rims (FGRs) composed of phyllosilicates and disseminated opaques. In between these is a fine-grained matrix of hydrated mineralogy. The setting and conditions of the aqueous alteration of these meteorites is difficult to unravel.
Derived from text
Carbonaceous Chondrites; Chondrites; Rims; Meteoritic Composition; Textures

20040062414 Grenoble-1 Univ., France
Petrologic Type of CV3 Chondrites as Revealed by Raman Spectroscopy of Organic Matter
Bonal, L.; Quirico, E.; Bourot-Denise, M.; Lunar and Planetary Science XXXV: Carbonaceous Chondrites; 2004; 2 pp.; In English; See also 20040062407; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Chondritic meteorites provide important information about conditions in the early solar system. However, as most chondritic meteorites were affected by thermal metamorphism and/or were exposed to aqueous solutions, during or after accretion to their parent bodies, nebular or presolar records may have been obscured or completely erased. The least altered meteorites are those of type 3. The chondritic meteorites CV3 are privileged studied objects due to the presence of refractory inclusions. An accurate evaluation of the metamorphic grade provides clues about the primitiveness of these objects, and in particular of the preservation of isotopic information located in the CAIs inclusions. In the present state of knowledge, the derivation of petrologic type of CV3s is ambiguous. Guimon et al (1995) have attributed a petrologic type of different objects by studying their induced thermoluminescence (ITL) properties. But, these results have recently been questioned by Quirico et al. (2003) for Allende and Axtell. The purpose of this work was to assign a petrologic type of a line of 8 CV3: Allende, Axtell, Mokoia, Grosnaja, Vigarano, Kaba, Efremovka and Leoville.
Derived from text
Petrology; Chondrites; Organic Materials; Meteorites; Solar System

20040062415 Centre de Recherches Petrographiques et Geochimiques, Nancy, France
Hydrogen Isotopic Composition of the Bencubbin Meteorite
Aleon, J.; Deloule, E.; Perron, C.; Lunar and Planetary Science XXXV: Carbonaceous Chondrites; 2004; 2 pp.; In English; See also 20040062407; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Bencubbin meteorite is a metal-rich, shocked and brecciated meteorite belonging to the so-called CB chondrites or Bencubbinites. Compared to most carbonaceous chondrites "Bencubbinites" are unusual in many ways. Especially, they have large and widespread excess of N-15, (reaching (delta)N-15 approx. +1000% in Bencubbin). It is usually thought that this enrichment is due to incorporation of presolar nitrogen during the last of a series of impacts but incorporation of an escape-fractionated atmosphere has also been discussed and deserves examination. Indeed, both hypotheses are

supported by astronomical observations such as N-15 excesses of similar amplitude attributed to solid organic compounds in different comets or N-15 excesses observed in the atmosphere of Mars (+620%) and Titan (+3500%). To our knowledge, no hydrogen isotope measurements of Bencubbinites are reported in the literature. Therefore the H isotopic composition of Bencubbin is studied here to bring new information's on the formation of this unusual meteorite. Indeed, hydrogen can be used as a tracer of heavily fractionated matter, either presolar or atmospheric. Interstellar chemistry leads to D-excesses far greater than those of N-15 and fractionation by atmospheric escape should be much larger for H than for N. But the distribution of the excesses are likely to be different.
Author
Hydrogen Isotopes; Meteoritic Composition; Breccia; Carbonaceous Chondrites

20040062416 NASA Johnson Space Center, Houston, TX, USA
Shock Effects in the Metal-rich Chondrites QUE 94411, Hammadah al Hamra 237 and Bencubbin
Meibom, A.; Righter, K.; Chabot, N.; Dehn, G.; Antignano, A. A.; McCoy, T. J.; Krot, A. N.; Zolensky, M. E.; Petaev, M. I.; Keil, K.; Lunar and Planetary Science XXXV: Carbonaceous Chondrites; 2004; 1 pp.; In English; See also 20040062407; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We have studied the metal-rich chondrites QUE94411 (QUE), Hammadah al Hamra 237 (HH237) and Bencubbin with an emphasis on the petrographical and mineralogical effects of the shock processing that these meteorite assemblages have undergone. Iron-nickel metal and chondrule silicates are the main components in these meteorites. These high-temperature components are held together by shock melts consisting of droplets of dendritically intergrown FeNi metal/sulfide embedded in ferrous silicate glass. The silicate glass component of the shock melt is substantially more FeO-rich (FeO: 30 to 40 wt%) than the prevailing chondrule silicates (FeO less than 5 wt%). Fine-grained matrix material, which is a major component in most other chondritic assemblages, is extremely scarce in QUE4411 and HH237; it has not been observed in Bencubbin. This material occurs as rare, hydrated, and fine-grained matrix lumps with major and minor element abundances roughly similar to the ferrous silicate shock melts (and CI). We infer that hydrated, fine-grained material, compositionally similar to these matrix lumps, was originally present between the FeNi metal grains and chondrules, but was preferentially heated by the shock wave and melted. Other shock-related features in QUE94411, HH237, and Bencubbin include a distinct alignment and occasionally strong plastic deformation of metal and chondrule fragments. However, the existence of chemically zoned and metastable FeNi metal condensates condensates in direct contact with shock melts indicates that the shock did not substantially increase the average temperature of the aggregate. TEM analyses of the FeNi metal droplets embedded in the shock melts show martensitic crystal structures, indicating rapid cooling, essentially quenching, of the shock melts. These findings indicate that the preshock temperature of the assemblage was low. Because porphyritic olivine-pyroxene chondrules are absent in QUE94411, HH237, and Bencubbin, it is difficult to determine the precise shock stage of these meteorites, but the shock was probably relatively light (S2- S3; 5-20 GPa) consistent with a bulk temperature increase of the assemblages of less than 200 C. The higher pressures within this range (i.e. 15-20 GPa) are consistent with the findings of shock produced diamonds in Bencubbin. The many mineralogical, petrological and isotopic (e.g. O and N) similarities between Bencubbin, Weatherford, Gujba and QUE/HH237 have been used to argue for a common origin of these meteorites on a single asteroidal parent body. The findings of this study, which indicate similar shock processing, lend support to this view.
Derived from text
Shock Waves; Chondrites; Mineralogy; Petrology; Metals; Meteoritic Composition

20040062417 Hawaii Univ., Honolulu, HI, USA
Mineralogy and Petrology of Al-rich Objects in the CH Carbonaceous Chondrite North West Africa 739
Krot, A. N.; Petaev, M. I.; Keil, K.; Lunar and Planetary Science XXXV: Carbonaceous Chondrites; 2004; 2 pp.; In English; See also 20040062407; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The CH carbonaceous chondrites are primitive meteorites, which appear to have escaped postaccretion thermal metamorphism and aqueous alteration, and can potentially provide important constraints on the nature of high temperature nebular processes. Ca,Al-rich inclusions (CAIs) in the previously studied CH chondrites ALH85085 and Acfer 182 show several unusual characteristics: (a) small sizes (5 - 80 microns in ALH85085 and up to 450 microns in Acfer 182), (b) commonly spherical shapes, (c) fine-grained textures, (d) refractory mineralogy dominated by hibonite, grossite, perovskite, and melilite, (e) rarity of isotopic anomalies in Ca and Ti, (f) general lack of Mg-26 excesses (Mg-26*) in the hibonite-rich and grossite-rich CAIs, (g) bi-modal distribution of O-isotopic compositions, and (h) lack of O-isotopic heterogeneity within an individual CAI. There are several fundamental questions concerning the origin of CAIs which remain to be answered: (1) Is there any relationship between CAIs and Al-rich chondrules? (2) Do CAIs show evidence for thermal processing during

chondrule formation? (3) Did CAIs and chondrules from a chondrite group experience size-sorting together or separately? (4) Is the lack of Mg-26* in many CH CAIs due to heterogeneous distribution of the 26Al in the solar nebula or due to the late stage formation? (5) Do the 26Mg*-free CH CAIs contain 10B excesses due to decay of 10Be? In order to answer these questions, we started a systematic survey of Al-rich objects in CHs. Here we report the mineralogical and petrologic studies of the CAIs, AOAs, Al-rich chondrules and isolated grains in the recently discovered CH chondrite North West Africa (NWA) 739.
Author
Mineralogy; Petrology; Carbonaceous Chondrites; Meteorites; Meteoritic Composition

20040062418 NASA Johnson Space Center, Houston, TX, USA
Aqueous Alteration Mineralogy in CM Carbonaceous Chondrites
Chokai, J.; Zolensky, M.; Le, L.; Nakamura, K.; Mikouchi, T.; Monkawa, A.; Koizumi, E.; Miyamoto, M.; Lunar and Planetary Science XXXV: Carbonaceous Chondrites; 2004; 2 pp.; In English; See also 20040062407; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Iron-nickel sulfides are found in most or all solar system environments, and are probably the only minerals found in all extraterrestrial materials on hand. Despite the ubiquity, they have not received the attention they deserve. The most common Fe-Ni sulfides in chondrites are troilite (FeS), pyrrhotite (Fe1- XS) and pentlandite (Fe,Ni)9S8. Troilite is believed to have resulted from sulfidation of metal (Fe-Ni) grains in an H2Scontaining environment. Pyrrhotite is produced when friable troilite grains, which are exfoliated from the metal nucleus, are submitted to continued sulfidation [1]. Some asteroids are known to have experienced aqueous alteration, forming products including new generations of sulfides (pyrrhotite and pentlandite). Pentlandite in particular is known to form during such alteration [1]. However, experimental work by Lauretta has indicated that pentlandite may also have been formed during the initial sulfidation process [2], due to the faster diffusion rate of nickel into the forming sulfide, as compared to iron. Finally, there is considerable evidence [1,3&4] for a family of phases intermediate between pyrrhotite and pentlandite, following the trend of the high temperature monosulfide solid solution [5], something not encountered in terrestrial rocks.
Derived from text
Carbonaceous Chondrites; Extraterrestrial Matter; Mineralogy; Pyrrhotite; Nickel; Asteroids

20040062419 New Mexico Univ., Albuquerque, NM, USA
In Situ Location and Characterization of Carbon-bearing Phases in Carbonaceous Chondrites: Insights from Yamato 791198, a Weakly-altered CM2 Chondrite
Brearley, Adrian J.; Lunar and Planetary Science XXXV: Carbonaceous Chondrites; 2004; 2 pp.; In English; See also 20040062407
Contract(s)/Grant(s): NAG5-13444; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Intense studies of carbonaceous chondrites have provided remarkable insights into the behavior of carbon during the earliest stages of our solar system. This research has demonstrated that carbonaceous meteorites contain a diverse array of organic compounds, whose origins are probably the result of multiple processes that occurred in different locations including interstellar space, the solar nebula and asteroidal parent bodies [1-3]. The most abundant organic carbon component in CI1 and CM2 carbonaceous chondrites is so-called macromolecular carbon, a high molecular weight material that has some affinities to terrestrial kerogen and constitutes approximately 60-70% of the organic material in these meteorites. Although recent studies e.g. [3] have radically improved our understanding of the structural and compositional characteristics of this material, a number of key questions remain to be addressed. In particular, our knowledge of where this macromolecular material is distributed at the fine-scale within carbonaceous chondrites is scant. [4] have shown that organic material is associated with phyllosilicate-rich matrix in CM chondrites, but the detailed mineralogical associations are not well-known. Over the past 2 years, we have begun to address this question by using energy filtered transmission electron microscopy (EFTEM) to locate carbon-bearing materials in situ, focusing specifically on the CM2s. To date we have reported data on the Murchison CM2 chondrite [5], a meteorite that has experienced a modest degree of aqueous alteration. To extend our observations to other CM2 chondrites, we have examined the occurrence of carbon-bearing phases in Yamato 791198. Our recent studies [5] have shown that Y-791198 is among the most weakly-altered CM chondrite currently known and hence is likely to preserve a quite primitive distribution of carbonaceous material. In this study, we present initial observations on the distribution of these materials in one fine-grained rim and compare them with our results from Murchison. Such information

may provide important insights into the origins of the carbonaceous material and how it was distributed in nebular and perhaps presolar dust.
Derived from text
Carbonaceous Chondrites; Carbonaceous Meteorites; Solar Nebula; Meteorites; Mineralogy; Molecular Weight; Organic Compounds; Asteroids

20040062420 Arizona Univ., Tucson, AZ, USA
A Quantitative NMR Analysis of Phosphorus in Carbonaceous and Ordinary Chondrites
Pasek, M. A.; Smith, V. D.; Lauretta, D. S.; Lunar and Planetary Science XXXV: Carbonaceous Chondrites; 2004; 2 pp.; In English; See also 20040062407
Contract(s)/Grant(s): NAG5-13470; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Phosphorus is important in a number of biochemical molecules, from DNA to ATP. Early life may have depended on meteorites as a primary source of phosphorus as simple dissolution of crustal apatite may not produce the necessary concentration of phosphate. Phosphorus is found in several mineral phases in meteorites. Apatite and other Ca- and Mg phosphate minerals tend to be the dominant phosphorus reservoir in stony meteorites, whereas in more iron-rich or reduced meteorites, the phosphide minerals schreibersite, (Fe, Ni)3P, and perryite, (Ni, Fe)5(Si, P)2 are dominant. However, in CM chondrites that have experienced significant aqueous alteration, phosphorus has been detected in more exotic molecules. A series of phosphonic acids including methyl-, ethyl-, propyl- and butyl- phosphonic acids were observed by GC-MS in Murchison. Phosphorian sulfides are in Murchison and Murray. NMR spectrometry is capable of detecting multiple substances with one experiment, is non-destructive, and potentially quantitative, as discussed below. Despite these advantages, NMR spectrometry is infrequently applied to meteoritic studies due in large part to a lack of applicability to many compounds and the relatively high limit of detection requirements. Carbon-13 solid-state NMR has been applied to macromolecular carbon in Murchison. P-31 NMR has many advantages over aqueous carbon-13 NMR spectrometry. P-31 is the only isotope of phosphorus, and P-31 gives a signal approximately twice as strong as C-13. These two factors together with the relative abundances of carbon and phosphorus imply that phosphorus should give a signal approximately 20 as strong as carbon in a given sample. A discussion on the preparation of the quantitative standard and NMR studies are presented
Derived from text
Carbonaceous Chondrites; Nuclear Magnetic Resonance; Phosphorus; Quantitative Analysis; Biochemistry; Mineralogy

20040062421 Lunar and Planetary Inst., Houston, TX, USA
Lunar and Planetary Science XXXV: Achondrite Mishmash
2004; In English; Lunar and Planetary Sciece XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040062422 - 20040062446
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The session "Achondrite Mishmash" included teh following presentations:Constraining the Formation and Evolution of IAB Irons - High Precision; 40Ar/39Ar Ages on Plagioclase Separates from Silicate Inclusions of the Campo Del Cielo Meteorite; Radiogenic 129-Xenon in Silicate Inclusions in the Campo Del Cielo Iron Meteorite; Significance of Iron Isotope Mineral Fractionation in Pallasite and Iron Meteorites; An Experimental Study of Phosphoran Olivine and Its Significance in Main Group Pallasites; Characterization of the Distribution of Siderophile and Highly Siderophile Elements in the Milton and Eagle Station Pallasites; Relationships Between HED and Mesosiderite Meteorites: An Iron Isotope Perspective; Production Rates for Noble-Gas Isotopes in Eucrites; Evidence for Subsolidus Metasomatism in the Eucrite Parent Body; Possible Contact Metamorphism of the Polymict Eucrite Petersburg; Early and Late Stage Metals and Sulfides in Diogenites; Constraints on the Lithological Variation near the Surface of the HED Planetoid from the Petrology of 91 & 92 Series Antarctic Achondrites; Cosmic Ray Exposure Ages, Ar-Ar Ages, and the Origin and History of Eucrites; Trace Elements Abundances Vs Closure Temperature in Orthopyroxenes from Howardites; The First Mesosiderite-like Clast in a Howardite; 39Ar-40Ar Dating of Unusual Eucrite NWA 011: Is it from Vesta?; Trace Element Systematics of Northwest Africa 011: A "Eucritic" Basalt from a Non-Eucrite Parent Body ; 33S Anomaly in Acapulcoites and Lodranites; Magnetic Force Microscopy of Primitive Achondrites; Experimental Constraints on Ureilite Petrogenesis; Reflectance Spectra of Ureilites: Nature of the Mafic Silicate Absorption Features; Nitrogen and Noble Gases in Two Monomict Ureilites Acfer 277 and FRO 90036 from Hot and Cold Deserts; Solar Noble Gases in the Angrite Parent Body - Evidence from Volcanic Volatiles Trapped in D'Orbigny Glass; Trace Element Distribution Between Phases of the D'Orbigny Angrite ; Petrological

Study of Six Angrites Including New Type; and Manganese-Chromium Isotope Systematics of Basaltic Achondrite Northwest Africa 011.
Derived from text
Achondrites; Meteoritic Composition

20040062422 NASA Johnson Space Center, Houston, TX, USA
Ar-39 - Ar-40 Dating of Unusual Eucrite NWA-011: Is it from Vesta?
Bogard, D. D.; Garrison, D. H.; Lunar and Planetary Science XXXV: Achondrite Mishmash; 2004; 2 pp.; In English; See also 20040062421; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Basaltic meteorite NWA-011 is similar to eucrites in many aspects, but its oxygen isotopic composition lies far off the oxygen fractionation line defined by eucrites. It was suggested that NWA011 may have derived from a different parent body from that of eucrites, which are thought to derive from the asteroid Vesta. Some other eucrites also show small anomalous oxygen compositions. This suggests that for all eucrites to derive from Vesta, it must be compositionally inhomogeneous. Some workers have speculated whether early, large impactors on Vesta might have contributed the anomalous oxygen.
Author
Argon Isotopes; Basalt; Meteorites; Oxygen; Chronology

20040062423 Pavia Univ., Italy
Trace Elements Abundances vs Closure Temperature in Orthopyroxenes from Howardites
Domeneghetti, M. C.; Molin, G. M.; Zema, M.; Tazzoli, V.; Lunar and Planetary Science XXXV: Achondrite Mishmash; 2004; 2 pp.; In English; See also 20040062421; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Howardites are meteorites made up of polymict breccias which are composed of diverse minerals and lithic clasts. Most of the material is identical or very similar to basaltic eucrites, cumulate eucrites and diogenites. Howardites, eucrites and diogenites (the HED meteorite group) are supposed to have been formed by igneous processes on the same parent body, probably asteroid 4 Vesta.
Derived from text
Trace Elements; Abundance; Temperature Dependence; Pyroxenes; Meteoritic Composition

20040062424 Centre National de la Recherche Scientifique, Toulouse, France
Significance of Iron Isotope Mineral Fractionation in Pallasite and Iron Meteorites
Poitrasson, F.; Levasseur, S.; Teutsch, N.; Lunar and Planetary Science XXXV: Achondrite Mishmash; 2004; 2 pp.; In English; See also 20040062421; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Earlier studies of the Fe isotope composition of meteorites, lunar and terrestrial rocks revealed that although significant variations may occur at the grain scale, these isotope signatures are much less variable at the bulk meteorite and planetary scale. Among the Fe isotope variations observed at the mineral scale, Zhu et al. presented two pallasite data showing a metal fraction with consistently heavier iron than that of the coexisting olivine. Given the potential implication this finding might have on our understanding of planetary mantle-core differentiation, we extended this database to other pallasites, iron meteorites and bulk chondrites.
Derived from text
Chondrites; Iron Isotopes; Meteoritic Composition; Planetary Mantles; Stony-Iron Meteorites; Minerals

20040062425 National Inst. of Polar Research, Tokyo, Japan
Possible Contact Metamorphism of the Polymict Eucrite Petersburg
Buchanan, P. C.; Kaiden, H.; Lunar and Planetary Science XXXV: Achondrite Mishmash; 2004; 2 pp.; In English; See also 20040062421; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Calculations suggest that a km-sized spherical laccolith emplaced into the crust of 4 Vesta would have caused contact metamorphism of adjacent rocks for 103-104 years. In contrast, regional metamorphism would have heated the crust for a period of 106-108 years. Heating of underlying material by a lava flow or layer of hot impact ejecta of moderate thickness would have lasted for a period of 1-10 years. Fragments of diogenitic orthopyroxene in the Petersburg polymict eucrite have

edges that are altered to more Fe-rich compositions to a distance of approximately 30 m. These alteration rims are consistent with heating of the breccia to a maximum of 850 C with cooling at 0.16 C/year to 400 C during a period of approximately 3000 years and are similar to effects expected from contact metamorphism.
Derived from text
Metamorphism (Geology); Metamorphic Rocks; Fragmentation; Meteoritic Composition

20040062426 Rutgers Univ., Piscataway, NJ, USA
Constraints on the Lithological Variation near the Surface of the HED Planetoid from the Petrology of 91 & 92 Series Antarctic Achondrites
Bjonnes, Emily E.; Delaney, Jeremy S.; Lunar and Planetary Science XXXV: Achondrite Mishmash; 2004; 2 pp.; In English; See also 20040062421
Contract(s)/Grant(s): NAG5-12148; NAG5-9528; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The petrography of a suite of meteorite sections: PCA91006,14; PCA91078,9; PCA91083,6; PCA91159,4; PCA91179,9; PCA91245,9; EET92003,14; EET92004,12; EET92015,4; EET92022,7; EET92026,4; and EET92027,5 is used as an initial sample of the lithological variation on the surface of the HED planetoid (presumably asteroid 4 Vesta). These samples will be combined with much larger arrays of petrographic data for the many Antarctic basaltic achondrites to provide a random sample of the surface of the body. The full variety of the lithologies existing on the parent body is only accessible when the polymict achondrites are considered. The polymict samples contain lithologies that sample multiple provenances as well as those not seen as monolithologic meteorites like eucrites and diogenites. Comparison of lithological variation within individual meteorites provides a subset of variations at the site of last impact. In aggregate, the variations within the achondrites now available may be close to a random sample of the parent body. In combination of microanalytical and imaging techniques now available permit a mass balanced assessment of the distribution and abundance of lithologies to be made. These initial results provide a description of methodology to be tested. All samples were studied and photographed on a polarizing microscope to provide location information. Major mineral phases and randomly selected points (on lines and grids) were analyzed in each thin section. In addition backscattered electron and X-ray imaging of clasts and sections provide the basis for high precision modal analyses of the abundance and distribution of both lithic and mineral clasts. These data provide objective, area based comparisons with other Antarctic samples.
Derived from text
Petrography; Lithology; Achondrites

20040062427 Massachusetts Inst. of Tech., Cambridge, MA, USA
Experimental Constraints on Ureilite Petrogenesis
Singletary, S. J.; Grove, T. L.; Lunar and Planetary Science XXXV: Achondrite Mishmash; 2004; 2 pp.; In English; See also 20040062421; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We have conducted melting experiments on liquids predicted to be in equilibrium with ureilites to explore the petrogenesis of ureilites by a partial melting/smelting process. Correlations of modal mineralogy, mineral chemistry and texture are consistent with smelting as a major process involved in ureilite petrogenesis. Although ureilites resemble igneous rocks their mode of origin remains controversial. The competing hypotheses include origin as products of fractional crystallization, residues of partial melting, or a nebular origin. Previous experiments provided support for the hypothesis that ureilites are the residues of a partial melting/smelting event that began just as augite was exhausted from the residue. Ureilites are comprised of approx. 90% anhedral olivine and pyroxene and <10% dark interstitial material consisting of a mixture of silicates, carbon, metal, carbides and sulfides.
Derived from text
Ureilites; Petrogenesis; Melting; Crystallization

20040062428 Washington Univ., Saint Louis, MO, USA
Radiogenic Xenon-129 in Silicate Inclusions in the Campo Del Cielo Iron Meteorite
Meshik, A.; Kurat, G.; Pravdivtseva, O.; Hohenberg, C. M.; Lunar and Planetary Science XXXV: Achondrite Mishmash; 2004; 2 pp.; In English; See also 20040062421
Contract(s)/Grant(s): NAG5-12776; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Iron meteorites present a challenge for the I-Xe dating technique because it is usually the inclusions, not metal, that contain radiogenic xenon and iodine. Silicate inclusions are frequent in only types IAB and IIE, and earlier studies of irons have demonstrated that I-Xe system can survive intact in these inclusions preserving valuable age information. Our previous studies of the I-Xe record in pyroxene grains from Toluca iron suggested an intriguing relationship between apparent I-Xe ages and (Mg+Fe)/Fe ratios. The I-Xe system in K-feldspar inclusions from Colomera (IIE) had the fingerprint of slow cooling, with an indicated cooling rate of 2-4 C/Ma. Here we present studies of the iodine-xenon system in a silicate-graphite-metal (SiGrMet) inclusion of the IA Campo del Cielo iron meteorite from the collection of the Museum of Natural History in Vienna.
Derived from text
Xenon 129; Silicates; Inclusions; Radiogenic Materials; Iron Meteorites; Meteoritic Composition

20040062429 Maryland Univ., College Park, MD, USA
Characterization of the Distribution of Siderophile and Highly Siderophile Elements in the Milton and Eagle Station Pallasites
Hillebrand, J. T.; McDonough, W. F.; Walker, R. J.; Piccoli, P. M.; Lunar and Planetary Science XXXV: Achondrite Mishmash; 2004; 2 pp.; In English; See also 20040062421
Contract(s)/Grant(s): NAG5-10425; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We examine the partitioning characteristics of several siderophile elements and HSE in the Eagle Station and Milton pallasites to determine if the D(sup Metal/Silicate) in natural systems are comparable to the range of values determined for synthetic systems. Eagle Station and Milton are particularly appropriate for this type of study because previous studies have shown that bulk samples of these meteorites have much higher abundances of siderophile elements and HSE than bulk samples of main group pallasites or mesosiderites. Thus, the expectation that initiated this study was that the abundances of at least some elements of interest present in the silicate phases may be at levels sufficiently high to be determined via in situ spot analysis using laser ablation ICP-MS.
Derived from text
Siderophile Elements; Characterization; Stony-Iron Meteorites; Protoplanets; Meteoritic Composition

20040062430 Geological Museum, Copenhagen, Denmark
The First Mesosiderite-like Clast in a Howardite
Rosing, M. T.; Haack, H.; Lunar and Planetary Science XXXV: Achondrite Mishmash; 2004; 2 pp.; In English; See also 20040062421; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Mesosiderites and HEDs are two groups of meteorites with close affinities. Both groups plot on the same oxygen isotope fractionation line and breccias from the two groups include silicate fragments that are nearly identical in petrology. The most striking difference between the two groups of meteorites is the occurrence of approximately 50 % metal in mesosiderites. Other features observed in mesosiderites but not in HEDs include the occurrence of some silicate inclusions that are reduced relative to the HEDs, and evidence of late recrystallization - possibly in connection with the introduction of molten metal. Mesosiderites are breccias composed of angular silicate fragments and metal. The silicate fragments in mesosiderites include howardite, eucrite, and diogenite like material. Howardites are breccias composed of eucritic and diogenitic fragments but so far no mesosiderite-like clasts have been reported in a howardite. This has been used as one of several arguments in favor of separate parent bodies for these two closely related groups of meteorites.
Derived from text
Meteoritic Composition; Oxygen Isotopes; Achondrites; Fragments; Inclusions

20040062431 NASA Johnson Space Center, Houston, TX, USA
Cosmic Ray Exposure Ages, Ar-Ar Ages, and the Origin and History of Eucrites
Wakefield, Kelli; Bogard, Donald; Garrison, Daniel; Lunar and Planetary Science XXXV: Achondrite Mishmash; 2004; 2 pp.; In English; See also 20040062421; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

HED meteorites likely formed at different depths on the large asteroid 4-Vesta, but passed through Vesta-derived, km-sized intermediary bodies (Vestoids), before arriving at Earth. Most eucrites and diogenites (and all howardites) are brecciated, and impact heating disturbed or reset the K-Ar ages (and some Rb-Sr ages) of most eucrites in the time period of approx. 3.4 - 4.1 Gyr ago. Some basaltic eucrites and most cumulate eucrites, however, are not brecciated. We recently showed

that the Ar-39 - Ar-40 ages for several of these eucrites tightly cluster about a value of 4.48 +/- 0.02 Gyr, and we argue that this time likely represents a single large impact event on Vesta, which ejected these objects from depth and quenched their temperatures. A different parent body has been suggested for cumulate eucrites, although the Ar-Ar ages argue for a common parent. Similarities in the cosmic-ray (space) exposure ages for basaltic eucrites and diogenites also have been used to infer a common parent body for some HEDs. Here we present CRE ages of several cumulate and unbrecciated basaltic (UB) eucrites and compare these with CRE ages of other HEDs. This comparison also has some interesting implications for the relative locations of various HED types on Vesta and/or the Vestoids.
Author
Cosmic Rays; Argon Isotopes; Meteoritic Composition; Breccia; Achondrites

20040062432 Washington Univ., Saint Louis, MO, USA
Trace Element Systematics of Northwest Africa 011: A "Eucritic" Basalt from a Non-Eucrite Parent Body
Floss, C.; Taylor, L. A.; Promprated, P.; Lunar and Planetary Science XXXV: Achondrite Mishmash; 2004; 2 pp.; In English; See also 20040062421; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Northwest Africa (NWA) 011 was originally classified as a non-cumulate eucrite, albeit one with anomalously high Fe/Mn ratios in pyroxene. However, oxygen isotopic data soon showed that it must have originated on a distinct parent body. We used the Cameca 3f ion microprobe at Washington University to measure the REE and other trace elements in individual grains of plagioclase, pyroxene and phosphate from NWA 011 in order to better understand its origin.
Author
Meteoritic Composition; Basalt; Oxygen Isotopes; Meteorite Parent Bodies

20040062433 Muenster Univ., Germany
Magnetic Force Microscopy of Primitive Achondrites
Rauschenbach, I.; Weber, I.; Stephan, T.; Jessberger, E. K.; Schroeder, C.; Lunar and Planetary Science XXXV: Achondrite Mishmash; 2004; 2 pp.; In English; See also 20040062421; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Scanning probe microscopy (SPM) techniques are currently very popular to examine surface morphologies down to nanometer scale by utilizing different types of interactions between a given surface and a probing sensor. This approach was first introduced by Binnig and Rohrer in 1982 as scanning tunneling microscopy (STM). In the following years, Binnig and Quate enhanced this technique and developed the scanning force microscopy (SFM). By measuring the force between tip and sample, instead of the current as in STM, SFM provides the opportunity to investigate insulating surfaces. Martin and Wickramasinghe introduced magnetic force microscopy (MFM) in 1987 as modification of SFM. MFM has been designed to study magnetic materials on a nanometer scale by detecting magnetic forces or force gradients exerted on a probing tip that is moved over a sample surface. The magnetic forces between tip and surface result in a change of the magnitude (or the phase) of an oscillating cantilever, which eventually provides information about the spatial distribution of the local magnetic properties.
Derived from text
Achondrites; Magnetic Properties; Spatial Distribution

20040062434 California Univ., San Diego, La Jolla, CA, USA
S-33 Anomaly in Acapulcoites and Lodranites
Rai, V. K.; Jackson, T. L.; Thiemens, M. H.; Lunar and Planetary Science XXXV: Achondrite Mishmash; 2004; 2 pp.; In English; See also 20040062421; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Sulfur is a significant constituent of all meteorites. It is not only present in appreciable amounts in meteorites but also has the added advantage of having multiple valance states. Because of its multiple valance states, it occurs in various chemical forms, such as sulfide, sulfate, elemental sulfur, and organic sulfur. Like oxygen, it has more than two stable isotopes that are produced in different stellar environments. Therefore any mass dependent processes (melting, recrystallization, differentiation etc.) can be estimated and corrected for, leaving the scope for detection of any isotopic anomaly produced either due to incomplete mixing of different nucleosynthetic components or mass independent chemical processes in the early solar nebula. Recently, it has been shown that the gas phase photochemical reactions, involving CS2, SO2 and H2S, either in planetary atmospheres or in laboratory experiments, fractionate S isotopes mass independently. The laboratory studies of photochemical

reactions has shown that the sign of mass independent fractionation depends upon the wavelength of UV light. Since meteorites have accreted from grains condensed directly from a cooling nebular gas, potentially in the presence of strong UV light from the proto sun, it is possible that sulfur phases in meteorites might capture a photochemical signature. Therefore, precise measurements of S isotopic compositions of sulfur containing phases in differing meteorites might provide insight into the physicochemical conditions, as well as the photochemical environment in meteorite forming regions. A mass independent sulfur isotopic fractionation has been reported in meteorites such as ureilites, oldhamite in the Norton county aubrite and in a few isolated components in Allende and Murchison. Here we present the sulfur isotopic data for all three sulfur isotopic ratios (delta)S-33, (delta)S-34 and (delta)S-36) for five meteorite samples from the acapulcoite-lodranite group of achondrites.
Derived from text
Sulfur Isotopes; Anomalies; Meteoritic Composition; Photochemical Reactions; Recrystallization

20040062435 NASA Johnson Space Center, Houston, TX, USA
Reflectance Spectra of Ureilites: Nature of the Mafic Silicate Absorption Features
Cloutis, E. A.; Hudon, P.; Lunar and Planetary Science XXXV: Achondrite Mishmash; 2004; 2 pp.; In English; See also 20040062421; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Ureilites are unique carbon-bearing achondrites. They are composed primarily of olivine and pyroxene with minor amounts of finely dispersed matrix material consisting mostly of carbon, metal, sulfides and fine-grained silicates. As is the case with many classes of meteorites, no clear chain of evidence exists which can relate them to specific asteroidal parent bodies. In order to provide insights into parent body connections, visible and near-IR (VNIR) reflectance spectra of a number of ureilites have been measured and analyzed in light of their mineralogy.
Author
Spectral Reflectance; Ureilites; Silicates; Meteorites; Absorption Spectra

20040062436 Physical Research Lab., Ahmedabad, India
Nitrogen and Noble Gases in Two Monomict Ureilites Acfer 277 and FRO 90036 from Hot and Cold Deserts
Rai, V. K.; Murty, S. V. S.; Ott, U.; Lunar and Planetary Science XXXV: Achondrite Mishmash; 2004; 2 pp.; In English; See also 20040062421; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In our continuing effort to understand the nitrogen and noble gas isotope systematics in ureilites, we analyzed bulk samples and acid resistant residues of two monomict ureilites ACFER277 and FRO90036 (henceforth AC277 and FRO36). These two ureilites have been recovered from Sahara desert and Antarctica respectively.
Author
Nitrogen; Ureilites; Acidity; Oxidation Resistance

20040062437 Bern Univ., Bern, Switzerland
Solar Noble Gases in the Angrite Parent Body: Evidence from Volcanic Volatiles Trapped in D'Orbigny Glass
Busemann, H.; Lorenzetti, S.; Eugster, O.; Lunar and Planetary Science XXXV: Achondrite Mishmash; 2004; 2 pp.; In English; See also 20040062421; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Angrites are meteorites that formed particularly early and rapidly during solar system evolution, only approx. 5-10 Ma after the CAIs, and remained mostly unaltered ever since. Angrites are presumably products of igneous processes, although nebular condensation was also suggested. D'Orbigny ("D'O", 16.6 kg) is special in being the first angrite containing abundant glass. As for the bulk angrites, most workers assume an igneous origin for the glass, whereas suggest a nebular origin. Most importantly, D'O glass might contain fossil Cm-247, which could explain unreasonably old Pb-Pb ages. Bulk samples of D'O and Sahara 99555 also show too old Pu-244 - Xe ages.
Derived from text
Solar System Evolution; Radioactive Isotopes; Glass; Rare Gases

20040062438 Iwate Univ., Morioka, Japan
Petrological Study of Six Angrites Including New Type
Yanai, K.; Noda, M.; Lunar and Planetary Science XXXV: Achondrite Mishmash; 2004; 2 pp.; In English; See also 20040062421; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Angrites are one of quite unique type of meteorites belong to achondrites group. Recently five and more meteorites are known as an achondrite angrite(Table). New meteorite specimen 1154 has been identified as an angrite meteorite which consists of aluminous clinopyroxene fassaite, plagioclase and calcic olivine kirschsteinite. The interior of 1154 is very fine grained-homogeneous appearances. Under the polarizing-microscope the sections are characterized by the quite unique texture of a very fine grained-holocrystalline lithology which is showing some liner with irregular patterns of slightly elongated brown pyroxene(fassaite)-clear plagioclase and very well elongated dendritic olivine aggragates(Fig.1a). This unique textual pattern looks like some dendritic textures in some terrestrial igneous rocks.
Derived from text
Pyroxenes; Petrology; Meteoritic Composition; Lithology; Achondrites; Olivine; Meteorites

20040062439 Max-Planck-Inst. fuer Chemie, Mainz, Germany
Manganese-Chromium Isotope Systematics of Basaltic Achondrite Northwest Africa 011
Bogdanovski, O.; Lugmair, G. W.; Lunar and Planetary Science XXXV: Achondrite Mishmash; 2004; 2 pp.; In English; See also 20040062421; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Northwest Africa (NWA) 011 is an unusual basaltic achondrite with an anomalous Fe/Mn ratio. It was initially classified as a non-cumulate eucrite based on mineralogy, texture and major element composition. Subsequent studies of trace elements, REE and oxygen isotopes suggested that NWA 011 is different from eucrites and probably derived from a unique parent body. It was even proposed that this meteorite might possibly come from Mercury. Already for this reason alone it was deemed important to study the Cr isotope systematics in NWA 011 since it was shown that a gradient exists in the 53Cr/52Cr ratio obtained in various solar system bodies with their heliocentric distances. Based on Mn-Cr isotope systematics of a bulk NWA 011 sample we have shown earlier that this meteorite is not related to the HED parent body [5]. We have also demonstrated that NWA 011 is a differentiation product from a relatively large parent body, which is related to CI (or CR?) chondrites.
Derived from text
Achondrites; Basalt; Chromium Isotopes; Manganese Isotopes; Meteorites; Mineralogy; Oxygen Isotopes

20040062440 Wien Univ., Austria
Trace Element Distribution Between Phases of the D'Orbigny Angrite
Kurat, G.; Varela, M. E.; Zinner, E.; Hoppe, P.; Ntaflos, T.; Nazarov, M.; Lunar and Planetary Science XXXV: Achondrite Mishmash; 2004; 2 pp.; In English; See also 20040062421; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The shape, structure and texture of D'Orbigny and its mineral and bulk chemical compositions indicate a genesis under changing redox conditions, more akin to chondritic than to planetary differentiated rocks. Our data and observations are incompatible with an igneous origin for this rock as entertained. Thus, D'Orbigny turns out to be the Rosetta Stone of angritic achondrites. Here we report the results of trace element (TE) studies of major and minor phases which support our previous conclusions.
Derived from text
Achondrites; Chemical Composition; Trace Elements; Oxidation-Reduction Reactions; Meteoritic Composition

20040062441 Berkeley Geochronology Center, CA, USA
Constraining the Formation and Evolution of IAB Irons: High Precision Ar-40/Ar-39 Ages on Plagioclase Separates from Silicate Inclusions of the Campo Del Cielo Meteorite
Vogel, N.; Renne, P. R.; Lunar and Planetary Science XXXV: Achondrite Mishmash; 2004; 2 pp.; In English; See also 20040062421; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In order to better constrain the history of IAB iron meteorites, we will present the first high precision Ar-40/Ar-39 ages on different grain size separates of pure plagioclase from silicate inclusions of the Campo del Cielo IAB iron meteorite. These measurements are performed in the framework of a larger study of IAB irons including also Ocotillo, Caddo County and Landes inclusions. Comparing the age information contained by the inclusions of the different meteorites will help elucidating the formation and thermal history of the IAB parent body, which is not yet agreed on.
Derived from text
Iron Meteorites; Silicates; Grain Size

20040062442 Rutgers Univ., Piscataway, NJ, USA

An Experimental Study of Phosphoran Olivine and Its Significance in Main Group Pallasites

Boesenberg, J. S.; Ebel, D. S.; Hewins, R. H.; Lunar and Planetary Science XXXV: Achondrite Mishmash; 2004; 2 pp.; In English; See also 20040062421; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Experiments were conducted to investigate the occurrence and stability of phosphoran olivine. Phosphoran olivine is rare in nature, but has been found in four Main Group pallasites: Springwater, Brahin, Rawlinna and Zaisho. Some olivine crystals within these pallasites contain regions of phosphoran olivine that have between 3 and 5 wt% P2O5, where phosphorus substitutes for silicon in the tetrahedral site of the olivine structure. The formation of phosphoran olivine has been interpreted as subsolidus reaction between olivine and phosphorus-bearing metal. However, subsolidus growth of phosphoran olivine is not consistent with existing phase diagrams or experimentally determined partitioning, which shows that phosphorus in olivine typically is present only at the level of tens to a few hundreds parts per million. The distribution coefficient for phosphorus in olivine in equilibrium with a melt is only 0.02-0.04. Texturally, phosphoran olivine in pallasites appears as a rim along the edge of a normal olivine crystal, however sharp contacts always exist between phosphoran and "normal" regions. Phosphoran regions as large as 200 microns wide and several millimeters long have been noted.

Derived from text

Phosphorus; Olivine; Stony-Iron Meteorites; Crystals; Stability; Silicon

20040062443 New Mexico Univ., Albuquerque, NM, USA

Production Rates for Noble-Gas Isotopes in Eucrites

Reedy, R. C.; Kim, K. J.; Lunar and Planetary Science XXXV: Achondrite Mishmash; 2004; 2 pp.; In English; See also 20040062421; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

To get cosmic-ray exposure ages of meteorites from measured concentrations of cosmic-ray-produced ("cosmogenic") noble-gas isotopes, production rates for those isotopes are needed. The best production rates take into consideration the composition of the meteorite and the "shielding" of the sample (the pre-atmospheric size and shape of the meteoroid and the sample s location in the meteoroid). For ordinary chondrites, there have been many sets of measurements to establish production systematics. The Ne-22/Ne-21 is often used to help to get shielding-dependent production rates. We report here numerical simulations for the production of isotopes of the light noble gases He, Ne, and Ar in both basaltic and cumulate eucrites for several sizes.

Author

Isotopes; Rare Gases; Meteoritic Composition

20040062444 Washington Univ., Seattle, WA, USA

Evidence for Subsolidus Metasomatism in the Eucrite Parent Body

McCallum, I. Stewart; Schwartz, Jeffrey M.; Mullen, Emily K.; Lunar and Planetary Science XXXV: Achondrite Mishmash; 2004; 2 pp.; In English; See also 20040062421

Contract(s)/Grant(s): NAG5-11587; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The eucrite parent body (4Vesta) was continuously and rapidy resurfaced by basaltic lavas that formed the non-cumulate eucrites. Ophitic and variolitic textures have been preserved even though eucrites exhibit varying degrees of equilibration based on the extent of thermal metamorphism. Types range from least metamorphosed (type 1) to most metamorphosed (type 7) based in part on the interpretation of textures and compositional zoning profiles within pigeonitic pyroxenes. To provide constraints on the source and duration of the heating event responsible for metamorphism we have investigated primary and secondary textural and compositional relations in noncumulate eucrites with emphasis on subsolidus textures developed in pyroxenes. We have studied examples of most metamorphic types including Pasamonte (type 2) Stannern (4), Nuevo Laredo (4), Juvinas (5), Lakangaon (5), Millbillillie (6), Palo Blanco Creek (7), Jonzac (7), Haraiya (7), along with the cumulate eucrites Moama and Moore County.

Derived from text

Metamorphism (Geology); Meteoritic Composition; Basalt; Heating; Lava

20040062445 Museum of Natural History, London, UK

Relationships Between HED and Mesosiderite Meteorites: An Iron Isotope Perspective

Mullane, E.; Russell, S. S.; Gounelle, M.; Mason, T. F. D.; Lunar and Planetary Science XXXV: Achondrite Mishmash; 2004; 2 pp.; In English; See also 20040062421; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The HED meteorite group broadly comprise: (a) cumulate, pyroxene-rich diogenites, (b) plagioclase-pigeonite bearing basaltic/gabbroic eucrites, and (c) impact brecciated polymict howardites. Geochemical, petrologic and isotopic data indicate that the HEDs derive from a single parent body, possibly asteroid 4 Vesta. Mesosiderites are breccias and comprise basaltic silicates (orthopyroxene, plagioclase and olivine) and HED-like lithic clasts (diogenites, cumulate and basaltic eucrites, and dunites) mixed with metallic FeNi-metal. The favoured mechanism of mesosiderite formation is by impact-mixing of silicates and metal and textural evidence suggests that the metal component was mainly molten when mixing occurred. The origin of the silicate portion of mesosiderites is debated. Some researchers believe that the silicates are genetically related to the achondritic HED meteorites. We examined the variation of iron isotopes within the HED meteorites, with a view to ascertaining the variation (if any) in Fe-56 and Fe-57 and the effect (if any) of magmatic (diogenites and eucrites) and impact processing (howardites) within an asteroidal setting. The fractionation systematics of mesosiderites were than investigated to determine their relationship to HED meteorites.

Derived from text

Geochemistry; Iron Isotopes; Meteoritic Composition; Iron Meteorites

20040062446 Arizona Univ., Tucson, AZ, USA

Early and Late Stage Metals and Sulfides in Diogenites

Sideras, L. C.; Domanik, K. J.; Lauretta, D. S.; Lunar and Planetary Science XXXV: Achondrite Mishmash; 2004; 2 pp.; In English; See also 20040062421

Contract(s)/Grant(s): NAG5-12795; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Diogenites are typically highly brecciated orthopyroxenites that contain 84-100 vol.% orthopyroxene. Common accessory minerals include olivine, chromite, Ca-pyroxene, plagioclase, silica, troilite and Fe-Ni metal. Metal and sulfides are minor phases in diogenites with an average abundance of < 1 vol.% and 0-2 vol.% respectively. However their presence is important, as they could provide information on T-fO2-fS2 conditions and the evolution of the diogenite parent magma during crystallization and/or later metamorphism. We have examined the occurrence of Fe-Ni metal and sulfides in thin sections of several diogenites including, Johnstown, Manegaon, Roda, Shalka, Bilanga, and Tatahouine using optical microscopy and the electron microprobe. Here, we describe three features of metals and sulfides that are common in most of these diogenites. These are: i) The widespread occurrence of pentlandite associated with copper and copper sulfide minerals; ii) Textural evidence that at least some of the metal and sulfide occurring interstitially between, and as inclusions within, orthopyroxene formed from an early immiscible sulfide-oxide liquid; iii) That this sulfide- oxide liquid subsequently fractionated into assemblages containing either Fe-Ni metal, troilite, and chromite or pentlandite, troilite, and copper-bearing sulfide.

Author

Meteoritic Composition; Sulfides; Nickel; Iron

20040062499 Lunar and Planetary Inst., Houston, TX, USA

Lunar and Planetary Science XXXV: Missions and Instruments: Hopes and Hope Fulfilled

2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040062500 - 20040062535

Contract(s)/Grant(s): NCC5-679

Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The titles in this section include: 1) Mars Global Surveyor Mars Orbiter Camera in the Extended Mission: The MOC Toolkit; 2) Mars Odyssey THEMIS-VIS Calibration; 3) Early Science Operations and Results from the ESA Mars Express Mission: Focus on Imaging and Spectral Mapping; 4) The Mars Express/NASA Project at JPL; 5) Beagle 2: Mission to Mars - Current Status; 6) The Beagle 2 Microscope; 7) Mars Environmental Chamber for Dynamic Dust Deposition and Statics Analysis; 8) Locating Targets for CRISM Based on Surface Morphology and Interpretation of THEMIS Data; 9) The Phoenix Mission to Mars; 10) First Studies of Possible Landing Sites for the Phoenix Mars Scout Mission Using the BMST; 11) The 2009 Mars Telecommunications Orbiter; 12) The Aurora Exploration Program - The ExoMars Mission; 13) Electron-induced Luminescence and X-Ray Spectrometer (ELXS) System Development; 14) Remote-Raman and Micro-Raman Studies of Solid CO2, CH4, Gas Hydrates and Ice; 15) The Compact Microimaging Spectrometer (CMIS): A New Tool for In-Situ Planetary

Science; 16) Preliminary Results of a New Type of Surface Property Measurement Ideal for a Future Mars Rover Mission; 17) Electrodynamic Dust Shield for Solar Panels on Mars; 18) Sensor Web for Spatio-Temporal Monitoring of a Hydrological Environment; 19) Field Testing of an In-Situ Neutron Spectrometer for Planetary Exploration: First Results; 20) A Miniature Solid-State Spectrometer for Space Applications - Field Tests; 21) Application of Laser Induced Breakdown Spectroscopy (LIBS) to Mars Polar Exploration: LIBS Analysis of Water Ice and Water Ice/Soil Mixtures; 22) LIBS Analysis of Geological Samples at Low Pressures: Application to Mars, the Moon, and Asteroids; 23) In-Situ 1-D and 2-D Mapping of Soil Core and Rock Samples Using the LIBS Long Spark; 24) Rocks Analysis at Stand Off Distance by LIBS in Martian Conditions; 25) Evaluation of a Compact Spectrograph/Detection System for a LIBS Instrument for In-Situ and Stand-Off Detection; 26) Analysis of Organic Compounds in Mars Analog Samples; 27) Report of the Organic Contamination Science Steering Group; 28) The Water-Wheel IR (WIR) - A Contact Survey Experiment for Water and Carbonates on Mars; 29) Mid-IR Fiber Optic Probe for In Situ Water Detection and Characterization; 30) Effects of Subsurface Sampling & Processing on Martian Simulant Containing Varying Quantities of Water; 31) The Subsurface Ice Probe (SIPR): A Low-Power Thermal Probe for the Martian Polar Layered Deposits; 32) Deploying Ground Penetrating Radar in Planetary Analog Sites to Evaluate Potential Instrument Capabilities on Future Mars Missions; 33) Evaluation of Rock Powdering Methods to Obtain Fine-grained Samples for CHEMIN, a Combined XRD/XRF Instrument; 34) Novel Sample-handling Approach for XRD Analysis with Minimal Sample Preparation; 35) A New Celestial Navigation Method for Mars Landers; 36) Mars Mineral Spectroscopy Web Site: A Resource for Remote Planetary Spectroscopy.
CASI
Spacecraft Instruments; Planetology; Mars Missions

20040062500 Malin Space Science Systems, San Diego, CA, USA
Mars Global Surveyor Mars Orbiter Camera in the Extended Mission: The MOC Toolkit
Malin, M.; Edgett, K.; Cantor, B.; Caplinger, M.; Davis, S.; Jensen, E.; Lipkaman, L.; Nixon, B.; Posiolova, L.; Sandoval, J., et al.; Lunar and Planetary Science XXXV: Missions and Instruments: Hopes and Hope Fulfilled; 2004; 2 pp.; In English; See also 20040062499; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Mars Global Surveyor (MGS) extended mission began 1 February 2001. A second extension authorized operations through 1 October 2004. A 3rd extension, through December 2006, is being considered. The Mars Orbiter Camera (MOC) has acquired more than 165,000 narrow angle (NA) and wide angle (WA) images over a period spanning > 3 Mars years. This paper documents the basic MOC 'toolkit' - the types of images and data acquisition techniques used in the extended mission. The MOC investigation was described by Malin et al.. Malin and Edgett gave a summary of operations through the primary mission.
Author
Mars Global Surveyor; Cameras; Data Acquisition

20040062503 Los Alamos National Lab., NM, USA
Field Testing of an In-Situ Neutron Spectrometer for Planetary Exploration: First Results
Lawrence, D. J.; Elphic, R. C.; Vaniman, D. T.; Feldman, W. C.; Wiens, R. C.; Lunar and Planetary Science XXXV: Missions and Instruments: Hopes and Hope Fulfilled; 2004; 2 pp.; In English; See also 20040062499; Original contains color illustrations
Contract(s)/Grant(s): NASA Order W-19902; NASA Order W-10217; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

As part of an ongoing effort to demonstrate the utility of using in-situ neutron spectroscopy to measure water content on planetary surfaces, we have developed a field site for carrying out neutron spectroscopy measurements. Specifically, our objectives in developing the field site are: 1) Demonstrate in-situ neutron measurements in a realistic field test scenario; 2) Demonstrate our ability to accurately model neutron measurements for various conditions and identify measurement factors that need to be controlled and/or accounted for such as detailed stratigraphy; 3) Provide a field test location for future in-situ neutron measurements using a variety of instrument and soil configurations.
Derived from text
Field Tests; In Situ Measurement; Neutron Spectrometers; Space Exploration; Mars Roving Vehicles

20040062504 Massachusetts Inst. of Tech., Cambridge, MA, USA
Mid-IR Fiber Optic Probe for In Situ Water Detection and Characterization
Garrick-Bethell, I.; Thomson, M. A.; Melling, P. J.; Lunar and Planetary Science XXXV: Missions and Instruments: Hopes

and Hope Fulfilled; 2004; 2 pp.; In English; See also 20040062499; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Mid-IR fiber optic probes offer a flexible sampling geometry with access to the important spectral range between 2 and 10 microns. Spectra of soils and rocks at these wavelengths offer a wealth of information about the presence of water and other volatiles. Other fiber optic probes for near-IR and Raman spectroscopy are under development [1,2], but their sensitivity to some important species is lower than what can be attained with the mid-IR. For example, the near-IR region (typically up to 2.5 microns) samples overtones of water vibrations, and does not capture the stronger fundamental modes that appear in the mid-IR. In Raman systems the selection rules are different, and polar bond vibrations such as O-H and N-H do not appear strongly in the spectrum. Using the greater sensitivity of the mid-IR spectral range, hydrated minerals, adsorbed water, and very low amounts of water ice can be detected and characterized. The mid-IR probe used in this study is made from chalcogenide glass optical fiber, which is the most technically mature type of mid-IR fiber, and fully covers the fundamental O-H stretch region where other solid mid-IR fibers do not [3]. It has low mass, uses minimal power, operates under low temperatures, and can be coupled to most FTIR spectrometers. In order to characterize the instrument s performance in detecting low levels of water and OH, spectra of 6 samples were collected. microns, for 5 minutes, with a wavelength resolution of 4/cm. Spectra are obtained in absorbance mode by taking the ratio of the single-beam spectrum against an air background with the probe head approximately 2-3 mm above the sample. All samples except the dry ice were at room temperature, approximately 20deg C. The lab air spectrum was collected in "double pass" transmittance mode by reflecting the signal from a polished aluminum surface approximately 5 mm from the probe head.
Derived from text

Fiber Optics; Infrared Radiation; Raman Spectroscopy; Probes; Near Infrared Radiation; Rocks

20040062506 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

The Mars Express/NASA Project at JPL

Thompson, T. W.; Horttor, R. L.; Acton, C. H., Jr.; Arroyo, B.; Barbieri, A. J.; Zamani, P.; Johnson, W. T. K.; Plaut, J. J.; Holmes, D. P.; No, S.; Lunar and Planetary Science XXXV: Missions and Instruments: Hopes and Hope Fulfilled; 2004; 1 pp.; In English; See also 20040062499; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

ESA's Mars Express Mission is an international collaboration between the European Space Agency (ESA) and the European space agencies with the National Aeronautics and Space Administration (NASA) as a junior partner. The primary objective of the mission is to conduct a search for potential hydrologic resources from orbit and on the surface of Mars. Launch was from Baikonur, Kazakhstan on June 2, 2003; arrival at Mars was on December 25, 2003.
Derived from text

Mars Express; NASA Space Programs; Space Missions; Mars Surface

20040062507 European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands

The Aurora Exploration Program: The ExoMars Mission

Kminek, G.; Vago, J. L.; Lunar and Planetary Science XXXV: Missions and Instruments: Hopes and Hope Fulfilled; 2004; 1 pp.; In English; See also 20040062499; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In the framework of the Aurora Exploration Program, the European Space Agency (ESA) plans to launch the ExoMars mission in 2009. ExoMars will deploy a high-mobility rover on the Martian surface, carrying a comprehensive suite of scientific instruments the Pasteur payload whose objectives will be to search for traces of past and present life, and to identify surface hazards to future human missions. Although the final programmatic decision concerning ExoMars will only be taken in late 2004, at the next ESA Ministerial Conference, to be able to meet the 2009 launch opportunity, the payload definition activities must begin now. ESA issued a Call for Ideas for scientific instruments and investigations to be performed by the ExoMars mission on 14. February 2003. Out of the 50 proposals received, 22 were ranked better then Very Good in the first peer review that took place in fall 2003. The ExoMars scientific objectives are: 1) To search for signs of past and present life on Mars by deploying a mobile exobiology instrumentation package on the Martian surface and performing in-situ soil sample analysis; 2) To identify and characterize possible hazards to human exploration (e.g. ionizing radiation, dust); and 3) To enhance the knowledge of the Martian environment. The ExoMars mission will build on existing know-how, and provide Europe with enhanced capability in the following areas: 1) Landing of large payloads on the surface of Mars; 2) Solar electric power application on the surface of Mars; 3) Mars surface mobility; and 4) Rendezvous in Mars orbit; a specific technological objective is to demonstrate rendezvous operations in a representative environment by means of a Rendezvous Experiment

(RVE). This experiment is a key element to validate the Rendezvous and Docking Technology required for the Mars Sample return Mission.
Derived from text
Auroras; Exobiology; Mars Surface; Mars Roving Vehicles; Mars Sample Return Missions; NASA Space Programs

20040062508 NASA Ames Research Center, Moffett Field, CA, USA
Evaluation of Rock Powdering Methods to Obtain Fine-grained Samples for CHEMIN, a Combined XRD/XRF Instrument
Chipera, S. J.; Vaniman, D. T.; Bish, D. L.; Sarrazin, P.; Feldman, S.; Blake, D. F.; Bearman, G.; Bar-Cohen, Y.; Lunar and Planetary Science XXXV: Missions and Instruments: Hopes and Hope Fulfilled; 2004; 2 pp.; In English; See also 20040062499; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A miniature XRD/XRF (X-ray diffraction / X-ray fluorescence) instrument, CHEMIN, is currently being developed for definitive mineralogic analysis of soils and rocks on Mars. One of the technical issues that must be addressed to enable remote XRD analysis is how best to obtain a representative sample powder for analysis. For powder XRD analyses, it is beneficial to have a fine-grained sample to reduce preferred orientation effects and to provide a statistically significant number of crystallites to the X-ray beam. Although a two-dimensional detector as used in the CHEMIN instrument will produce good results even with poorly prepared powder, the quality of the data will improve and the time required for data collection will be reduced if the sample is fine-grained and randomly oriented. A variety of methods have been proposed for XRD sample preparation. Chipera et al. presented grain size distributions and XRD results from powders generated with an Ultrasonic/Sonic Driller/Corer (USDC) currently being developed at JPL. The USDC was shown to be an effective instrument for sampling rock to produce powder suitable for XRD. In this paper, we compare powder prepared using the USDC with powder obtained with a miniaturized rock crusher developed at JPL and with powder obtained with a rotary tungsten carbide bit to powders obtained from a laboratory bench-scale Retsch mill (provides benchmark mineralogical data). These comparisons will allow assessment of the suitability of these methods for analysis by an XRD/XRF instrument such as CHEMIN.
Author
Mars Surface Samples; Rocks; Powder (Particles); Samplers

20040062509 NASA Ames Research Center, Moffett Field, CA, USA
Novel Sample-handling Approach for XRD Analysis with Minimal Sample Preparation
Sarrazin, P.; Chipera, S.; Bish, D.; Blake, D.; Feldman, S.; Vaniman, D.; Bryson, C.; Lunar and Planetary Science XXXV: Missions and Instruments: Hopes and Hope Fulfilled; 2004; 2 pp.; In English; See also 20040062499; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Sample preparation and sample handling are among the most critical operations associated with X-ray diffraction (XRD) analysis. These operations require attention in a laboratory environment, but they become a major constraint in the deployment of XRD instruments for robotic planetary exploration. We are developing a novel sample handling system that dramatically relaxes the constraints on sample preparation by allowing characterization of coarse-grained material that would normally be impossible to analyze with conventional powder-XRD techniques.
Author
Samples; Powder (Particles); X Ray Diffraction; Planetary Geology

20040062511 European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands
Early Science Operations and Results from the ESA Mars Express Mission: Focus on Imaging and Spectral Mapping
Martin, P. D.; Zegers, T.; Pischel, R.; Lunar and Planetary Science XXXV: Missions and Instruments: Hopes and Hope Fulfilled; 2004; 2 pp.; In English; See also 20040062499; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Mars Express orbiter went into Mars orbit as planned on 25 December 2003 and has started delivering the first scientific measurements and results. High-resolution, down to nearly 10 m/pixel (HRSC) and 2 m/pixel (SRC), stereo color images are being processed following the preliminary data acquisition, as well as high-resolution spectral data from the OMEGA imaging spectrometer. Other instruments, PFS, SPICAM, and ASPERA are taking measurements as well in the early orbits of the Mars Express mission, and radio science data are being collected using both ESA New Norcia and NASA DSN

ground stations. The status of the mission is briefly given below, followed by a description of the scientific goals and planning focused on the imaging and mapping spectrometer data.
Author
Mars Express; Planetary Mapping; Thematic Mapping; Imaging Spectrometers

20040062512 NASA Johnson Space Center, Houston, TX, USA
Beagle 2: Mission to Mars - Current Status
Gibson, E. K., Jr.; Pillinger, C. T.; Wright, I. P.; Morgan, G. H.; Yau, D.; Stewart, J. L. C.; Leese, M. R.; Praine, I. J.; Sheridan, S., et al.; Lunar and Planetary Science XXXV: Missions and Instruments: Hopes and Hope Fulfilled; 2004; 2 pp.; In English; See also 20040062499; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Beagle 2 is a 72 kg probe (with a 32 kg lander) developed in the UK for inclusion on the European Space Agency's 2003 Mars Express. Beagle 2 was launched on June 2, 2003 with Mars Express on a Soyuz-Fregat rocket from the Baikonur Cosmodrome in Kazakhstan. Beagle 2 landed on Mars on December 25th, 2003 in Isidis Planitia (approx. 10.7 N and 268.6 W), a large sedimentary basin that overlies the boundary between ancient highlands and northern plains. Isidis Planitia, the third largest impact basin on Mars, which is possibly filled with sediment deposited at the bottom of long-standing lakes or seas, offers an ideal environment for preserving traces of life. The team is awaiting signals from the Beagle 2 lander at the time when this abstract was written. Current status of the mission will be reported. Beagle 2 was developed to search for organic material and other volatiles on and below the surface of Mars in addition to the study of the inorganic chemistry and mineralogy. Several fundamental properties can be used to determine the existence of an active or past biology on any planet, Earth or Mars. Beagle 2's targets for investigation included: (a) The presence of water, or the existence of minerals deposited from water to show that water was present, even if only transiently; (b) The detection of carbonaceous debris, the remains of organisms that might have lived in water or were washed to a final resting place by the action of water; (c) The structure of organic matter, to demonstrate that it might have been synthesized for a biological purpose; (d) The recognition of isotopic fractionation between carbonaceous phases (organic vs inorganic carbon phases), a condition which on Earth suggests that life emerged nearly 4 billion years ago.
Author
Mars Missions; Spacecraft Instruments; Instrument Packages

20040062513 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Mars Environmental Chamber for Dynamic Dust Deposition and Statics Analysis
Moeller, L. E.; Tuller, M.; Islam, M. R.; Baker, L.; Kuhlman, K.; Lunar and Planetary Science XXXV: Missions and Instruments: Hopes and Hope Fulfilled; 2004; 1 pp.; In English; See also 20040062499; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Recent observations of the 2001 dust storms encircling Mars confirm predictions of environmental challenges for exploration. Martian dust has been found to completely mantle the Martian surface over thousands of square kilometers and the opacity of airborne dust has been shown to be capable of modifying atmospheric temperature, radiative transfer and albedo. Planetary dust cycling dynamics are suggested to be a key factor in the evolution of the Martian surface. Long-term robotic and manned exploration of Mars will be confronted by dust deposition in periods of atmospheric calm and violent wind storms. Aeolian dust deposition recorded during the Mars Pathfinder mission was estimated to fall at rates of 20-45 microns per Earth year. Although many tools of exploration will be challenged by coating, adhesion, abrasion and possible chemical reaction of deposited, wind blown and actively disturbed Martian dust, solar cells are thought to be of primary concern. Recent modeling work of power output by gallium arsenide/germanium solar cells was validated by the Pathfinder Lander data and showed power output decreases of 0.1 to 0.5% per Martian day. A major determinant for the optimal positioning angle of solar panels employed in future missions is the angle of repose of the settling dust particles that is dependent on a variety of physical and chemical properties of the particles, the panel surface, and the environmental conditions on the Mars surface. While the effects of many of these factors are well understood qualitatively, quantitative analyses, especially under physical and chemical conditions prevailing on the Mars surface are lacking.
Derived from text
Mars Environment; Statics; Dust Storms; Mars Surface; Manned Mars Missions; Test Chambers; Deposition

20040062514 Los Alamos National Lab., NM, USA
LIBS Analysis of Geological Samples at Low Pressures: Application to Mars, the Moon, and Asteroids
Cremers, D. A.; Sevostiyanova, E. V.; Gibson, L.; Wiens, R. C.; Lunar and Planetary Science XXXV: Missions and

Instruments: Hopes and Hope Fulfilled; 2004; 2 pp.; In English; See also 20040062499; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Recently, LIBS (Laser-Induced Breakdown Spectroscopy) has been proposed as a new method for elemental analysis in space exploration with Mars specifically targeted. There are many reasons for this including rapid analysis (less than 2 min.), in-situ and stand-off analysis (less than 20 meters) capability, and the ability to readily combine LIBS with other spectroscopic methods (Raman, fluorescence) that provide data complementary to LIBS. In comparison with past and current elemental analysis methods used on planetary surfaces, these capabilities of LIBS should greatly increase the scientific return from future missions. We are characterizing the LIBS method for space exploration applications with emphasis on analysis at reduced pressures (approximately equal to 7 Torr CO2 for Mars) and near vacuum (50 mTorr for asteroids and the Moon; at pressures below about 50 mTorr no significant changes in the plasma are observed). This characterization is important because the excitation properties of the LIBS plasma are strongly dependent on pressure of the surrounding atmosphere. Topics addressed include: (1) calibration curves and detection limits for major and minor elements of interest to geochemistry at the two lower pressures as well as atmospheric pressure (for comparison), (2) using short (less than 22 cm for in-situ) and medium length (4 m for stand-off) light paths for analysis, and (3) characterization of the LIBS plasma at different pressures.
Derived from text

Laser-Induced Breakdown Spectroscopy; Moon; Mars Surface; Planetary Geology; Low Pressure; Asteroids

20040062515 Los Alamos National Lab., NM, USA

In-Situ 1-D and 2-D Mapping of Soil Core and Rock Samples Using the LIBS Long Spark

Rodolfa, K. T.; Cremers, D. A.; Ebinger, M. H.; Lunar and Planetary Science XXXV: Missions and Instruments: Hopes and Hope Fulfilled; 2004; 2 pp.; In English; See also 20040062499; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

LIBS is being developed for stand-off interrogation of samples up to 20 m from a lander or rover. Stand-off capability is important to access targets not conveniently located for in-situ analysis. On the other hand, in-situ techniques are still important and are being developed for future missions such as MSL. Retrieved samples may consist of loose soils, subsurface soil cores, drilled rock cores, and ice cores. For these sample types, it is possible to employ LIBS analysis and take advantage of LIBS capabilities. These include (1) rapid analysis, (2) good detection sensitivity for many elements, (3) good spatial resolution (3-100 microns), and (4) ability to clean a surface prior to analysis. Using LIBS, it possible to perform a 1-dimensional analysis, for example, determining element concentrations along a soil core, or a 2- dimensional mapping of the sample surface using a unique "long" spark. Two-dimensional sampling has been developed previously by focusing the laser pulses as small spots on the sample and then moving the sample a short distance between sampling locations. Although demonstrated, this method is time consuming, requiring a large number of shots to span even a small region (for 3 micron resolution, an area 600 x 480 microns sampled in approximately equal to 30 min using a 20 Hz laser). For a spacecraft instrument, the ability to more rapidly prepare a 2D elemental spatial map will be desirable. Here we discuss the use of LIBS for sampling along a core in 1D (detection of carbon) and for 2D mapping of a rock face.
Derived from text

Laser-Induced Breakdown Spectroscopy; Sparks; In Situ Measurement; Core Sampling; Igneous Rocks; Soil Mapping

20040062516 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

A Miniature Solid-State Spectrometer for Space Applications: Field Tests

Smythe, W. D.; Johnson, E; Lunar and Planetary Science XXXV: Missions and Instruments: Hopes and Hope Fulfilled; 2004; 2 pp.; In English; See also 20040062499; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A solid state infrared spectrometer has been developed under the Planetary Instrument Definition and Development Program PIDDP to implement a small rugged spectrometer principally for landed applications. The instrument uses the high index of refraction and waveguide properties of a silicon slab to achieve good spectral resolution and high throughput in a small instrument footprint (less than 25 cm). Light enters the silicon slab and is reflected off a grating (Ebert configuration), utilizing the silicon index of refraction to achieve high dispersion. An array of microthermopiles is used to measure the amplitude of the dispersed light. Input optics are typically utilized to focus light on the input aperture and a chopper is used to compensate system drift.
Derived from text

Infrared Spectrometers; Miniaturization

20040062517 Los Alamos National Lab., NM, USA

Application of Laser Induced Breakdown Spectroscopy (LIBS) to Mars Polar Exploration: LIBS Analysis of Water Ice and Water Ice/Soil Mixtures

Arp, Z. A.; Cremers, D. A.; Wiens, R. C.; Lunar and Planetary Science XXXV: Missions and Instruments: Hopes and Hope Fulfilled; 2004; 2 pp.; In English; See also 20040062499; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The polar regions of Mars are of great interest due to the presence of water ice and CO2 ice combined with wind blown deposits. Due to seasonal changes and repeated cycles of precipitating dusts and H2O, geological samples appear to have built up in the polar regions. These polar layered deposits (PLD) may include volcanic ash, fallout from surface impacts, evaporates from subliming lakes and seas, and even wind blown ancient microbial life[1]. The ability to examine the PLDs will be of great importance in the study of past Martian geological history and the determination of the past presence of life on Mars. Analysis of the ice fields which are present in the polar regions of Mars will almost certainly be of great interest to future surface rovers and landers to this region. The use of LIBS will maximize the scientific return of these missions. Through the development of a compact sensor head and a pan and tilt mechanism, analysis of PLD may be made in areas that are otherwise inaccessible to either a lander or a surface rover. This gives LIBS a significant advantage over other analysis techniques which require more than just optical access. Also, through the use of repetitive laser pulses it will be possible to ablate away the water ice layer to better examine the PLDs which exist below the surface. Another potential use for LIBS is the analysis of retrieved ice core samples. Laser pulses formed along the length of the ice core can monitor composition as a function of depth. This method has already been shown to work for mineral drill cores and terrestrial ice cores using laser ablation ICPMS.
Derived from text

Mars Surface; Polar Regions; Ice; Soils; Water; Laser-Induced Breakdown Spectroscopy; Laser Ablation

20040062518 NASA Johnson Space Center, Houston, TX, USA

Effects of Subsurface Sampling & Processing on Martian Simulant Containing Varying Quantities of Water

Menard, J.; Sangillo, J.; Savain, A.; McNamara, K. M.; Lunar and Planetary Science XXXV: Missions and Instruments: Hopes and Hope Fulfilled; 2004; 2 pp.; In English; See also 20040062499; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The presence of water-ice in the Martian subsurface is a subject of much debate and excited speculation. Recent results from the gammaray spectrometer (GRS) on board NASA's Mars Odyssey spacecraft indicate the presence of large amounts of hydrogen in regions of predicted ice stability. The combination of chemistry, low gravitational field (3.71 m/s(exp 2)) and a surface pressure of about 6.36 mbar at the mean radius, place limits on the stability of H2O on the surface, however, results from the GRS indicate that the hydrogen rich phase may be present at a depth as shallow as one meter in some locations on Mars. The potential for water on Mars leads directly to the speculation that life may once have existed there, since liquid water is the unifying factor for environments known to support life on Earth. Lubricant-free drilling has been considered as a means of obtaining water-rich subsurface samples on Mars, and two recent white papers sponsored by the Mars Program have attempted to identify the problems associated with this goal. The two major issues identified were: the engineering challenges of drilling into a water-soil mixture where phase changes may occur; and the potential to compromise the integrity of in-situ scientific analysis due to contamination, volatilization, and mineralogical or chemical changes as a result of processing. This study is a first attempt to simulate lubricantfree drilling into JSC Mars-1 simulant containing up to 50% water by weight. The goal is to address the following: 1) Does sample processing cause reactions or changes in mineralogy which will compromise the interpretation of scientific measurements conducted on the surface? 2) Does the presence of water-ice in the sample complicate (1)? 3) Do lubricant-free drilling and processing leave trace contaminants which may compromise our understanding of sample composition? 4) How does the torque/power required for drilling change as a function of water content and does this lead to unexpected thermal effects?
Author (revised)

Planetary Crusts; Water; Drilling; Simulation; Mars Surface

20040062520 Commissariat a l'Energie Atomique, Gif-sur-Yvette, France

Rocks Analysis at Stand Off Distance by LIBS in Martian Conditions

Lacour, J. L.; Salle, B.; Fichet, P.; Vors, E.; Fabre, C.; Dubessy, J.; Maurice, S.; Wiens, R. C.; Cremers, D. A.; Lunar and Planetary Science XXXV: Missions and Instruments: Hopes and Hope Fulfilled; 2004; 2 pp.; In English; See also 20040062499; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The research project called MALIS (Mars Analysis by Laser-Induced breakdown Spectroscopy) aims at producing a LIBS

facility allowing rocks and soils analysis on Mars at stand off distance up to 10 or ideally 20 m. The capability of LIBS to perform a sample analysis at different distances was previously shown. Basically, the LIBS technique uses a pulsed laser beam focused on a sample surface. With sufficient power, the laser ablates the material, producing atoms and ions in an excited state, resulting in a visible spark. This one is characteristic of the elements present in the material. Light emission recording allows the qualitative and the quantitative elemental analysis. Up to now the technique needs a pre calibration in order to obtain quantitative data. But some works indicated that even with a lack of calibration quantitative results can be obtained. Our previous works studied different parameters (laser energy, atmospheric pressure, ...) that are of importance (laser energy, atmospheric pressure,...) to control the quality of the measurements in Martian conditions. With those optimized parameters, some analytical results were obtained and will be presented.
Derived from text
Laser-Induced Breakdown Spectroscopy; Mars Surface; Igneous Rocks; Quantitative Analysis; Distance

20040062521 Arizona Univ., Tucson, AZ, USA
The Phoenix Mission to Mars
Smith, P. H., et al.; Lunar and Planetary Science XXXV: Missions and Instruments: Hopes and Hope Fulfilled; 2004; 2 pp.; In English; See also 20040062499; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Phoenix mission was selected in August 2003 as the first Scout mission to Mars. The ground rules for this Scout opportunity require missions to launch in 2007 and meet a cost cap of $325M in fiscal year 2003 dollars that encompasses all mission costs including the launch vehicle, an education program, and a healthy reserve. Scouts are principal investigator (PI) led missions like those of the Discovery program; Peter Smith is the PI for the Phoenix mission. Barry Goldstein has been designated the project manager at JPL and Lockheed Martin has the contract to build, integrate, and test the spacecraft. Phoenix derives its name from the mythological bird that is reborn from the embers of its former incarnation. Appropriately, the Phoenix spacecraft is the Mars Surveyor 2001 (MSP) spacecraft that resides in the Lockheed Martin highbay in Denver. It was placed in storage after cancellation in 2000 following the loss of Mars Polar Lander (MPL). The payload derives heritage from the MPL and MSP developments, but has been optimized and tailored to its new mission: studying the history of water contained in the near surface ice recently discovered in the northern plains.
Derived from text
Launch Vehicles; Mars Polar Lander; Mars Missions

20040062522 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Berlin, Germany
First Studies of Possible Landing Sites for the Phoenix Mars Scout Mission Using the BMST
Helbert, J.; Benkhoff, J.; Lunar and Planetary Science XXXV: Missions and Instruments: Hopes and Hope Fulfilled; 2004; 2 pp.; In English; See also 20040062499
Contract(s)/Grant(s): DFG-BE-1630/2; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The 2007 Phoenix Mars Scout will land at a site between 65 degrees and 75 degrees N, where the Gamma Ray Spectrometer (GRS) on Mars Odyssey (MO) observed near-surface ground ice. The main selection criterion for the landing site is the high probability for the presence of ice as determined by GRS data. However the spatial resolution of the GRS data is extremely coarse with a footprint of about 600km. To increasing the probability of finding near surface ice deposits at the landing site an extensive modeling effort is necessary. One of Phoenix science goals is to search for clues to the origin of the ice. The magnitude of the ice signature seen by Mars Odyssey is difficult to explain by a diffusive model. We have therefore just started to use the BMST (Berlin Mars near Surface Thermal model) to study the stability of ice deposits over long periods of time in the planned landing area of Phoenix. This allows to test the hypothesis of the ice being a remnant of a once large ice cap. The modeling, especially the data on surface and subsurface temperature distribution, volatile transport and ice abundance can support the landing site selection process. We have also started to consider the implications for the existence and extend of habitable zones in the subsurface.
Derived from text
Landing Sites; Mars Missions; Mars Surface; Ice; NASA Space Programs

20040062523 Northwestern Univ., Evanston, IL, USA
Locating Targets for CRISM Based on Surface Morphology and Interpretation of THEMIS Data
Nogeire, K.; Robinson, M. S.; Lunar and Planetary Science XXXV: Missions and Instruments: Hopes and Hope Fulfilled;

2004; 2 pp.; In English; See also 20040062499; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Compact Reconnaissance Imaging Spectrometer for Mars (CRISM) is one of several instruments on the Mars Reconnaissance Orbiter (MRO) to be launched in August 2005. Data from the CRISM spectrometer will be used to globally map the geology, composition and stratigraphy of Mars at a scale of 200 m/pixel. CRISM's overarching objective is to search for evidence of aqueous and hydrothermal deposits. CRISM is also able to acquire high resolution local area spectra at approximately 20 m/pixel. A list of targets of high science value is being complied based on all available data. Unraveling local geology requires spectral measurements of local rocks. Therefore, CRISM has the greatest possibility of sending back information describing local geology by targeting locations with exposed rock (bedrock or boulders close to their source). The most imposing obstacle to accomplishing this objective is the ubiquitous fine-grained dust that covers nearly all of the surface. The goal of this work is to identify exposed rock in many diverse regions on the martian surface.
Derived from text
Imaging Spectrometers; Planetary Geology; Reconnaissance; Geomorphology; Mars Surface

20040062525 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Analysis of Organic Compounds in Mars Analog Samples
Mahaffy, P. R.; Brinckerhoff, W. B.; Buch, A.; Cabane, M.; Coll, P.; Demick, J.; Glavin, D. P.; Lunar and Planetary Science XXXV: Missions and Instruments: Hopes and Hope Fulfilled; 2004; 2 pp.; In English; See also 20040062499; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The detailed characterization of organic compounds that might be preserved in rocks, ices, or sedimentary layers on Mars would be a significant step toward resolving the question of the habitability and potential for life on that planet. The fact that the Viking gas chromatograph mass spectrometer (GCMS) did not detect organic compounds should not discourage further investigations since (a) an oxidizing environment in the near surface fines analyzed by Viking is likely to have destroyed many reduced carbon species; (b) there are classes of refractory or partially oxidized species such as carboxylic acids that would not have been detected by the Viking GCMS; and (c) the Viking landing sites are not representative of Mars overall. These factors motivate the development of advanced in situ analytical protocols to carry out a comprehensive survey of organic compounds in martian regolith, ices, and rocks. We combine pyrolysis GCMS for analysis of volatile species, chemical derivatization for transformation of less volatile organics, and laser desorption mass spectrometry (LDMS) for analysis of elements and more refractory, higher-mass organics. To evaluate this approach and enable a comparison with other measurement techniques we analyze organics in Mars simulant samples.
Derived from text
Mars Surface Samples; Organic Compounds; Rocks; Pyrolysis; Planetary Geology; Ice

20040062526 Washington Univ., Saint Louis, MO, USA
The Water-Wheel IR (WIR): A Contact Survey Experiment for Water and Carbonates on Mars
Wang, Alian; Haskin, Larry A.; Freeman, John; Dong, Edward X.; Kuebler, Karla E.; Lunar and Planetary Science XXXV: Missions and Instruments: Hopes and Hope Fulfilled; 2004; 2 pp.; In English; See also 20040062499; Original contains color illustrations
Contract(s)/Grant(s): NAG5-12114; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Minimum requirements for life include water and accessible carbon. Mars has both in its polar caps and atmosphere. Water (or water-equivalent hydrogen) is present at shallow depths (approx. 10-20 cm) at latitudes =60 and is heterogeneously distributed in other parts of Mars [1]. Mars may have once had surface water that could plausibly have produced carbonate deposits [2-5]. Mars shows signs of hydrothermal activity [6-8] that may have affected soil composition [9, 10]. The Thermal Emission Spectrometer on the Mars Global Surveyor found large and small patches of hematite that may have been water-borne or water-derived [11, 12]. Current orbiting spacecraft (MGS & Odyssey) have not found massive carbonate deposits, however [13]. Shales and limestones, which we associate with moist and benign environments on Earth, are apparently not abundant on Mars. Both carbonate and organic carbon occur as alteration products in Martian meteorites of igneous origin [14]. One study of MGS-TES data suggests 2-5 wt% carbonates (mainly MgCO3) in surface dust, but found no concentrated source [15]. Carbonates and H2O/OH bearing minerals will be sought by the mini-TES and Mossbauer experiments on the Mars Exploration Rovers, one of which landed successfully on Mars on January 3.
Derived from text
Water Wheels; Carbonates; Mars Surface; Surface Water

20040062527 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Report of the Organic Contamination Science Steering Group

Mahaffy, P. R.; Beaty, D. W.; Anderson, M. S.; Aveni, G.; Bada, J. L.; Clemett, S. J.; DesMaris, D. J.; Douglas, S.; Dworkin, J. P.; Kern, R. G., et al.; Lunar and Planetary Science XXXV: Missions and Instruments: Hopes and Hope Fulfilled; 2004; 2 pp.; In English; See also 20040062499; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The exploration of the possible emergence and duration of life on Mars from landed platforms requires attention to the quality of measurements that address these objectives. In particular, the potential impact of terrestrial contamination on the measurement of reduced carbon with sensitive in situ instruments must be addressed in order to reach definitive conclusions regarding the source of organic molecules. Following the recommendation of the Mars Exploration Program Analysis Group (MEPAG) at its September 2003 meeting [MEPAG, 2003], the Mars Program Office at NASA Headquarters chartered the Organic Contamination Science Steering Group (OCSSG) to address this issue. The full report of the six week study of the OCSSG can be found on the MEPAG web site [1]. The study was intended to define the contamination problem and to begin to suggest solutions that could provide direction to the engineering teams that design and produce the Mars landed systems. Requirements set by the Planetary Protection Policy in effect for any specific mission do not directly address this question of the potential interference from terrestrial contaminants during in situ measurements.

Derived from text

Contaminants; Extraterrestrial Life; Mars Exploration; In Situ Measurement; Carbon

20040062528 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

The Subsurface Ice Probe (SIPR): A Low-Power Thermal Probe for the Martian Polar Layered Deposits

Cardell, G.; Hecht, M. H.; Carsey, F. D.; Engelhardt, H.; Fisher, D.; Terrell, C.; Thompson, J.; Lunar and Planetary Science XXXV: Missions and Instruments: Hopes and Hope Fulfilled; 2004; 2 pp.; In English; See also 20040062499; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The distinctive layering visible in images from Mars Global Surveyor of the Martian polar caps, and particularly in the north polar cap, indicates that the stratigraphy of these polar layered deposits may hold a record of Martian climate history covering millions of years. On Earth, ice sheets are cored to retrieve a pristine record of the physical and chemical properties of the ice at depth, and then studied in exacting detail in the laboratory. On the Martian north polar cap, coring is probably not a practical method for implementation in an autonomous lander. As an alternative, thermal probes that drill by melting into the ice are feasible for autonomous operation, and are capable of reasonable approximations to the scientific investigations performed on terrestrial cores, while removing meltwater to the surface for analysis. The Subsurface Ice Probe (SIPR) is such a probe under development at JPL. To explore the dominant climate cycles, it is postulated that tens of meters of depth should be profiled, as this corresponds to the vertical separation of the major layers visible in the MOC images [1]. Optical and spectroscopic analysis of the layers, presumably demarcated by embedded dust and possibly by changes in the ice properties, would contribute to the construction of a chronology. Meltwater analysis may be used to determine the soluble chemistry of the embedded dust, and to monitor gradients of atmospheric gases, particularly hydrogen and oxygen, and isotopic variations that reflect atmospheric conditions at the time the layer was deposited. Thermal measurements can be used to determine the geothermal gradient and the bulk mechanical properties of the ice.

Derived from text

Ice; Mars Surface; Probes; Climate; Chronology; Planetary Geology; Spectroscopic Analysis; Stratigraphy

20040062530 Hawaii Univ., Honolulu, HI, USA

Remote-Raman and Micro-Raman Studies of Solid CO2, CH4, Gas Hydrates and Ice

Sharma, S. K.; Misra, A. K.; Lucey, P. G.; Exarhos, G. J.; Windisch, C. F., Jr.; Lunar and Planetary Science XXXV: Missions and Instruments: Hopes and Hope Fulfilled; 2004; 2 pp.; In English; See also 20040062499

Contract(s)/Grant(s): NAG5-13101; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

It is well known that on Mars CO2 is the principal constituent of the thin atmosphere and on a seasonal basis CO2 snow and frost coats the polar caps. Also over 25% of the Martian atmosphere freezes out and sublimes again each year. The Mars Odyssey Emission Imaging system (THEMIS) has discovered water ice exposed near the edge of Mars southern perennials cap. In recent years, it has been suggested that in Martian subsurface CO2 may exist as gas hydrate (8CO2 + 44 H2O) with melting temperature of 10C. Since the crust of Mars has been stable for enough time there is also a possibility that methane formed by magmatic processes and/or as a byproduct of anaerobic deep biosphere activity to have raised toward the planet

s surface. This methane would have been captured and stored as methane hydrate, which concentrates methane and water. Determination of abundance and distribution of these ices on the surface and in the near surface are of fundamental importance for understanding Martian atmosphere, and for future exploration of Mars. In this work, we have evaluated feasibility of using remote Raman and micro-Raman spectroscopy as potential nondestructive and non-contact techniques for detecting solid CO2, CH4 gas, and gas hydrates as well as water-ice on planetary surfaces.
Derived from text
Imaging Techniques; Planetary Surfaces; Raman Spectroscopy; Remote Sensing; Planetary Composition

20040062531 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Sensor Web for Spatio-Temporal Monitoring of a Hydrological Environment
Delin, K. A.; Jackson, S. P.; Johnson, D. W.; Burleigh, S. C.; Woodrow, R. R.; McAuley, M.; Britton, J. T.; Dohm, J. M.; Ferre, T. P. A.; Ip, Felipe, et al.; Lunar and Planetary Science XXXV: Missions and Instruments: Hopes and Hope Fulfilled; 2004; 2 pp.; In English; See also 20040062499; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Sensor Web is a macroinstrument concept that allows for the spatio-temporal understanding of an environment through coordinated efforts between multiple numbers and types of sensing platforms, including, in its most general form, both orbital and terrestrial and both fixed and mobile. Each of these platforms, or pods, communicates within its local neighborhood and thus distributes information to the instrument as a whole. The result of sharing and continual processing of this information among all the Sensor Web elements will result in an information flow and a global perception of and reactive capability to the environment. As illustrated, the Sensor Web concept also allows for the recursive notion of a web of webs with individual distributed instruments possibly playing the role of a single node point on a larger Sensor Web instrument. In particular, the fusion of inexpensive, yet sophisticated, commercial technology from both the computation and telecommunication revolutions has enabled the development of practical, fielded, and embedded in situ systems that have been the focus of the NASA/JPL Sensor Webs Project (http://sensorwebs.jpl.nasa.gov/). These Sensor Webs are complete systems consisting of not only the pod elements that wirelessly communicate among themselves, but also interfacing and archiving software that allows for easy use by the end-user. Previous successful deployments have included environments as diverse as coastal regions, Antarctica, and desert areas. The Sensor Web has broad implications for Earth and planetary science and will revolutionize the way experiments and missions are conceived and performed. As part of our current efforts to develop a macrointelligence within the system, we have deployed a Sensor Web at the Central Avra Valley Storage and Recovery Project (CAVSARP) facility located west of Tucson, AZ. This particular site was selected because it is ideal for studying spatio-temporal phenomena and for providing a test site for more sophisticated hydrological studies in the future.
Derived from text
Hydrology; World Wide Web; Measuring Instruments; Spatial Distribution; Remote Sensors; Earth Sciences

20040062534 National Air and Space Museum, Washington, DC, USA
Deploying Ground Penetrating Radar in Planetary Analog Sites to Evaluate Potential Instrument Capabilities on Future Mars Missions
Williams, K. K.; Grant, J. A.; Schutz, A. E.; Leuschen, C. J.; Lunar and Planetary Science XXXV: Missions and Instruments: Hopes and Hope Fulfilled; 2004; 2 pp.; In English; See also 20040062499; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Over the past 30 years, the number of applications for ground penetrating radar (GPR) has increased dramatically, leading to GPR being an invaluable tool for efficient, non-intrusive investigation of subsurface structure and properties [1-3]. GPR has been used on Earth to address a variety of geological, archaeological, and engineering problems. Typical GPR operation involves pulling an antenna across the ground, sending a radar signal into the subsurface, and collecting the returned signal to reveal information about the dielectric properties and structure of subsurface materials and interfaces. Terrestrial GPRs operate over a large frequency range from less than 2 MHz to ~1.5 GHz, depending on the desired depth of penetration and resolution where lower frequencies penetrate deeper at lesser resolution. Penetration depth also depends on material properties, but GPRs operating between 100 and 1000 MHz can often penetrate up to 10-20 m. This frequency range is between the lower frequencies of airborne and orbital radar sounders [4-6] and the higher frequencies of airborne and orbital imaging radars [7,8] and is effective in constraining near surface geologic structure and setting. The ability to reveal subsurface structure remotely without drilling or excavating has proven economical and even invaluable in some applications on Earth and would add a new

dimension to rover-based investigations on Mars, the Moon, or other solar system bodies.
Derived from text
Airborne Radar; Ground Penetrating Radar; Nonintrusive Measurement; Imaging Techniques; Penetration

20040062535 Mount Holyoke Coll., South Hadley, MA, USA
Mars Mineral Spectroscopy Web Site: A Resource for Remote Planetary Spectroscopy
Dyar, M. D.; Schaefer, M. W.; Griswold, J. L.; Hanify, K. M.; Rothstein, Y.; Lunar and Planetary Science XXXV: Missions and Instruments: Hopes and Hope Fulfilled; 2004; 2 pp.; In English; See also 20040062499; Original contains color illustrations
Contract(s)/Grant(s): NAG5-10424; NAG5-12848; NAG5-12687; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A web site dedicated to Mars Mineral Spectroscopy has been established at http://www.mtholyoke.edu/go/mars. Its goal is to provide an easily accessible data set of Mossbauer spectra of minerals collected over a range of temperatures, to provide suitable analog spectra for data acquired on remote surfaces such as Mars. Complementing these data (eventually) will be both reflectance FTIR data, collected at Brown University's RELAB facility, and Raman spectra to be collected by Jill Pasteris at Washington University St. Louis. Through our Education link, we provide information for those wishing to learn about how Mossbauer and other types of spectroscopy work. Our emphasis is to study only well-characterized mineral samples that represent typical rock-forming occurrences such as might exist on Mars and other terrestrial bodies in our solar system.
Author
Mars (Planet); Planetary Geology; Astronomical Spectroscopy; Mineralogy; Websites

20040062536 Lunar and Planetary Inst., Houston, TX, USA
Lunar and Planetary Science XXXV: Weird Martian Minerals: Complex Mars Surface Processes
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040062537 - 20040062549
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The session "Complex Mars Surface" included the following reports:A Reappraisal of Adsorbed Superoxide Ion as the Cause Behind the Reactivity of the Martian Soils; Sub-Surface Deposits of Hydrous Silicates or Hydrated Magnesium Sulfates as Hydrogen Reservoirs near the Martian Equator: Plausible or Not?; Thermal and Evolved Gas Analysis of Smectites: The Search for Water on Mars; Aqueous Alteration Pathways for K, Th, and U on Mars; Temperature Dependence of the Moessbauer Fraction in Mars-Analog Minerals; Acid-Sulfate Vapor Reactions with Basaltic Tephra: An Analog for Martian Surface Processes; Iron Oxide Weathering in Sulfuric Acid: Implications for Mars; P/Fe as an Aquamarker for Mars; Stable Isotope Composition of Carbonates Formed in Low-Temperature Terrestrial Environments as Martian Analogs; Can the Phosphate Sorption and Occlusion Properties Help to Elucidate the Genesis of Specular Hematite on the Mars Surface?; Sulfate Salts, Regolith Interactions, and Water Storage in Equatorial Martian Regolith; Potential Pathways to Maghemite in Mars Soils: The Key Role of Phosphate; and Mineralogy, Abundance, and Hydration State of Sulfates and Chlorides at the Mars Pathfinder Landing Site.
Derived from text
Mars Surface; Mineralogy

20040062537 Los Alamos National Lab., NM, USA
Sub-Surface Deposits of Hydrous Silicates or Hydrated Magnesium Sulfates as Hydrogen Reservoirs near the Martian Equator: Plausible or Not?
Fialips, C. I.; Carey, J. W.; Vaniman, D. T.; Feldman, W. C.; Bish, D. L.; Mellon, M. T.; Lunar and Planetary Science XXXV: Weird Martian Minerals: Complex Mars Surface Processes; 2004; 2 pp.; In English; See also 20040062536; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Neutron maps obtained using the neutron spectrometer (NS) and the high-energy neutron detector aboard the Mars Odyssey spacecraft reveal variations in the concentration of hydrogen over the martian low to middle latitudes, with up to approximately 10 wt% water-equivalent hydrogen in some equatorial regions. Infrared spectroscopic data provide evidence of chemically and/or physically bound H2O and/or OH. Likewise, the decrease in flux of epithermal neutrons in Arabia Terra and southwest of Olympus Mons has been attributed to enhanced concentration of waterbearing minerals in the subsurface.

The near-surface martian regolith is expected to contain both unweathered and weathered materials. It may contain significant and heterogeneously distributed amounts of hydrous minerals, such as clays, zeolites, and/or salt hydrates, such as MgSO4(raised dot)nH2O. Experimental studies suggest that if such water-bearing minerals formed in the past on the martian surface, they may retain significant amounts of water under present martian surface conditions. Hydrous minerals could thus account for some or all of the water observed in the martian regolith by Odyssey. Our study uses surface P-T data to predict regions of stability and the hydration state of selected waterbearing minerals from low to middle latitudes and to identify the nature and amount of hydrous minerals that could possibly account for the water observed by NS.
Derived from text
Hydrates; Hydrogen; Magnesium Sulfates; Mars Surface; Mineral Deposits; Equatorial Regions; Planetary Geology

20040062538 Hawaii Univ., Honolulu, HI, USA
Aqueous Alteration Pathways for K, Th, and U on Mars
Stopar, J. D.; Taylor, G. J.; Boynton, W.; Lunar and Planetary Science XXXV: Weird Martian Minerals: Complex Mars Surface Processes; 2004; 2 pp.; In English; See also 20040062536; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

K, U, and Th are important elements for deciphering the evolution of a planetary crust and mantle. Th and U behave similarly in magmas and concentrate in residual glass, phosphates, zircon, and other minor minerals. K resides in feldspar and glass. Mars Odyssey Gamma Ray Spectrometer (MO GRS) data show that the K/Th ratio varies considerably over the martian surface [1]. Some of this variation might be caused by aqueous processes.
Derived from text
Planetary Crusts; Phosphates; Mars Surface; Magma; Feldspars

20040062539 Louisiana State Univ., Baton Rouge, LA, USA
Temperature Dependence of the Moessbauer Fraction in Mars-Analog Minerals
Schaefer, M. W.; Dyar, M. D.; Rothstein, Y.; Hanify, Kylie M.; Griswold, J. L.; Lunar and Planetary Science XXXV: Weird Martian Minerals: Complex Mars Surface Processes; 2004; 2 pp.; In English; See also 20040062536; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Moessbauer spectrometers are being used on the martian Athena rovers to identify and quantify relative amounts of Fe-bearing minerals, as well as to determine their Fe3+/Fe2+ ratios, allowing more realistic modeling of martian mineralogy and evolution. But successful attainment of these values from the data acquired on the Mars surface is not possible using present data on the Moessbauer spectra of likely minerals. The accurate analysis of these data requires (among other data) knowledge of the fundamental Moessbauer parameters needed to correct Moessbauer peak areas. We present here the first results from a broader initiative to determine the intrinsic isomer, or center shift (d.), the characteristic Moessbauer temperature (Theta(sub M)), and the recoilless fraction (f) of a suite of Mars-analog minerals.
Derived from text
Minerals; Mossbauer Effect; Mars Surface; Mineralogy; Gamma Rays; Temperature Dependence

20040062540 Arizona State Univ., Tempe, AZ, USA
Mineralogy, Abundance, and Hydration State of Sulfates and Chlorides at the Mars Pathfinder Landing Site
Zolotov, M. Y.; Kuzmin, R. O.; Shock, E. L.; Lunar and Planetary Science XXXV: Weird Martian Minerals: Complex Mars Surface Processes; 2004; 2 pp.; In English; See also 20040062536; Original contains color illustrations
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Detection of elevated concentrations of S and Cl at the landing sites of Viking 1 and 2 [1], and Mars Pathfinder (MP) [2-5] reveals the presence of sulfates and chlorides in soil and rock samples [1-10]. These data are consistent with the findings of Ca sulfates and NaCl in Martian meteorites [11,12], and with Earth-based spectroscopic observations [13,14] tentatively indicating the presence of sulfates on Mars. Although the correlation of S and Mg in Viking and MP samples could reveal the occurrence of Mg sulfate [1-10], the mineralogy of sulfates and chlorides remains unclear.
Derived from text
Mineralogy; Hydration; Abundance; Sulfates; Chlorides; Soil Sampling; Rocks

20040062541 Yale Univ., New Haven, CT, USA

P/Fe as an Aquamarker for Mars

Greenwod, J. P.; Blake, R. E.; Barron, V.; Torrent, J.; Lunar and Planetary Science XXXV: Weird Martian Minerals: Complex Mars Surface Processes; 2004; 2 pp.; In English; See also 20040062536; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Here we outline a simple chemical proxy for the action of past water on the Martian surface that can be measured by MER APXS. Sorption of P by iron oxyhydroxides in aqueous solution is a well-known property of these materials, and we use this important process, and its chemical signature, as an indicator of water on the Martian surface. Our basic approach is to: 1) identify chemical indicators for the sorption of P by iron oxyhydroxides that are measurable by APXS, and 2) determine how materials such as specular hematite, palagonite, and basalt may be affected by the process of P sorption under putative Martian conditions. Results on specular hematite and palagonite (JSC Mars-1 simulant) are presented separately.

Author

Aqueous Solutions; Chemical Indicators; Chemical Reactions; Water; Mars Surface

20040062542 State Univ. of New York, Stony Brook, NY, USA

A Reappraisal of Adsorbed Superoxide Ion as the Cause Behind the Reactivity of the Martian Soils

Hurowitz, J. A.; Tosca, N. J.; McLennan, S. M.; Lindsley, D. H.; Schoonen, M. A. A.; Lunar and Planetary Science XXXV: Weird Martian Minerals: Complex Mars Surface Processes; 2004; 2 pp.; In English; See also 20040062536; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

It has been suggested that oxygen release from the Martian soils, detected during the Viking Gas Exchange (GEX) soil humidification and wetting experiments [1], can be attributed to reactions between water and superoxide (O2) radicals adsorbed on mineral surfaces [2]. A number of chemical compounds which could be responsible for the unusual reactivity of the Martian soils have been proposed [3], however the mechanism of Yen et al. [2] is particularly appealing given its simple requirements of "ultraviolet (UV) photons, atmospheric oxygen, mineral grain surfaces, and extremely low concentrations of water vapor", all of which are present at the Martian surface. Although experimental work relevant to the presence of adsorbed superoxides in the Martian soils has been performed [2, 4], it is unclear whether the conditions of these experiments are applicable to the Martian surface environment. We have therefore performed a number of additional experiments to test the "superoxide mechanism" under conditions relevant to Mars.

Derived from text

Soils; Humidity; Gas Exchange; Wetting; Mars Surface; Adsorption

20040062543 Lockheed Martin Space Operations, Houston, TX, USA

Thermal and Evolved Gas Analysis of Smectites: The Search for Water on Mars

Lauer, H. V., Jr.; Ming, D. W.; Golden, D. C.; Morris, R. V.; Lunar and Planetary Science XXXV: Weird Martian Minerals: Complex Mars Surface Processes; 2004; 2 pp.; In English; See also 20040062536; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The theme of NASA s Mars Exploration Program is to "follow the water." Water has important implications in the search for life, climate evolution, evolution of the Martian surface and interior, and preparing for human exploration. The two Viking Landers detected small amounts of water (e.g., 1-2 wt. %) in the surface materials [1]. However, it is not known how the water is incorporated into these materials. From Viking data, it appears that most of the water evolved between 350 and 500deg C. It was difficult to interpret the water data in terms of mineralogy because of the uncertainty of the Viking GC-MS measurements; the large temperature increases between evolved gas analysis (150deg C) precluded obtaining an accurate temperature for evolution of water, and there are a large number of candidate minerals that may evolve water in this temperature range. Water evolved between 350 and 500 C indicates that the water is structurally bound. A variety of minerals may evolve water in this region, including phyllosilicates, iron oxyhydroxides, some sulfates (e.g., Fe and Al sulfates), and hydrated glass (e.g., palagonites, hydrated amorphous Si).

Derived from text

Amorphous Silicon; Gas Analysis; Surface Properties; Mars Surface; Mineralogy; Iron

20040062544 Hernandez Engineering, Inc., Houston, TX, USA

Acid-Sulfate Vapor Reactions with Basaltic Tephra: An Analog for Martian Surface Processes

Golden, D. C.; Ming, D. W.; Morris, R. V.; Lunar and Planetary Science XXXV: Weird Martian Minerals: Complex Mars

Surface Processes; 2004; 2 pp.; In English; See also 20040062536; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Sulfur is a major chemical component of the Martian surface materials and is thought to have a volcanic origin. Pathfinder and Viking chemical analyses give SO3 concentrations for soil and dust in the range approx. 4-7 wt. % [1,2]. Although we know that S is chemically important, we do not know its speciation. Small amounts of sulfates (e.g., Ca and Mg sulfates) and sulfides (e.g., pyrrhotite, pyrite) have been identified in SNC meteorites [3]; however, sulfates have not been detected from remote spectral measurements. A variety of Fe-bearing sulfates (e.g., jarosite, schwertmannite) have been suggested as possible phases that might have formed under oxidative, acidic weathering conditions at the surface of Mars [4-7]. Other possible sulfate-bearing phases that might have formed at the surface include Al, Ca, and Mg sulfates.

Derived from text

Sulfates; Sulfur Oxides; Chemical Analysis; Chemical Composition; Mars Surface; Sulfur

20040062545 Los Alamos National Lab., NM, USA

Sulfate Salts, Regolith Interactions, and Water Storage in Equatorial Martian Regolith

Vaniman, D. T.; Chipera, S. J.; Bish, D. L.; Carey, J. W.; Fialips, C. I.; Feldman, W. C.; Lunar and Planetary Science XXXV: Weird Martian Minerals: Complex Mars Surface Processes; 2004; 2 pp.; In English; See also 20040062536; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Neutron spectrometer data from the Odyssey Mars Orbiter provide evidence of water abundances up to approx. 10 wt% in regolith to a depth of approx. 1 m in some near-equatorial locations on Mars [1]. Water ice is unstable in these locations, suggesting that some of this water may be present in hydrous silicates (clays or zeolites) or hydrated salts [2,3]. Viking chemical analyses of excavated duricrust indicate that Mg and S are correlated and approx. 10% MgSO4 (anhydrous weight) is a likely cementing agent [4]. Pathfinder chemical data support a similar abundance of MgSO4 in the most altered materials [5]. However, there are many possible Mg-sulfates with widely varying hydration states. On Earth, the only common members of this series are epsomite (7-hydrate; 51 wt% water), hexahydrite (6-hydrate; 47 wt% water), and kieserite (monohydrate; 13 wt% water). Occurrences on Mars may be very different; intermediate hydrates such as pentahydrite (5-hydrate, 43 wt% water), starkeyite (4- hydrate; 37 wt% water), a possible 3-hydrate (no mineral name; 31 wt% water), and sanderite (2-hydrate; 23 wt% water) could be present. Important to this study as well is gypsum (CaSO4 2H2O; 21 wt% water). Complexity in martian salts is suggested by lesser but significant amounts of Cl. In addition the Mg-S correlation in Viking and especially Pathfinder data is weak, and other cations (Mn, Fe, Co, Ni, Cu, Zn) that readily substitute for Mg in the MgSO4 series could be present in the sulfate salts. These are important points to consider, but here we focus on other complicating factors, particularly potential regolith-salt interactions that may influence sulfate mineralogy in martian regolith.

Derived from text

Equatorial Regions; Magnesium Sulfates; Regolith; Mars Surface; Neutron Spectrometers

20040062546 Cordoba Univ., Cordoba, Spain

Potential Pathways to Maghemite in Mars Soils: The Key Role of Phosphate

Barron, V.; Torrent, J.; Lunar and Planetary Science XXXV: Weird Martian Minerals: Complex Mars Surface Processes; 2004; 2 pp.; In English; See also 20040062536; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Maghemite is considered to be a firm candidate to account for the magnetic behavior of Mars soils [1]. The need thus exists to establish the physical and geochemical conditions that may have favored its formation on the red planet. Maghemite rarely abounds in terrestrial soils, where it forms mainly by (a) thermal transformation of goethite and ferrihydrite in the presence of organic matter, (b) oxidation of biogenic magnetite, (c) oxidation of lithogenic magnetite, and (d) dehydroxylation of lepidocrocite [2]. Because pathways (a) and (b) require the presence of significant amounts of organic matter, they can in principle be dismissed for Mars. Pathway (c) is possible since the Martian environment is oxidizing and (titano)magnetite is a likely constituent of Mars rocks [3]. Finally, pathway (d) requires the prior formation of lepidocrocite.

Derived from text

Phosphates; Iron Oxides; Soils; Organic Materials; Mars Surface; Magnetite; Planetary Geology

20040062547 NASA Johnson Space Center, Houston, TX, USA

Stable Isotope Composition of Carbonates Formed in Low-Temperature Terrestrial Environments as Martian Analogs

Socki, Richard A.; Gibson, Everett K., Jr.; Perry, Eugene C., Jr.; Galindo, Charles; Golden, D. C.; Ming, Douglas W.; McKay, Gordon A.; Lunar and Planetary Science XXXV: Weird Martian Minerals: Complex Mars Surface Processes; 2004; 2 pp.; In English; See also 20040062536; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We examine the carbon and oxygen isotope composition of carbonate minerals that formed in two low-temperature terrestrial environments. Field locations were chosen to represent environments where microcrystalline carbonates (caliches) form. Samples include caliche crusts collected from the tsekel zone of N. Yucatan, Mexico, as well as carbonate mud from the edge of a near-by salt pan, representing both ancient and modern-precipitated carbonates. Additional field samples of surface-coating caliche were collected from two volcanic fields in Arizona. Preliminary results indicate that there is an overall depletion of 18O and 13C as a function of the extent of meteoric diagenesis. These data are used as terrestrial analogs to gauge whether carbonates that have been found within Martian meteorites could possibly have formed under these or similar conditions on Mars.

Author

Carbon Isotopes; Low Temperature; Mars Environment; Oxygen Isotopes; Measuring Instruments

20040062548 State Univ. of New York, Stony Brook, NY, USA

Iron Oxide Weathering in Sulfuric Acid: Implications for Mars

Arlauckas, S. M.; Hurowitz, J. A.; Tosca, N. J.; McLennan, S. M.; Lunar and Planetary Science XXXV: Weird Martian Minerals: Complex Mars Surface Processes; 2004; 2 pp.; In English; See also 20040062536; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The presence of liquid water at some point in the history of Mars may explain many of its dramatic surficial features. The intense volcanism that took place in the past is the probable source for the abundant sulfur in Martian surface material. Liquid water present on Mars may have therefore been acidic due to the high concentrations of sulfur (as H2SO4) in the system. It is likely that acidic fluids would have weathered the basaltic crust to varying degrees. Both Viking and Pathfinder missions have yielded data in support of magnetic materials present on the surface and in the atmospheric dust of Mars. From Viking magnetic experiments, Hargraves et al. have determined that there is approximately 1-7 wt% of a magnetic phase that is present on the Martian surface. It is widely believed that the magnetic mineral present on the surface of Mars is maghemite (Fe2O3), although it is recognized that magnetite ([Fe2+Fe3+ 2]O4) may supply either some, or possibly all of the magnetic character of the soil.

Derived from text

Iron Oxides; Weathering; Sulfuric Acid; Mars Surface

20040062549 Cordoba Univ., Cordoba, Spain

Can the Phosphate Sorption and Occlusion Properties Help to Elucidate the Genesis of Specular Hematite on the Mars Surface?

Barron, V.; Torrent, J.; Greenwood, J. P.; Blake, R. E.; Lunar and Planetary Science XXXV: Weird Martian Minerals: Complex Mars Surface Processes; 2004; 2 pp.; In English; See also 20040062536; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The conditions and environment in which the gray, coarse-grained hematite (specularite) deposits on Mars formed is central to the MER investigations at Sinus Meridiani. Several different models have been proposed for the formation of platy hematite on Mars; with the exception of high temperature oxidation of basalt, an aqueous environment is favored for the formation of specularite on Mars. Platy hematite is consistent with TES spectra, and an origin by precipitation of iron oxide followed by burial metamorphism to produce the coarse textures has been proposed. Other scenarios envision a low-pressure hydrothermal origin, or a low pressure, cold transformation of goethite to hematite. If specularite formed in an aqueous medium there exists the possibility that its chemical composition reflects that of the surrounding water. Laboratory experiments have shown that micro- and nanosized hematite is an effective sorbent for dissolved (ortho) phosphate and that hematite synthesized in phosphate-rich water can incorporate structural P in tetrahedral sites, the P/Fe atomic ratio being as high as 2.5%. However, little is known of the P-sorption and P-occlusion capacity of large hematite (i.e. specularite) natural crystals. This information would be useful to establish the origin of Martian specularites because Martian rocks are rich in P and so presumably are the Martian fluids. P and Fe can be measured accurately by MER APXS, and P/Fe could be an indicator of aqueous activity on Mars. Accordingly, we examined the capacity of different terrestrial specularites to sorb phosphate, as

well as their content in occluded P. We also did a similar study on the JSC-Mars 1 regolith simulant, as an analogue for palagonite on Mars.
Author
Nitrogen; Sorption; Occlusion; Hematite; Mars Surface; Calcium

20040062550 Lunar and Planetary Inst., Houston, TX, USA
Lunar and Planetary Science XXXV: Special Session: Mars Climate Change
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040062551 - 20040062559
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The titles in this section include: 1) Mars South Pole CO2 Paleoatmosphere; 2) Do SNC Noble Gas and Deuterium Data Provide Evidence for Large Cometary Impact Between 1300-300 Ma on Mars? 3) Medusae Fossae Formation: Ice-rich Airborne Dust Deposited During Periods of High Obliquity? 4) Ascraeus Mons, Mars: Characterisation and Interpretation of the Fan-shaped Deposit on Its Western Flank; 5) Evidence of Recent Glaciation in Elysium Planitia, Mars; 6) Craters and Other Circular Features in the Northern Circumpolar Area, Mars; 7) Intra-Annual Variations of the Martian Swiss-Cheese Terrain; 8) Drastic Climate Change of Mars Induced by H2O Ice Caps; 9) Modelling the Mass Balance of the North Polar Ice Cap on Mars.
CASI
Mars Environment; Paleoclimatology; Climate Change; Mars Atmosphere

20040062551 Schneck (Therese), USA
Mars South Pole CO2 Paleoatmosphere
Schneck, Therese; Lunar and Planetary Science XXXV: Special Session: Mars Climate Change; 2004; 1 pp.; In English; See also 20040062550; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Noachian structures of impact origin located near the South Pole, are interpreted to have had a profound influence on the evolution of south polar dry ice deposits. The measurements show minimum temperatures and chemical alteration in OH species in spectra of the dust near the winter South Pole more in accord with radiative equilibrium. In november and South Pole residual cap, Orographic Clouds are found around The Tharsis-induced though which may have sustained the CO2 release for the Noachian pressurized atmosphere. Parts of the CO2 spectrum indicate that the lower atmospheric region of Mars is at a warmer temperature than the underlying surface. The concentration of PAH's, which represent a major carrier of Deuterium excesses, found in noachian martian meteorite is a thousand times higher than the highest concentrations found in the snows of the greenland icesheet. Fresh and old snow have difference (0.75-0.95) in albedo, on earth for an albedo jump of 0.1, glacial area is only fully covered 30% of the year with present CO2 concentrations.Large changes in the relative reflectivity of several areas of Mars has been observed over 20 years. The albedo of the residual polar ice cap(unit Ac) is higher than all other units. The highest reflectivity gradients occur along the boundary of the seasonal CO2 ice cap. The South Pole region made of cryptic CO2 has sublimed away much quicker than other areas(figure) of the seasonal polar cap. Seasonal asymmetry in the CO mixing ratio is explained by the intense condensation of CO2 in the south polar cap at Ls=112 degrees a high level of deuteration can be obtained if the gas phase is depleted of CO. Spectra taken at the Nasa Infrared Telescope Facility (IRTF) at 4.67 microns show emission (2-1 vibrational band) and atmospheric absorptions of isotopic forms of CO and water.UV limbs measurements have found intense Cameron band emissions of CO from 1900-2700 A, which are primarily produced by dissociative excitation of CO2 by ionospheric photoelectrons and by photons. CO2+ emissions at 2890 A and from 3000-4000 Angstroms are produced by the photoionization of CO2. The strong orbital variation (40%) in solar flux incident on Mars leads to distinct aphelion paleoclimate and perihelion climate.
Author
Carbon Dioxide; Mars Surface; Mars Atmosphere; Polar Regions; Primitive Earth Atmosphere

20040062552 Center for Planetary Science, Copenhagen, Denmark
Modelling the Mass Balance of the North Polar Ice Cap on Mars
Schmidt, K. G.; Buchardt, S. L.; Lunar and Planetary Science XXXV: Special Session: Mars Climate Change; 2004; 2 pp.; In English; See also 20040062550; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The ice caps on Mars are believed to consist mostly of water ice, with large amounts of dust and possibly some CO2 ice. The surface appears while along the horizontal and north-facing surfaces, while the steep south-facing scarps are dark due to dust and exposure numerous horizontal layers that are believed to be related to climate changes on Mars.
Derived from text
Mars Surface; Mass Distribution; Models; Polar Caps; Balance

20040062553 Museum of Natural History, London, UK
Evidence of Recent Glaciation in Elysium Planitia, Mars
Nussbaumer, J.; Hauber, E.; Jaumann, R.; Lunar and Planetary Science XXXV: Special Session: Mars Climate Change; 2004; 2 pp.; In English; See also 20040062550; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We present evidence for recent glaciation in southeastern Elysium Planitia, near the Martian equator. The surface features indicating glacial processes include eskers, ground moraines, and boulder trains. They are located next to wind-eroded, layered materials, that are part of the Medusae Fossae Formation. The characteristics of the esker-like features (concertina eskers) suggest that they were formed by a surging ice-sheet. The identification of equatorial glaciation in the recent past might confirm theories about climatic changes on Mars due to variations of the planet s orbital parameters.
Derived from text
Glacial Drift; Ice; Glaciers; Mars Surface; Planetary Geology; Climate Change

20040062554 Brown Univ., Providence, RI, USA
Medusae Fossae Formation: Ice-rich Airborne Dust Deposited During Periods of High Obliquity?
Head, James W.; Kreslavsky, Mikhail; Lunar and Planetary Science XXXV: Special Session: Mars Climate Change; 2004; 2 pp.; In English; See also 20040062550; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

On the basis of the similarity of the Medusae Fossae Formation to polar and circumpolar deposits, we propose that the unit formed from airborne ice-rich material emplaced during periods of high obliquity when polar regions underwent volatile loss and were much warmer; the northern lowland-highland topographic boundary favored upwelling of vapor-rich air and preferential condensation there. Emplacement may also have been aided considerably by abundant water supply during and immediately subsequent to outflow events. Thus, sources of volatiles include polar regions undergoing concurrent sublimation at high obliquity, and freezing and subliming water deposited from outflow channels. The complex stratigraphy of the Medusae Fossae Formation suggests that periods of emplacement were interrupted by periods of erosion and volatile loss. Previous mapping of stratigraphic relationships suggests an extended duration of emplacement in the Amazonian, and recent mapping using MOLA data suggests that the record of this type of process might extend back into the Hesperian Period. Recent parallel results from several different areas show that: 1) the MFF has enhanced water contents (Odyssey GRS/NS); 2) GCMs predict ice deposition in these general areas during periods of high obliquity, and 3) orbital calculations suggest that extended high obliquity periods may be much more common than previously thought.
Derived from text
Dust; Ice; Mars Surface; Sublimation; Moisture Content; Deposits

20040062555 Brown Univ., Providence, RI, USA
Ascraeus Mons, Mars: Characterisation and Interpretation of the Fan-shaped Deposit on Its Western Flank
Parsons, R. L.; Head, J. W., III; Lunar and Planetary Science XXXV: Special Session: Mars Climate Change; 2004; 2 pp.; In English; See also 20040062550; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Ascraeus Mons is one of the three Tharsis Montes shield volcanoes that are aligned along a N40 E trend on the crest of the broad Tharsis Rise. Although largely constructed of volcanic deposits, each of the Tharsis Montes has a distinctive and unusual fan-shaped deposit extending approximately north-west on their western flanks. Three major facies have been identified within the fan-shaped deposits of Arsia and Pavonis Mons [1-6]: (1) A ridged facies consisting of numerous ridges that trace the distal margin of the lobe, often cutting across flow features and craters without any obvious deflection. (2) A knobby-terrain facies characterized by a chaotic assemblage of equidimensional hills. (3) A smooth facies containing concentric ridges superposed on broad lobes.
Derived from text
Craters; Mars Surface; Mars Volcanoes; Topography

20040062556 Wien Univ., Austria

Do SNC Noble Gas and Deuterium Data Provide Evidence for Large Cometary Impact Between 1300-300 Ma on Mars?

Bodiselitsch, B.; Lammer, H.; Lunar and Planetary Science XXXV: Special Session: Mars Climate Change; 2004; 2 pp.; In English; See also 20040062550; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Martian volatile inventory and climate have changed markedly throughout the planet's history. It is generally accepted that the volatiles of the Martian and terrestrial atmospheres were initially derived from the same major reservoir, such as the solar nebula, or gases modified during planetary formation. This reservoir is now represented in primitive meteorites and comets. From the beginning, the Martian atmosphere was subject by mass fractionation and to addition of specific components (e.g., radioactive gases, or material introduced by asteroids and comets). Today there are many models and assumptions, but none of them can explain exactly the processes that have modified the volatiles of the Martian atmosphere. There is evidence of appreciable mass fractionation of hydrogen, argon, and xenon, compared to the solar wind components, the composition of which are assumed to be similar to the initial composition of proto-Mars. Krypton appears not to have been mass fractionated, whereas Xe is strongly fractionated.

Derived from text

Deuterium; Data Acquisition; Impact Melts; Mars Environment

20040062557 Geological Survey, Flagstaff, AZ, USA

Intra-Annual Variations of the Martian Swiss Cheese Terrain

Titus, T. N.; Cushing, G.; Pathare, A.; Christensen, P. R.; Byrne, S.; Ivanov, A. B.; Ingersoll, A.; Richardson, M.; Kirk, R. L.; Soderblom, L. A., et al.; Lunar and Planetary Science XXXV: Special Session: Mars Climate Change; 2004; 2 pp.; In English; See also 20040062550; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Much of the surface of the carbon dioxide South Polar Residual Cap of Mars consists of quasi-circular pits with steep walls that have been dubbed "Swiss Cheese" terrain by Thomas et al. Using high-resolution Mars Observer Camera (MOC) images from two separate years of MOC observations, Malin et al. showed that the Swiss cheese has retreated on the order of 1-3 meters per Martian year; more recently, a similar rate of retreat has also been observed for the third Martian year of MOC observations. Byrne and Ingersoll developed a sublimation model to explain the rapid interannual recession of Swiss cheese walls, concluding that their relatively high slopes (typically on the order of 20) could only result from the presence of high albedo CO2 frost over a low albedo substrate approximately 10 m deep. Titus et al. showed with Mars Odyssey Thermal Emission Imaging System (THEMIS) infrared observations that there are numerous exposures of warm H2O ice throughout the colder CO2 South Polar Residual Cap. Hence, the curious morphology and inter-annual variability of Swiss cheese terrain most likely results from the interaction of a highly volatile surface layer of carbon dioxide frost overlying a base of less volatile water ice. Here, we examine the intra-annual variations of the Martian Swiss Cheese terrain using both MOC and THEMIS imaging. We compare digital elevation maps (DEM) derived from MOLA constrained photoclinometry of both MOC and THEMIS Vis images of Swiss cheese terrain. We also compare spring and summer THEMIS Vis imaging with the summer THEMIS IR, thus showing the distribution of CO2 and non-CO2 surface materials.

Derived from text

Annual Variations; Carbon Dioxide; Mars Surface; Terrain; Planetary Geology

20040062558 Tokyo Univ., Hongo, Japan

Drastic Climate Change of Mars Induced by H2O Ice Caps

Nakamura, T.; Tajika, E.; Lunar and Planetary Science XXXV: Special Session: Mars Climate Change; 2004; 2 pp.; In English; See also 20040062550; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Behaviors of the Martian climate system have been investigated in several studies. If the Martian climate was warm and wet owing to the greenhouse effect of CO2 in the past as suggested by many geomorphological features, a drastic climate change (climate jump or climate collapse) due to decrease in the amount of CO2 in the atmosphere must have occurred during the evolution from a warm condition to the present cold condition. The climate jump is caused by a runaway condensation of dense CO2 atmosphere into large CO2 ice caps. These studies, however, did not consider the effect of H2O ice. If the Martian climate was warm and wet, the formation of H2O ice should have preceded CO2 condensation (that is, the climate jump) because the freezing point of H2O is much higher than that of CO2. Because the ground covered with H2O ice has higher albedo than the bare ground, the formation of H2O ice might have affected the climatic evolution of Mars. Yokohata

et al. examine the effect of H2O ice on the Martian climate. They assume the latitudinal extent of H2O ice (iceline) as a free parameter. Actually, however, the latitude of iceline should be determined according to the climatic condition. In this study, we estimate the extent of H2O ice by using an energy balance climate model and investigate the relation between the H2O ice formation and the CO2 condensation. We examine the possibility that the appearance of H2O ice cap itself triggers the runaway condensation of CO2.
Author
Mars Environment; Climate Change; Greenhouse Effect; Polar Caps; Ice

20040062559 Oulu Univ., Finland
Craters and Other Circular Features in the Northern Circumpolar Area, Mars
Kostama, V.-P.; Kreslavsky, M. A.; Head, J. W.; Lunar and Planetary Science XXXV: Special Session: Mars Climate Change; 2004; 2 pp.; In English; See also 20040062550; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

At high latitudes (from approx. 55degN to polar deposits), the northern plains of Mars are covered with a thin geologically young mantle with specific decameter-scale surface texture [1, 2] containing much water ice [3, 4]. High-resolution MGS MOC images [1] showed many circular features interpreted to be mantled craters [1]. We carried out a systematic survey of the high-resolution MOC images at high northern latitudes with a focus on the mantle texture and circular features. Preliminary results related to the textures have been reported [5, 6]. Here we report on our observations regarding the other circular features.
Derived from text
Craters; Mars Surface; Short Wave Radiation; Textures; Decametric Waves

20040062560 Lunar and Planetary Inst., Houston, TX, USA
Lunar and Planetary Science XXXV: Mars: Wind, Dust Sand, and Debris
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040062561 - 20040062574
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The session "Mars: Wind, Dust Sand, and Debris" included: Mars Exploration Rovers: Laboratory Simulations of Aeolian Interactions; Thermal and Spectral Analysis of an Intracrater Dune Field in Amazonis Planitia; How High is that Dune? A Comparison of Methods Used to Constrain the Morphometry of Aeolian Bedforms on Mars; Dust Devils on Mars: Scaling of Dust Flux Based on Laboratory Simulations; A Close Encounter with a Terrestrial Dust Devil; Interpretation of Wind Direction from Eolian Features: Herschel Crater, Mars Erosion Rates at the Viking 2 Landing Site; Mars Dust: Characterization of Particle Size and Electrostatic Charge Distributions; Simple Non-fluvial Models of Planetary Surface Modification, with Application to Mars; Comparison of Geomorphically Determined Winds with a General Circulation Model: Herschel Crater, Mars; Analysis of Martian Debris Aprons in Eastern Hellas Using THEMIS; Origin of Martian Northern Hemisphere Mid-Latitude Lobate Debris Aprons; Debris Aprons in the Tempe/Mareotis Region of Mars;and Constraining Flow Dynamics of Mass Movements on Earth and Mars.
Derived from text
Mars Atmosphere; Mars Surface

20040062561 Open Univ., Milton Keynes, UK
A Close Encounter with a Terrestrial Dust Devil
Towner, M. C.; Ringrose, T. J.; Patel, M. R.; Balme, M.; Metzger, S. M.; Greeley, R.; Zarnecki, J. C.; Lunar and Planetary Science XXXV: Mars: Wind, Dust Sand, and Debris; 2004; 2 pp.; In English; See also 20040062560; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

During August 03 a dust devil field investigation campaign was conducted in the El Dorado Valley, Nevada. This field site has been well characterized previously, and has a well documented record of dust devil events. We report on one particular encounter from this field campaign, whereby a dust devil was sampled by a large number of sensors. These measurements consist of wind speed at 8 heights up to 4m, wind direction at 5 heights, air temperature at 6 heights, air pressure at 2 heights, upward looking UV flux (opacity) and 2 dust impact sensors. As such this data set represents one of the best characterizations

of a dust devil lower structure to date. Dust flux estimates obtained can be compared to those expected on Mars.
Derived from text
Dust; Mars Surface; Planetary Geology; Mars Atmosphere

20040062563 Arizona State Univ., Tempe, AZ, USA
Dust Devils on Mars: Scaling of Dust Flux Based on Laboratory Simulations
Neakrase, Lynn D. V.; Greeley, Ronald; Iversen, James D.; Lunar and Planetary Science XXXV: Mars: Wind, Dust Sand, and Debris; 2004; 1 pp.; In English; See also 20040062560; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Dust devils are effective for lifting dust into the martian atmosphere. Calculations and measurements of dust devil dust flux on Mars are important for determining the role of dust devils in the martian dust cycle. Comparison of dust devils on Earth, Mars, and in laboratory simulations under terrestrial and martian atmospheric conditions show similarities in vortex mechanical structure. Measurements from Earth and Mars Pathfinder show that the magnitude of the pressure well (delta P) in the center of the vortex as a percentage of ambient pressure (0.1-0.5%) is about the same for both planets. Laboratory measurements, until recently, have not taken that into consideration while measuring dust flux, yielding skewed estimates for Earth and Mars analogs (approximately 0.2-5 grams per square meters per second and 0.06-0.4 grams per square meters per second, respectively). It is possible to scale results to appropriate pressure well sizes in order to model dust devil dust flux at laboratory scales.
Derived from text
Dust; Mars Surface; Simulation; Mars Atmosphere

20040062564 Tennessee Univ., Knoxville, TN, USA
Analysis of Martian Debris Aprons in Eastern Hellas Using THEMIS
Piatek, J. L.; Crown, D. A.; Moersch, J. E.; Christensen, P. R.; Lunar and Planetary Science XXXV: Mars: Wind, Dust Sand, and Debris; 2004; 2 pp.; In English; See also 20040062560; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Martian debris aprons, which typically are lobate masses extending from massif slopes, have been identified as possible indicators of ground ice on Mars. A concentration of these features has been identified in the eastern Hellas region. THEMIS infrared images are used to examine spatial variability in both the thermal inertia and the emissivity of these features; changes in these properties across the surface of the apron may be related to formation and/or modification processes associated with these aprons. THEMIS nighttime images presented in this abstract were analyzed using the JMARS application written at Arizona State University. THEMIS brightness temperature images are overlain on a MOLA shaded relief map. Further image analyses will be undertaken using brightness temperature and thermal inertia calculation routines written in IDL for use in ENVI. The intended output of this processing is a set of thermal inertia 'maps' covering the debris aprons in question, which can then be used to identify thermal surface features.
Derived from text
Mars Surface; Debris; Infrared Imagery

20040062565 NASA Kennedy Space Center, Cocoa Beach, FL, USA
Mars Dust: Characterization of Particle Size and Electrostatic Charge Distributions
Mazumder, M. K.; Saini, D.; Biris, A. S.; Srirama, P. K.; Calle, C.; Buhler, C.; Lunar and Planetary Science XXXV: Mars: Wind, Dust Sand, and Debris; 2004; 2 pp.; In English; See also 20040062560; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Some of the latest pictures of Mars surface sent by NASA s Spirit rover in early January, 2004, show very cohesive, mud-like dust layers. Significant amounts of dust clouds are present in the atmosphere of Mars. NASA spacecraft missions to Mars confirmed hypotheses from telescopic work that changes observed in the planet s surface markings are caused by wind-driven redistribution of dust. In these dust storms, particles with a wide range of diameters (< 1 m to 50 m) are a serious problem to solar cells, spacecraft, and spacesuits. Dust storms may cover the entire planet for an extended period of time. It is highly probable that the particles are charged electrostatically by triboelectrification and by UV irradiation.
Author
Dust; Electrostatic Charge; Mars Surface; Particles

20040062566 Brown Univ., Providence, RI, USA
Erosion Rates at the Viking 2 Landing Site
Thomson, B. J.; Schultz, P. H.; Lunar and Planetary Science XXXV: Mars: Wind, Dust Sand, and Debris; 2004; 2 pp.; In English; See also 20040062560; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Martian surface has been eroded in a non-uniform manner in both space and time. While many regions retain much of the impact signature from the heavy bombardment during the very earliest epoch of Martian history, other high latitude terrains are almost devoid of craters. Erosion rates on the south polar residual cap, for example, are high enough that it is visibly disintegrating on a time scale measured in years. Understanding the rate of landscape evolution can provide insight into the nature and vigor of erosive processes through time. Temporal variations in erosion rates are also likely tied to climate variations. In this work, the erosion rate in the vicinity of the Viking 2 lander (VL2) is estimated using direct measurements of pedestal crater relief. We then compare these rates to other erosional rates established for a variety of Martian surfaces.
Author
Erosion; Topography; Temporal Distribution; Mars Surface; Craters

20040062567 Virginia Univ., Charlottesville, VA, USA
Simple Non-fluvial Models of Planetary Surface Modification, with Application to Mars
Howard, A. D.; Lunar and Planetary Science XXXV: Mars: Wind, Dust Sand, and Debris; 2004; 2 pp.; In English; See also 20040062560; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Simple models of geomorphic modification of planetary surfaces by erosion or deposition are reported here. These processes are linear and non-linear creep, uniform accrescence and decrescence, and non-linear airfall deposition. They do not include models of flow whose depth is of the same order of magnitude as the landform, such as glacial flow or relaxation of crater forms in planetary ices. The models are applied to a simulated saturation cratered surface whose dimensions are 25.6 x 25.6 km and represented on a 256 x 256 grid, using crater statistics.
Author
Planetary Surfaces; Creep Properties; Erosion; Geomorphology; Models

20040062568 Hawaii Univ., Honolulu, HI, USA
Thermal and Spectral Analysis of an Intracrater Dune Field in Amazonis Planitia
Schneider, R. D.; Hamilton, V. E.; Lunar and Planetary Science XXXV: Mars: Wind, Dust Sand, and Debris; 2004; 2 pp.; In English; See also 20040062560; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Intracrater dune fields were first recognized in Mariner 9 images and they occur in a variety of terrains. Detailed studies of dunes yield important information about past and present aeolian activity, the dominant force currently responsible for modifying the Martian surface. The dune field in this study is in an unnamed crater at approximately 18 degrees N, 190 degrees E, in Amazonis Planitia. The dune field appears as a dark-toned splotch about 8 km in diameter on the western side of the crater floor. Extending off the northeastern edge of the dune field is an area intermediate in tone between the dune field and the brighter crater floor materials. Here we present thermal and spectral analysis of the dune field and nearby materials, using data from the Mars Odyssey THEMIS and MGS TES.
Derived from text
Dunes; Mars Surface; Spectrum Analysis; Thermal Analysis; Mars Craters

20040062569 Planetary Science Inst., Tucson, AZ, USA
How High is that Dune? A Comparison of Methods Used to Constrain the Morphometry of Aeolian Bedforms on Mars
Bourke, M.; Balme, M.; Beyer, R. A.; Williams, K. K.; Lunar and Planetary Science XXXV: Mars: Wind, Dust Sand, and Debris; 2004; 2 pp.; In English; See also 20040062560
Contract(s)/Grant(s): NAG5-11090; NAG5-11075; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Methods traditionally used to estimate the relative height of surface features on Mars include: photoclinometry, shadow length and stereography. The MOLA data set enables a more accurate assessment of the surface topography of Mars. However, many small-scale aeolian bedforms remain below the sample resolution of the MOLA data set. In response to this a number of research teams have adopted and refined existing methods and applied them to high resolution (2-6 m/pixel) narrow angle

MOC satellite images. Collectively, the methods provide data on a range of morphometric parameters (many not previously available for dunes on Mars). These include dune height, width, length, surface area, volume, longitudinal and cross profiles). This data will facilitate a more accurate analysis of aeolian bedforms on Mars. In this paper we undertake a comparative analysis of methods used to determine the height of aeolian dunes and ripples.
Author
Mars Surface; Dunes; Altimetry; Mars (Planet)

20040062570 Arizona State Univ., Tempe, AZ, USA
Mars Exploration Rovers: Laboratory Simulations of Aeolian Interactions
Neakrase, Lynn D. V.; Greeley, Ronald; Foley, Daniel; Lunar and Planetary Science XXXV: Mars: Wind, Dust Sand, and Debris; 2004; 2 pp.; In English; See also 20040062560; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Aeolian activity is an important pervasive surface modifiers on Mars. Therefore it is important to study the interactions between the wind and landed mission components, specifically the Mars Exploration Rovers (MERs). The goals of this study are subdivided into two main groups: (1) Hazard assessment, and (2) Science analysis of the aeolian environment around the rover. Within these categories, simple boundary layer wind shear and vortical, "dust devil" action were both studied in the context of a 1/6 scale model of the MER in the laboratory.
Derived from text
Mars Exploration; Roving Vehicles; Wind (Meteorology); Wind Shear; Boundary Layers

20040062571 Oberlin Coll., OH, USA
Interpretation of Wind Direction from Eolian Features: Herschel Crater, Mars
Stanley, B. D.; Adcock, C. T.; Marston, R. A.; Lunar and Planetary Science XXXV: Mars: Wind, Dust Sand, and Debris; 2004; 2 pp.; In English; See also 20040062560; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Eolian landforms, which are abundant on Mars, serve as indicators of the strongest prevailing wind direction in an area. Using these landforms we can add to the knowledge of surface wind regimes which are currently based mainly on meteoritic data from past lander missions. Interpreting high resolution Mars Orbiter Camera Narrow Angle (MOC NA) images allows us to observationally determine the prominent wind direction for an area through geomorphic analogy to Earth. Viking images reveal dark albedo spots, thought to be large dunefields, in the southern half of many craters of the southern highlands on Mars. Herschel Crater is one such crater with a 304 km diameter lying northeast of Hellas Basin and centered at 228 deg.W and 15 deg.S.
Derived from text
Wind Direction; Albedo; Craters; Geomorphology; Ground Wind; Mars Surface

20040062572 Planetary Science Inst., Tucson, AZ, USA
Debris Aprons in the Tempe/Mareotis Region of Mars
Chuang, F. C.; Crown, D. A.; Lunar and Planetary Science XXXV: Mars: Wind, Dust Sand, and Debris; 2004; 2 pp.; In English; See also 20040062560; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Martian debris aprons are part of a suite of features attributed to the progressive downslope creep of ice-rich material. Lobate debris aprons, along with concentric crater fill and lineated valley fill, are found in mid-latitude regions on Mars. Their distribution is consistent with model predictions of near-surface ground-ice. Because these features are considered to be geomorphic indicators of ground ice, they are important in understanding the climate and volatile inventory on Mars. Their presence suggests storage of ice in the Martian regolith, either currently or in the recent geologic past. Recent studies of aprons have focused on two regions, eastern Hellas and Deuteronilus/Protonilus Mensae. However, there are several other locales that have significant populations of aprons. We have initiated a new study of aprons located along the northern lowlands-southern highlands boundary in the Tempe Terra/Mareotis Fossae region (43-55 deg. N, 274-294deg. E). Comparison of apron populations from different parts of Mars will allow us to evaluate regional geologic controls and potential climatic differences on apron development.
Author
Debris; Climate; Craters; Creep Properties; Ice; Mars Surface

20040062573 Northwestern Univ., Evanston, IL, USA

Origin of Martian Northern Hemisphere Mid-Latitude Lobate Debris Aprons

Li, Han; Ronibson, Mark S.; Jurdy, Donna M.; Lunar and Planetary Science XXXV: Mars: Wind, Dust Sand, and Debris; 2004; 2 pp.; In English; See also 20040062560; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

To understand the formation and evolution of Martian debris aprons, thirty three MOLA topographic profiles across debris aprons from various locations in the northern hemisphere (Tantalus Mensae, Protonilus Mensae, Deuteronilus Mensae, and Acheron Fossae) and one profile across Valles Marineris landslide were collected. These data are compared with profiles calculated from simple plastic and viscous power law models. Our analysis supports previous interpretations that debris aprons are formed due to deformation of ice rich mixtures and therefore indicate Martian permafrost/glacial conditions during their formation. Deviations from a plastic equilibrium state as exhibited in longitudinal profiles of some debris aprons indicate that these ice-lubricated flows have experienced post-emplacement modifications in general, possibly primarily due to loss of internal ice through sublimation and secondarily due to basal sliding as ice melt at the bottom of deposits due to temperature increases from loading.

Author

Mars Surface; Northern Hemisphere; Debris; Topography; Planetary Geology

20040062574 Johns Hopkins Univ., Laurel, MD, USA

Constraining Flow Dynamics of Mass Movements on Earth and Mars

Barnouin-Jha, O. S.; Bulmer, M. H.; Lunar and Planetary Science XXXV: Mars: Wind, Dust Sand, and Debris; 2004; 2 pp.; In English; See also 20040062560; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A better understanding of the emplacement dynamics of mass movements on Mars should lead to inference on the rheology of these mass movements, including the presence of water. Implications for the location and near surface evolution of water on Mars could be derived. We utilize topographic data obtained both on Earth and Mars to estimate the flow velocity of observed mass movement. By comparing these estimates with simple flow models, we begin to constrain their flow dynamics. With a few notable exceptions , velocity is not typically used in such investigations. We show, however, that velocity provides an important additional constraint to flow thickness, flow volume and morphology, that can improve inferences and models of mass movement emplacement. We use field data from terrestrial analogues as ground truth to test model results and analyzes of flow emplacement based on topographic and remote sensing data. In this way, we establish the validity and limitations of interpretations made with similar topographic (MOLA) and high resolution imagery (MOC) at Mars, and determine what additional types of topographic data such as Mars Express' 10 m per pixel stereoscopic topography might be required to ameliorate such interpretations.

Author

Mars Surface; Topography

20040065031 Lunar and Planetary Inst., Houston, TX, USA

Lunar and Planetary Science XXXV: Mars: Remote Sensing and Terrestrial Analogs

2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040065032 - 20040065053

Contract(s)/Grant(s): NCC5-679

Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The session "Mars: Remote Sensing and Terrestrial Analogs" included the following:Physical Meaning of the Hapke Parameter for Macroscopic Roughness: Experimental Determination for Planetary Regolith Surface Analogs and Numerical Approach; Near-Infrared Spectra of Martian Pyroxene Separates: First Results from Mars Spectroscopy Consortium; Anomalous Spectra of High-Ca Pyroxenes: Correlation Between Ir and M ssbauer Patterns; THEMIS-IR Emissivity Spectrum of a Large Dark Streak near Olympus Mons; Geomorphologic/Thermophysical Mapping of the Athabasca Region, Mars, Using THEMIS Infrared Imaging; Mars Thermal Inertia from THEMIS Data; Multispectral Analysis Methods for Mapping Aqueous Mineral Depostis in Proposed Paleolake Basins on Mars Using THEMIS Data; Joint Analysis of Mars Odyssey THEMIS Visible and Infrared Images: A Magic Airbrush for Qualitative and Quantitative Morphology; Analysis of Mars Thermal Emission Spectrometer Data Using Large Mineral Reference Libraries ; Negative Abundance : A Problem in Compositional Modeling of Hyperspectral Images; Mars-LAB: First Remote Sensing Data of Mineralogy Exposed at Small Mars-Analog Craters, Nevada Test Site; A Tool for the 2003 Rover Mini-TES: Downwelling Radiance Compensation Using Integrated Line-Sight Sky Measurements; Learning About Mars Geology Using Thermal Infrared Spectral Imaging:

Orbiter and Rover Perspectives; Classifying Terrestrial Volcanic Alteration Processes and Defining Alteration Processes they Represent on Mars; Cemented Volcanic Soils, Martian Spectra and Implications for the Martian Climate; Palagonitic Mars: A Basalt Centric View of Surface Composition and Aqueous Alteration; Combining a Non Linear Unmixing Model and the Tetracorder Algorithm: Application to the ISM Dataset; Spectral Reflectance Properties of Some Basaltic Weathering Products; Morphometric LIDAR Analysis of Amboy Crater, California: Application to MOLA Analysis of Analog Features on Mars; Airborne Radar Study of Soil Moisture at a Mars Analog Site: Tohachi Wash/Little Colorado River; and Antarctic Dry Valleys: Modification of Rocks and Soils and Implications for Mars The Arkaroola Mars Analogue Region, South Australia.
Derived from text
Mars Surface; Mineralogy; Remote Sensing

20040065032 Colorado Univ., Boulder, CO, USA
Mars Thermal Inertia from THEMIS Data
Putzig, N. E.; Mellon, M. T.; Jakosky, B. M.; Pelkey, S. M.; Martinez-Alonso, S.; Hynek, B. M.; Murphy, N. W.; Lunar and Planetary Science XXXV: Mars: Remote Sensing and Terrestrial Analogs; 2004; 2 pp.; In English; See also 20040065031; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

As part of a Jet Propulsion Laboratory (JPL) Critical Data Products (CDP) initiative, we have developed a new technique for deriving thermal inertia from the Mars Odyssey (MO) Thermal Emission Imaging System (THEMIS) data. Our algorithm employs a modified version of the standard software developed for deriving thermal inertia from Mars Global Surveyor (MGS) Thermal Emission Spectrometer (TES) data. This approach avoids complicating the comparison of THEMIS and TES results with thermal model differences. While THEMIS data provide greater than an order of magnitude improvement in spatial resolution over TES data, large uncertainties in calculated thermal inertias are introduced by a 5-fold increase in NE.T (noise equivalent temperature uncertainty) for THEMIS and by the lack of coincident-resolution albedo, elevation, and dust opacity. The higher resolution also complicates THEMIS data by increasing the role of surface slopes. Our analysis shows non-uniform differences between THEMIS and TES results, highlighting the need to calibrate THEMIS-derived thermal inertias from individual images against the more reliable TES-derived values.
Derived from text
Imaging Techniques; Spectrometers; Thermal Emission; Mars Surface; Planetary Geology; Data Processing

20040065033 Army Cold Regions Research and Engineering Lab., Hanover, NH, USA
Morphometric LIDAR Analysis of Amboy Crater, California: Application to MOLA Analysis of Analog Features on Mars
Finnegan, D. C.; Ghent, R. R.; Byrnes, J. M.; Bourke, M.; Lunar and Planetary Science XXXV: Mars: Remote Sensing and Terrestrial Analogs; 2004; 2 pp.; In English; See also 20040065031; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Terrestrial analogs are of great importance to our understanding of process geomorphology on Mars. The quantitative description of forms (geomorphometry) is an important tool for understanding the evolution of analogous landscapes. It demonstrates how aspects of the land surface are interrelated and, importantly, provides parameters that can be related to specific geologic processes. This is particularly valuable in planetary geology, where geomorphometry may be the only means by which these processes can be estimated. Specific geomorphometric techniques have already been employed in studies on Mars. However, caution must be exercised as issues of landscape scale and data resolution can be crucial to interpretation. Terrestrial analogs can be effectively used to test the limitations that MOLA-resolution data impose when modeling geomorphometric parameters of landforms on Mars.
Derived from text
Morphology; Optical Radar; Craters; Mars Surface

20040065034 Geological Survey, Flagstaff, AZ, USA
Geomorphologic/Thermophysical Mapping of the Athabasca Region, Mars, Using THEMIS Infrared Imaging
Keszthelyi, L.; Burr, D. M.; McEwen, A. S.; Lunar and Planetary Science XXXV: Mars: Remote Sensing and Terrestrial Analogs; 2004; 2 pp.; In English; See also 20040065031; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Athabasca region of Mars is of special interest because it appears to contain the youngest catastrophic aqueous flood

features on Mars. The region also has extremely fresh lava surfaces and evidence for lava-water interaction. Our initial geomorphologic mapping of the region was made when it was a candidate landing site for the MER rovers. This initial mapping only used MOC images, which provided incomplete coverage of the region. 100-m/pixel THEMIS IR images now provide almost complete coverage of the region and are the basis of the new map. The THEMIS mosaics and additional interpretation of these data are presented elsewhere.
Author
Geomorphology; Infrared Imagery; Planetary Geology; Planetary Mapping

20040065035 Geological Survey, Flagstaff, AZ, USA
Joint Analysis of Mars Odyssey THEMIS Visible and Infrared Images: A "Magic Airbrush" for Qualitative and Quantitative Morphology
Kirk, R. L.; Soderblom, L. A.; Cushing, G.; Titus, T.; Lunar and Planetary Science XXXV: Mars: Remote Sensing and Terrestrial Analogs; 2004; 2 pp.; In English; See also 20040065031; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We present a novel approach to analyzing data from the THEMIS instrument that combines information from daytime visible reflected, daytime IR emitted, and nighttime IR emitted images. This allows us to isolate and map separately the physical effects of topography, albedo, and thermal inertia, which influence the three image types in distinct and readily separable ways. In this abstract we apply a simple, empirical version of this approach to map the Mars Exploration Rover (MER) landing sites. The resulting topographic maps in both qualitative (shaded relief portrayal) and quantitative (digital elevation model or DEM) form are of interest both in the study of geomorphology and surface processes and for mission applications such as rover localization and operations planning. A full, physics-based theory, including error bounds, is currently being developed. It will yield maps of thermophysical properties corrected for the influences of slopes and albedo.
Derived from text
2001 Mars Odyssey; Infrared Imagery; Mars Surface; Mars (Planet); Planetary Mapping

20040065036 Winnipeg Univ., Manitoba, Canada
Spectral Reflectance Properties of Some Basaltic Weathering Products
Cloutis, E. A.; Lunar and Planetary Science XXXV: Mars: Remote Sensing and Terrestrial Analogs; 2004; 2 pp.; In English; See also 20040065031; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Basalt is one of the most widespread rock types in the inner solar system [1]. It can weather to form a variety of alteration products; the nature of these alteration products are a function of the specific conditions present during alteration, as well as the composition of the initial basalt. Detection of specific alteration products on specific targets (e.g., Mars, asteroid) would enable us to place constraints on the conditions prevalent during this alteration. In order to facilitate detection of basaltic alteration products, the spectral reflectance properties of a number of known basaltic alteration products, which have not been previously characterized are presented here.
Derived from text
Spectral Reflectance; Basalt; Asteroids; Weather

20040065037 Geological Survey, Flagstaff, AZ, USA
Analysis of Mars Thermal Emission Spectrometer Data Using Large Mineral Reference Libraries
Staid, M. I.; Johnson, J. R.; Gaddis, L. R.; Lunar and Planetary Science XXXV: Mars: Remote Sensing and Terrestrial Analogs; 2004; 2 pp.; In English; See also 20040065031; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A method is presented for the analysis of Mars Thermal Emission Spectrometer and Mini-TES data that allows mineralogical analysis relative to spectral reference libraries of unlimited size. The algorithm has been applied to the Mars type I and II surface spectra of Bandfield et al. using spectral libraries of various composition and size. Our goals are to determine the influence that reference library size and composition have on the interpretation of Mars TES and Mini-TES data and to demonstrate a method of analysis relative to very large spectral libraries where the number of reference materials exceeds the number of wavelength measurements.
Derived from text
Mars Surface; Mineralogy; Spectrometers; Thermal Emission; Data Processing

20040065038 Paris XI Univ., Orsay, France

Combining a Non Linear Unmixing Model and the Tetracorder Algorithm: Application to the ISM Dataset

Gendrin, A.; Poulet, F.; Charvin, N.; Langevin, Y.; Mustard, J. F.; Lunar and Planetary Science XXXV: Mars: Remote Sensing and Terrestrial Analogs; 2004; 2 pp.; In English; See also 20040065031; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Feature matching algorithms are largely used to analyze the datasets of imaging spectrometers. The Tetracorder algorithm is one method based on this principle. This freely available algorithm takes as input a spectral library, for which diagnostic features have been defined: a diagnostic feature is an absorption band which needs to be present in a spectrum for the identification of a mineral. Tetracorder fits each spectrum of the dataset with the defined diagnostic features, after continuum removal, and attributes the mineralogy of the best obtained fit. In this work, we combine the two methods to identify and map the mineralogy on Mars in some regions observed by ISM/Phobos2. Synthetic spectra of a sample of possible mineralogies on Mars are calculated using our non-linear unmixing model. We add these spectra to the input library used by Tetracorder, and apply the algorithm on six observations acquired by ISM.

Derived from text

Algorithms; Mineralogy; Planetary Geology; Nonlinearity; Spectroscopy

20040065039 NASA Johnson Space Center, Houston, TX, USA

Palagonitic Mars: A Basalt Centric View of Surface Composition and Aqueous Alteration

Morris, R. V.; Graff, T. G.; Ming, D. W.; Bell, J. F., III; Le, L.; Mertzman, S. A.; Christensen, P. R.; Lunar and Planetary Science XXXV: Mars: Remote Sensing and Terrestrial Analogs; 2004; 2 pp.; In English; See also 20040065031; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Palagonitic tephra from certain areas on Mauna Kea Volcano (Hawaii) are well-established spectral and magnetic analogues of high-albedo regions on Mars. By definition, palagonite is "a yellow or orange isotropic mineraloid formed by hydration and devitrification of basaltic glass." The yellow to orange pigment is nanometer-sized ferric oxide particles (np-Ox) dispersed throughout the hydrated basaltic glass matrix. The hydration state of the np-Ox particles and the matrix is not known, but the best Martian spectral analogues contain allophane-like materials and not crystalline phyllosilicates. Martian low-albedo regions are also characterized by a palagonite-like ferric absorption edge, but, unlike the highalbedo regions, they also show evidence for absorption by ferrous iron. Thermal emission spectra (TES) obtained by the Mars Global Surveyor Thermal Emission Spectrometer suggest that basaltic (surface Type 1) and andesitic (surface Type 2) volcanic compositions preferentially occur in southern (Syrtis Major) and northern (Acidalia) hemispheres, respectively. The absence of a ferric-bearing component in the modeling of TES spectra is in apparent conflict with VNIR spectra of Martian dark regions, as discussed above. However, the andesitic spectra have also been interpreted as oxidized basalt using phyllosilicates instead of high-SiO2 glass as endmembers in the spectral deconvolution of surface Type 2 TES spectra. We show here that laboratory VNIR and TES spectra of rinds on basaltic rocks are spectral endmembers that provide a consistent explanation for both VNIR and TES data of Martian dark regions.

Author

Basalt; Analogs; Andesite; Crusts; Mars Surface; Spectral Signatures; Surface Layers

20040065040 Search for Extraterrestrial Intelligence Inst., Moffett Field, CA, USA

Cemented Volcanic Soils, Martian Spectra and Implications for the Martian Climate

Bishop, J. L.; Schiffman, P.; Drief, A.; Southard, R. J.; Lunar and Planetary Science XXXV: Mars: Remote Sensing and Terrestrial Analogs; 2004; 2 pp.; In English; See also 20040065031; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Cemented soils formed via reactions with salts are studied here and provide information about the climate when they formed. Spectroscopic and microprobe studies have been performed on cemented volcanic crusts in order to learn about the composition of these materials, how they formed, and what they can tell us about climatic interactions with surface material on Mars to form cemented soils. These crusts include carbonate, sulfate and opaline components that may all be present in cemented soil units on Mars.

Derived from text

Cementation; Climatology; Mars Surface; Soils; Mars Volcanoes; Microanalysis; Spectroscopy

20040065041 Rice Univ., Houston, TX, USA

Learning About Mars Geology Using Thermal Infrared Spectral Imaging: Orbiter and Rover Perspectives

Probst, L. W.; Kirkland, L. E.; Burt, D. M.; Lunar and Planetary Science XXXV: Mars: Remote Sensing and Terrestrial Analogs; 2004; 2 pp.; In English; See also 20040065031; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Much can be learned about a planet's mineralogy with spectral data from both a rover and an orbiter. Amboy Crater is a recent cinder cone volcano surrounded by a basalt lava field 70 square kilometers in area and located in southern California s Mojave Desert. Amboy Crater and its lava field are shown. Parts of the landscape included in the Amboy lava field resemble pictures of the Martian surface taken from the Viking and Pathfinder spacecraft. In this work we study the Amboy Crater site with Thermal Infrared (TIR) spectral imaging in order to learn how to better interpret the geology of a site from TIR data. We will then apply this type of study to understanding TIR data from Mars. We intend to correlate TIR spectral signatures with true mineralogy, viewing geometry, and texture. Properties that can be analyzed to determine the degree of correlation include the ratio of target size to pixel size, surface dip angles, surface textures, the degree of rock vesicularity, the percentage of the rock surface that is exposed, and a description of material covering the rock (such as a rock coating or dust).

Derived from text

Mars Surface; Planetary Geology; Mars Roving Vehicles; Imaging Techniques; Mars Craters; Topography

20040065042 Tennessee Univ., Knoxville, TN, USA

Multispectral Analysis Methods for Mapping Aqueous Mineral Depostis in Proposed Paleolake Basins on Mars Using THEMIS Data

Stockstill, K. R.; Moersch, J. E.; McSween, H. Y., Jr.; Christensen, P.; Lunar and Planetary Science XXXV: Mars: Remote Sensing and Terrestrial Analogs; 2004; 2 pp.; In English; See also 20040065031; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Several geomorphic studies have proposed the existence of paleolake basins on Mars. A list of 179 proposed paleolake basins in impact craters was compiled with corresponding geomorphic evidence for each basin. Among the geomorphic evidence, it was noted that some basins display alternating bands of light and dark albedo materials conformal with basin margins. It has been suggested (ibid.) that the bright materials may be evaporite deposits, but spectral studies of these areas have not confirmed this hypothesis [3,4,5]. Recently, we conducted a TES study to search for small (~5 km-scale) exposures of evaporite minerals within the 80 largest putative paleolake basins from the list presented in [1]. Seven basins displayed one or more surface spectral units distinct from their surroundings. Averaged TES spectra from regions of interest (ROI) were extracted and examined to see what spectral features distinguish these units from each other. Linear deconvolution of the mean ROI spectra was used to search for carbonates (ibid). In addition, new spectral indices, sensitive to the carbonate absorption features near 890 cm-1 and 360 cm-1 and their relative band depths, were developed to search for carbonates present in abundances >12-53% (depending on the specific variety). The deconvolution routine never used evaporite minerals in credible amounts (i.e., not > 10-15%) and the spectral indices method did not detect carbonates in any TES ROI mean spectra.

Author

Multispectral Photography; Mineral Deposits; Geomorphology; Spectra; Photomapping

20040065043 Boston Univ., Boston, MA, USA

Antarctic Dry Valleys: Modification of Rocks and Soils and Implications for Mars

Marchant, David R.; Head, James W.; Lunar and Planetary Science XXXV: Mars: Remote Sensing and Terrestrial Analogs; 2004; 2 pp.; In English; See also 20040065031; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Rocks exposed to salt-weathering, wind-erosion, and thermal stresses over million-year time scales in the Dry Valleys region of Antarctica are morphologically similar to rocks observed at lander/rover scales on the martian surface. In upland regions of the Dry Valleys, including areas that lack traditional active layer processes (such as buoyancy-driven convection, lateral and vertical sorting associated with the growth of near-surface ice, and seasonal creep), surface rocks are fixed and stable; they are modified solely by salt weathering, wind deflation, and thermal stresses. Here we outline some of the key characteristics of surface rocks and near-surface sediment in the upland regions of the Dry Valleys that may help provide clues to the origin of surface features observed at lander/rover scales on Mars.

Author

Antarctic Regions; Valleys; Mars Surface; Mars Environment; Planetary Geology

20040065045 Search for Extraterrestrial Intelligence Inst., Moffett Field, CA, USA

Classifying Terrestrial Volcanic Alteration Processes and Defining Alteration Processes they Represent on Mars

Bishop, J. L.; Schiffman, P.; Southard, R. J.; Drief, A.; Verosub, K. L.; Smith, D. J.; Lunar and Planetary Science XXXV: Mars: Remote Sensing and Terrestrial Analogs; 2004; 2 pp.; In English; See also 20040065031; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Characterizing alteration of the rocks on Mars is difficult, but some guidelines can be made through comparison with terrestrial volcanic alteration. Subaerial volcanic activity on the Hawaiian islands and subglacial volcanic activity on Iceland have led to the formation of a variety of silicate and iron oxide-rich alteration products that may serve as models for chemical alteration on Mars. Multiple samples have been collected from palagonitized tuffs, altered pillow lavas, altered tephra, and S-rich vents for study in the lab. Variations in the kinds of alteration products have been observed depending on the sample environment. We are defining associations between the alteration products and formation conditions that can be used to provide information about environmental conditions on Mars. In particular, we are providing definitions for palagonitic, pedogenic and solfataric alteration that can be used to characterize these alteration processes.

Author

Mars Environment; Petrology; Volcanoes; Analogs; Planetary Geology

20040065046 Observatoire de Midi-Pyrenees, Toulouse, France

Physical Meaning of the Hapke Parameter for Macroscopic Roughness (Theta): Experimental Determination for Planetary Regolith Surface Analogs and Numerical Approach

Cord, A.; Pinet, P. C.; Chevrel, S. D.; Daydou, Y.; Shkuratov, Y. G.; Stankevich, D. G.; Petrov, D. V.; Lunar and Planetary Science XXXV: Mars: Remote Sensing and Terrestrial Analogs; 2004; 2 pp.; In English; See also 20040065031; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The semi-empirical model developed by Hapke is widely used to analyze reflectance data from planetary surfaces. It requires the knowledge of six parameters to calculate the bidirectional reflectance. Its application relies on physical quantities characterizing the optical properties of the materials under examination: the phase function, the opposition effect, and the roughness. We focus here on the physical meaning of the shadowing function parameter and show with new laboratory observations on natural surfaces that the mean topographic slope angle (Theta) is an integral of the mesoscale and microscale roughness properties in the submillimetric - centimetric range.

Derived from text

Planetary Surfaces; Regolith; Shadows; Surface Roughness; Topography; Bidirectional Reflectance

20040065047 Los Alamos National Lab., NM, USA

THEMIS-IR Emissivity Spectrum of a Large 'Dark Streak' near Olympus Mons

Brumby, S. P.; Lunar and Planetary Science XXXV: Mars: Remote Sensing and Terrestrial Analogs; 2004; 2 pp.; In English; See also 20040065031; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Dark streaks appear across a large fraction of the surface of Mars, and many are observed in the vicinity of Olympus Mons. Also known as slope streaks, these transient surface features are known to appear and fade away on timescales of years. Various explanations have been proposed for their origin and composition, including dry avalanches, and wet debris or precipitates from brines. Previous investigations have been based on analysis of panchromatic imagery and altimetry from Viking and Mars Global Surveyor missions. We have obtained an infrared emissivity spectrum of a large dark streak on the north-western edge of Olympus Mons, using imagery from the THEMIS instrument on the Mars Odyssey 2001 spacecraft.

Derived from text

Emissivity; Infrared Spectra; Mars Surface; Mars Volcanoes

20040065048 Science Applications International Corp., Chantilly, VA, USA

Near-Infrared Spectra of Martian Pyroxene Separates: First Results from Mars Spectroscopy Consortium

Sunshine, J. M.; Bishop, J.; Dyar, D.; Hiroi, T.; Klima, R.; Pieters, C. M.; Lunar and Planetary Science XXXV: Mars: Remote Sensing and Terrestrial Analogs; 2004; 2 pp.; In English; See also 20040065031; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A consortium has recently been established to analyze whole rock and mineral separates from Mars meteorites with a

variety of spectroscopic techniques (visible to far infrared reflectance and Moessbauer). This work presents analyses of visible near-infrared (VNIR) spectra of pyroxene separates from ALH84001, LEW88516, Nakhla, and Zagami. For the first time, these samples provide a suite of Martian pyroxenes including low-calcium orthopyroxene, high-calcium augite, and a pigeonite. The relative purity of these separates allows us to examine the origins of specific absorptions in Martian samples without potential confusion with other phases. Initial results suggest that variations in site occupancy of Fe/Ca/Mg play an import role in explaining their VNIR absorption features. Mineral structural differences will also lead to corresponding changes in the bending and stretching features observed at mid- and far-infrared wavelengths and therefore have implications for interpretation of most Martian remote sensing data sets.
Derived from text
Mars (Planet); Pyroxenes; Spectroscopy; SNC Meteorites

20040065050 Houston Univ.-Clear Lake, Houston, TX, USA
Negative Abundance: A Problem in Compositional Modeling of Hyperspectral Images
Rodricks, N.; Kirkland, L. E.; Lunar and Planetary Science XXXV: Mars: Remote Sensing and Terrestrial Analogs; 2004; 2 pp.; In English; See also 20040065031; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Linear mixture modeling is a technique used to identify and estimate the abundance of minerals in hyperspectral images, terrestrially and on Mars. A primary drawback of this established method is that it can return a negative abundance of a material. Linear mixture modeling theorizes that radiance from a multi-mineral surface is a linear combination of the endmember spectra weighted by the aerial coverage of each endmember. "Linear least squares is the most common method used in the linear mixture modeling of hyperspectral data. It can be used to identify minerals in the Thermal Emission Spectrometer (TES) and the Mini Thermal Emission Spectrometer (Mini TES) data sets. The intent of our research is to address the problem of negative abundance, which is critical especially on Mars because the endmembers actually present are unknown.
Derived from text
Abundance; Images; Thermal Emission; Spectrometers; Mineralogy; Models

20040065051 Arizona Univ., Tucson, AZ, USA
Mars-LAB: First Remote Sensing Data of Mineralogy Exposed at Small Mars-Analog Craters, Nevada Test Site
Kirkland, L. E.; Herr, K. C.; Allen, B. M.; Adams, P. M.; McAfee, J. M.; Keim, E. R.; Lunar and Planetary Science XXXV: Mars: Remote Sensing and Terrestrial Analogs; 2004; 2 pp.; In English; See also 20040065031; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

On Earth and Mars, small craters expose near-surface composition, weathering processes, and layering. The MarsLab project is the first thermal infrared, remote sensing study of the mineralogy exposed by small terrestrial craters (approx 25 - 400 m diameter). Small craters are important because they can partially replicate drilling in that they expose near-surface material. On Mars, identification of the minerals on the crater interior wall and in ejecta would uncover currently unknown information on near-surface compositional variations and weathering processes. Near-surface explosive tests at the Nevada Test Site (NTS) in the Mojave desert created numerous craters that are unique Mars analog sites. Infrared remote sensing is a primary method used to identify minerals on Mars; however, the technique has never before been applied to small Mars analog craters. The MarsLab project utilizes thermal-infrared, hyperspectral images from uniquely high quality airborne and field spectrometers.
Derived from text
Craters; Mars Craters; Mars Surface; Planetary Geology; Analogs

20040065052 Washington Univ., Saint Louis, MO, USA
A Tool for the 2003 Rover Mini-TES: Downwelling Radiance Compensation Using Integrated Line-Sight Sky Measurements
Greenhagen, B. T.; Kirkland, L. E.; Grabowski, T.; Rainey, E. S. G.; Lunar and Planetary Science XXXV: Mars: Remote Sensing and Terrestrial Analogs; 2004; 2 pp.; In English; See also 20040065031; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The 2003 Mars Exploration Rover science strategy is to identify promising targets using the visible/near-infrared imaging Pancam and the thermal infrared spectrometer Mini-TES. The rover would then traverse to those targets for more detailed

examination. Team members will select geologic targets from target morphology and color using Pancam, and target mineralogy using Mini-TES. This strategy requires low ambiguity, near real-time interpretations of Pancam and Mini-TES data. Field spectrometer (i.e. Mini-TES) measurements differ significantly from both laboratory and airborne/ satellite (i.e. Mars Global Surveyor TES) measurements. The primary difference in ground-based measurements is that reflected atmospheric downwelling radiance can significantly complicate the result. Here we show compensation strategies, including a new method that relies entirely on line-sight sky measurements.
Author
Infrared Spectrometers; Mars Exploration; Infrared Imagery; Radiance; Mars Global Surveyor

20040065053 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Airborne Radar Study of Soil Moisture at a Mars Analog Site: Tohachi Wash/Little Colorado River
Doggett, T. C.; Greeley, R.; Baker, V.; Chien, S.; Davies, A. G.; Dohm, J. M.; Ferre, T. P. A.; Hinnel, A.; Rucker, D.; Williams, K.; Lunar and Planetary Science XXXV: Mars: Remote Sensing and Terrestrial Analogs; 2004; 2 pp.; In English; See also 20040065031; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The search for sub-surface water is a key aspect of current Mars exploration efforts. The surface backscatter in response to microwave radiation, such as radar instruments, is a function of both surface roughness (including vegetation) and the dielectric permittivity of the near-surface materials. Most previous work has focused on studying the signal of soil moisture in agricultural settings that are poor analogs to Mars. Our study uses the NASA/JPL Airborne Synthetic Aperture Radar (AIRSAR) system to acquire repeat coverage for various Mars analog sites in conjunction with field measurement of soil moisture, in order to assess the feasibility of using radar to detect soil moisture on Mars and the optimal instrument parameters for such soil moisture detection.
Author
Mars Surface; Earth Surface; Analogs; Soil Moisture

20040065744 Lunar and Planetary Inst., Houston, TX, USA
Lunar and Planetary Science XXXV: Mars Impact Cratering
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040065745 - 20040065752
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

This document discusses the following topics: High Resolution Digital Elevation Models of Pristine Explosion Craters; Crater Degradation in the Martian Highlands: Morphometric Analysis of the Sinus Sabaeus Region and Simulation Modeling Suggest Fluvial Processes; Analysis of Impact Crater Preservation on Mars Using THEMIS Data; Atmospheric Entry Studies and the Smallest Impact Craters on Mars; Updating the Crater Count Chronology System for Mars; Control of Impact Crater-related Fracture Systems on the Subsurface Hydrology and Ground Collapse; Quantitative Analyses of Terrestrial Crater Deposits: Constraining Formation and Sediment Transport Processes on Mars; and Predicted Effects of Surface Processes on Martian Impact Crater Depth/Diameter Relationships
Derived from text
Chronology; Cratering; Degradation; Hydrology; Mars Craters; Planetary Geology; Quantitative Analysis; Sediment Transport

20040065745 Virginia Univ., Charlottesville, VA, USA
Crater Degradation in the Martian Highlands: Morphometric Analysis of the Sinus Sabaeus Region and Simulation Modeling Suggest Fluvial Processes
Forsberg-Taylor, N.; Howard, A. D.; Craddock, R.; Lunar and Planetary Science XXXV: Mars Impact Cratering; 2004; 2 pp.; In English; See also 20040065744; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Sinus Sabaeus Quadrangle (0 deg.S to 30 deg.S and 0 deg.E to 45 deg.E) was selected as a representative highly cratered region to characterize the morphometry of 530 fresh and degraded craters greater that 10 km in diameter. Individual MOLA tracks were utilized rather than gridded data to avoid artifacts due to sparse data. An additional 320 craters were included in crater counts but were not morphometrically analyzed because of: 1) poor MOLA coverage; 2) strong modification by later impacts, or 3) breaching of the crater wall by entering or exiting fluvial channels (not a closed depositional system).

Each crater was visually assigned a degree of degradation using the standard classification system, ranging from A for fresh to E for highly degraded craters. Qualitative characteristics were used in conjunction with the quantitative morphometric measurements to examine the properties of crater modification within the quadrangle as a function of crater diameter, location within the quadrangle and elevation. A variety of measurements and analyses were conducted, but we report here results related to determining the processes responsible for degradation.
Author
Degradation; Craters; Mars (Planet)

20040065746 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
High Resolution Digital Elevation Models of Pristine Explosion Craters
Farr, T. G.; Krabill, W.; Garvin, J. B.; Lunar and Planetary Science XXXV: Mars Impact Cratering; 2004; 1 pp.; In English; See also 20040065744; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In order to effectively capture a realistic terrain applicable to studies of cratering processes and landing hazards on Mars, we have obtained high resolution digital elevation models of several pristine explosion craters at the Nevada Test Site. We used the Airborne Terrain Mapper (ATM), operated by NASA's Wallops Flight Facility to obtain DEMs with 1 m spacing and 10 cm vertical errors of 4 main craters and many other craters and collapse pits. The main craters that were mapped are Sedan, Scooter, Schooner, and Danny Boy. The 370 m diameter Sedan crater, located on Yucca Flat, is the largest and freshest explosion crater on Earth that was formed under conditions similar to hypervelocity impact cratering. As such, it is effectively pristine, having been formed in 1962 as a result of a controlled detonation of a 100 kiloton thermonuclear device, buried at the appropriate equivalent depth of burst required to make a simple crater. Sedan was formed in alluvium of mixed lithology and subsequently studied using a variety of field-based methods. Nearby secondary craters were also formed at the time and were also mapped by ATM. Adjacent to Sedan and also in alluvium is Scooter, about 90 m in diameter and formed by a high-explosive event. Schooner (240 m) and Danny Boy (80 m) craters were also important targets for ATM as they were excavated in hard basalt and therefore have much rougher ejecta. This will allow study of ejecta patterns in hard rock as well as engineering tests of crater and rock avoidance and rover trafficability. In addition to the high resolution DEMs, crater geometric characteristics, RMS roughness maps, and other higher-order derived data products will be generated using these data. These will provide constraints for models of landing hazards on Mars and for rover trafficability. Other planned studies will include ejecta size-frequency distribution at the resolution of the DEM and at finer resolution through air photography and field measurements, correlation of ejecta size and composition with radar and visible-thermal IR remote sensing signatures, and comparison of these results with similar measurements of Mars. The final DEMs, ancillary data sets, and derived data products will be made available to the community.
Author
Digital Elevation Models; Nuclear Explosions; Craters; Terrain

20040065747 Tokyo Univ., Hongo, Japan
Control of Impact Crater-related Fracture Systems on the Subsurface Hydrology and Ground Collapse
Rodriquez, J. A. P.a; Sasaki, S.; Miyamoto, H.; Dohm, James M.; Lunar and Planetary Science XXXV: Mars Impact Cratering; 2004; 2 pp.; In English; See also 20040065744; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Mars is a planet enriched by ground-water. Control of the subsurface hydrology by tectonic and igneous processes is widely documented, both for Earth and Mars. Impact craters result in extensive fracturing of the ground, which includes radial and concentric peripheral fault systems, which in the case of Earth have been recognized as predominantly strike-slip and listric extensional, respectively. In this work we propose that, basement structures of Mars largely result from impact-related tectonism, except in regions that are dominated by magmatic-driven activity such as Tharsis and/or possible plate tectonism during the extremely ancient period of Mars. However, complex basement structural fabrics in magmatically active regions such as Tharsis are the result of both impact and magmatism. In many cases, impact-induced faults appear to have been reactivated and/or displaced by subsequent magmatic-driven activity.
Author
Mars Craters; Geological Faults; Hydrology; Ground Water; Planetary Geology

20040065748 Hampshire Coll., Amherst, MA, USA

Analysis of Impact Crater Preservation on Mars Using THEMIS Data

Cull, S.; Barlow, N. G.; Lunar and Planetary Science XXXV: Mars Impact Cratering; 2004; 2 pp.; In English; See also 20040065744; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Relative ages of impact craters on Mars can be estimated by comparing crater degradation states. Several crater features can be used to estimate a crater's degradation state, including the presence and preservation of interior features, the height of the crater rim, depth to the crater floor, and preservation of the ejecta blanket. Of these, the first three are best determined using high-resolution satellite images and topographic data. However, ejecta blanket preservation is best gauged using multispectral imagery, with infrared data providing important insights. Rocky, fresh impact crater ejecta blankets appear brighter in night IR images than dusty, degraded ejecta blankets. With the growing database of night IR THEMIS images, it is now possible to begin estimating the degradation states of ejecta blankets surrounding Martian impact craters. This study began classifying Martian impact craters based on the degree of degradation of their ejecta blankets.

Author

Mars Craters; Geochronology; Planetary Geology

20040065749 Pittsburgh Univ., Pittsburgh, PA, USA

Quantitative Analyses of Terrestrial Crater Deposits: Constraining Formation and Sediment Transport Processes on Mars

Ramsey, M. S.; Crown, D. A.; Lunar and Planetary Science XXXV: Mars Impact Cratering; 2004; 2 pp.; In English; See also 20040065744; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The intent of the current research is to examine small, relatively fresh craters and their ejecta deposits on Earth in order to develop the tools critical for a similar style of investigation at Mars. Craters serve as probes of Martian stratigraphy, and their ejecta can be used to examine recent erosional styles and rates. At present, two craters (Meteor Crater, AZ and El Elegante Crater, Mexico) created by different processes (impact and volcanic) and yet of similar size, age, and erosional histories are being examined with both orbital and field-based research.

Derived from text

Meteorite Craters; Mars Surface; Earth Surface; Planetary Geology; Sediment Transport; Calderas

20040065750 Hawaii Univ., Honolulu, HI, USA

Predicted Effects of Surface Processes on Martian Impact Crater Depth/Diameter Relationships

Boyce, Joseph M.; Mouginis-Mark, Peter; Garbeil, Harold; Lunar and Planetary Science XXXV: Mars Impact Cratering; 2004; 2 pp.; In English; See also 20040065744; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In the past, most Mars crater morphology studies concentrated on the planimetric shape of the craters, but the acquisition of high quality topographic data from MOLA has allowed three-dimensional analysis of those craters. One of the most useful morphologic parameters is the crater depth (d) and diameter (D) relationship. This parameter is sensitive to the effects of surface processes, and includes the largest dimensions of the craters and as such is least sensitive to measurement error. While individual MOLA profiles can provide accurate d/D measurements for individual small craters (sub-kilometer, in some cases), MOLA gridded DIM data provide the only practical means to determine d/D for whole populations of craters. However, because of the irregular spacing of the MOLA ground tracks, only the diameters of craters larger than about 5-6 km can be measured with reasonable accuracy. This size normally ensures both accurate morphologic measurements and enough craters to provide statistically meaningful values for analysis of morphologic trends in regional crater populations. Although d/D has been used as an indicator of surface processes, a systematic discussion of how to interpret observed Martian crater d/D relationships in terms of the processes responsible for their modification has yet to be presented. In this abstract, we describe, in general terms, the characteristic of d/D relationships (where depth is measured from the crater rim to its floor (dr), and the relief between the crater floor and the surrounding terrain (ds)) produced by different surface processes on Mars. It should be kept in mind that surface processes that modify crater shapes and produce characteristic changes to the d/D relationship on Mars fall under either gradation (erosion, transport, and deposition of surface materials by wind, water, gravity, impacts and ice) or volcanic processes. We will discuss each of the major processes and their predicted effects on the d/D of Martian craters.

Author

Mars Craters; Planetary Geology; Depth; Diameters

20040065751 NASA Johnson Space Center, Houston, TX, USA

Atmospheric Entry Studies and the Smallest Impact Craters on Mars

Hoerz, F.; Cintala, M. J.; Rochelle, W. C.; Mitchell, C. M.; Smith, R. N.; Dobarco-Otero, J.; Finch, B. K.; See, T. H.; Lunar and Planetary Science XXXV: Mars Impact Cratering; 2004; 2 pp.; In English; See also 20040065744; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

High-resolution images from the Mars Orbiter Camera reveal impact craters as small as 10 m [1], and still smaller craters (< 0.5 m) have been inferred from surface boulders at the Pathfinder landing site [2]. Any small-scale impact environment at scales of meters or smaller would obviously be a potent contributor to erosive processes on Mars, to the small-scale evolution of its surface, and to mineralogic/ compositional alterations of its surface materials. It is not very clear from the analysis of Viking and Pathfinder images, however, what the smallest craters are on Mars. As a consequence, it might be informative to consult atmospheric-entry calculations that specify the smallest meteoroid able to survive passage through the present martian atmosphere. We conducted such calculations and perceive them as providing useful constraints for understanding small-scale surface processes on Mars and as possible guides for the interpretation of surface images from past and future lander missions.

Derived from text

Craters; Mars Surface; Mars Global Surveyor; Mars Photographs; Surface Properties; Meteoroids

20040065752 Planetary Science Inst., Tucson, AZ, USA

Updating the Crater Count Chronology System for Mars

Hartmann, W. K.; Lunar and Planetary Science XXXV: Mars Impact Cratering; 2004; 1 pp.; In English; See also 20040065744; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A 2004 iteration of the crater count isochron system has been developed, using recent estimates of the Mars/moon cratering ratio, improved gravity/velocity scaling, and for the first time a correction for the loss of small meteoroids by the effect of the Martian atmosphere based on the work of Popova et al. (2003) [1]. An "isochron" is a curve giving the number of craters/sq km N as a function of diameter D on a Martian surface of fixed age. The new isochrons are very similar to the last, 2002 iteration and the joint isochrons of Hartmann and Neukum [2], although the small crater populations observed in many areas of Mars fit the new curves somewhat better. The results confirm the presence of scattered examples of very young volcanic and fluvial activity in the last few percent of geologic time, and also suggest youthful ice flow and exhumation activity that may be controlled by 10-15 My cycles of climate change due to obliquity excursions.

Derived from text

Chronology; Cratering; Mars Craters; Geochronology; Climate Change; Meteoroids; Mars Surface

20040065753 Lunar and Planetary Inst., Houston, TX, USA

Lunar and Planetary Science XXXV: Impacts: Modeling and Observations

2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040065754 - 20040065770

Contract(s)/Grant(s): NCC5-679

Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

This document covers the following topics: Cratering on Titan: Projectiles, Craters and Impact Melt; The Cratering Database: Making Code Jockeys Honest; Popigai Impact Structure Modeling: Morphology and Worldwide Ejecta; Anhydrite EOS and Phase Diagram in Relation to Shock Decomposition; Computational Investigations of the Chesapeake Bay Impact Structure; Hydrocode Simulations of the Chesapeake Bay Impact; Lockne Crater as a Result of Oblique Impact; The Influence of a Deep Shelf Sea on the Excavation and Modification of a Marine-Target Crater, the Lockne Crater, Central Sweden; Pre-Drilling Investigation of the Lake Bosumtwi Impact Crater: Constraints from Geophysics and Numerical Modelling; Central Uplift Formation at the Middlesboro Impact Structure, Kentucky, USA; A SRTM Investigation of Serra da Cangalho Impact Structure, Brazil; Brazilian Impact Craters: A Review; Flynn Creek Impact Structure: New Insights from Breccias, Melt Features, Shatter Cones, and Remote Sensing; The Howell Structure, Lincoln County, Tennessee: A Review of Past and Current Research; After the Chicxulub Impact: Control on Depositional and Diagenetic History of the Cenozoic Carbonate Formations of the Northwestern Yucatan Peninsula, Mexico; Ni Contents by Non-Destructive In-Situ XRF Method of Takamatsu-Kagawa Crater District in Japan; and Akiyoshi Limestone Blocks Transported by the P/T Boundary Event to Japan Islands.

Derived from text

Carbonates; Cratering; Decomposition; Limestone; Morphology; Sediments; Projectiles; Geochemistry; Geophysics

20040065754 Syracuse Univ., NY, USA

Pre-Drilling Investigation of the Lake Bosumtwi Impact Crater: Constraints from Geophysics and Numerical Modelling

Karp, T.; Artemieva, N.; Milkereit, B.; Lunar and Planetary Science XXXV: Impacts: Modeling and Observations; 2004; 2 pp.; In English; See also 20040065753; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The topography of the Lake Bosumtwi crater and some of its structural dimensions are determined by geophysical methods. Numerical modelling uses those parameters in order to evaluate the cratering process itself (i.e. melt and tektite generation) as well as to test the modeling code. The geophysical maps show some asymmetry with the main anomaly north of the crater center. The simulations show asymmetric patterns only in ejecta and tektite distributions. The combination of field evidence and theoretic models not only provides necessary information for upcoming scientific drilling of the structure, it also suggests interesting and well suited drill sites. Besides the central uplift and the annular moat with a suggested thick breccia cover, drilling at the location of the geophysical anomalies and comparison of downrange and transversal locations might bring insight about pre-impact and impact induced asymmetries.

Derived from text

Geophysics; Mathematical Models; Mars Craters; Drilling; Topography; Lakes

20040065756 Tennessee Univ., Knoxville, TN, USA

The Howell Structure, Lincoln County, Tennessee: A Review of Past and Current Research

Deane, B.; Lee, P.; Milam, K. A.; Evenick, J. C.; Zawislak, R. L.; Lunar and Planetary Science XXXV: Impacts: Modeling and Observations; 2004; 2 pp.; In English; See also 20040065753; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Howell Structure is a roughly circular feature about 2.5 km in diameter, comprising brecciated, deformed, and disturbed sedimentary strata, located at 35 degrees 13.9 min N and 86 degrees 36.6 min W. The structure is centered on the unincorporated village of Howell, in Lincoln County, Tennessee, USA, about 110 km SSE of Nashville, TN. The feature is delineated on the geologic map of the Fayetteville Quadrangle, Tennessee as an Area of Disturbance. The western two-thirds of the Howell Structure occur in rolling, grass-covered pastureland, while the eastern one-third consists of forested hills rising 130 m above the surrounding terrain. Exposures are limited. The regional geology and past as well as current research on the Howell Structure is presented.

Derived from text

Tennessee; Structural Properties (Geology); Geomorphology; Strata

20040065757 Northern Illinois Univ., De Kalb, IL, USA

After the Chicxulub Impact: Control on Depositional and Diagenetic History of the Cenozoic Carbonate Formations of the Northwestern Yucatan Peninsula, Mexico

Lefticariu, M.; Perry, E.; Lefticariu, L.; Ward, W.; Lunar and Planetary Science XXXV: Impacts: Modeling and Observations; 2004; 2 pp.; In English; See also 20040065753; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Chicxulub bolide impact produced a crater structure that had a long-term influence on carbonate deposition and subsequent diagenesis in northwestern Yucatan Peninsula. The Chicxulub Sedimentary Basin roughly occupies the impact crater and is circumscribed by the Ring of Cenotes. The control of the Basin on sediment deposition and diagenesis was established by comparing lithologic, petrographic, and geochemical data of 11 cores from inside the Ring (depth ranges: 1,100 to 98 mbls<meters below the present land surface>) to those of 8 cores from outside the Ring (depth ranges: 671 to 21 mbls). The Ring of Cenotes and Ticul Fault are the main known structural features of northwestern Yucatan Peninsula. A comparison of the depositional and diagenetic features from inside the Ring of Cenotes to those from outside is presented.

Derived from text

Carbonates; Geochemistry; Mexico; Geochronology; Peninsulas; Structural Basins; Bolides; Hypervelocity Impact; Mineral Deposits

20040065761 Instituto Nacional de Tecnica Aeroespacial, Torrejon de Ardoz, Spain

The Influence of a Deep Shelf Sea on the Excavation and Modification of a Marine-Target Crater, the Lockne Crater, Central Sweden

Ormoe, Jens; Lindstroem, Maurits; Lunar and Planetary Science XXXV: Impacts: Modeling and Observations; 2004; 2 pp.; In English; See also 20040065753; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Comparisons between craters formed at different target water depth and in different strength and configuration of the rocks below the seafloor is a prerequisite for the understanding of the marine impact process. The Lockne crater is a wellpreserved and well-exposed example of a crater that was strongly affected by the target water. Geologically well-constrained numerical modeling has showed that the water depth exceeded the impactor diameter: Approximately 800 m water, 600 m impactor diameter. Below the water, about 80 m of limestone and loose, bituminous mud rested on the weathered Precambrian crystalline peneplain. Recently, improved outcrop has shown that its ejecta deposits and morphological features are better preserved than hitherto assumed. These new data have improved the interpretation of the formation of the crater. The excavation and modification of the Lockne Crater is summarized.
Derived from text
Excavation; Ocean Bottom; Sweden; Water Depth; Mars Craters; Marine Environments

20040065763 Academy of Sciences (USSR), Moscow, USSR
Cratering on Titan: Projectiles, Craters and Impact Melt
Artemieva, N.; Lunine, J.; Lunar and Planetary Science XXXV: Impacts: Modeling and Observations; 2004; 2 pp.; In English; See also 20040065753; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In July 2004, NASA's Cassini spacecraft will reach Saturn and on-board instruments will allow us to take a detailed look at the surface of the largest Saturn's moon, Titan. Later, in January 2005, planetary scientists will get even a closer look at Titan's atmosphere and surface when the European Space Agency's Huygens probe floats to the surface (http://saturn.jpl.nasa.gov/index.cfm). Titan is the only natural satellite in the solar system that possesses an extensive, thick atmosphere. It also exhibits a surface that, on scales of hundreds of kilometers, is highly variegated, with very dark areas that in whole or in part could be layers of organic detritus from the prodigious methane photochemistry of the stratosphere [1]. We continue our three-dimensional hydrodynamic simulations of hypervelocity cometary impacts into the atmosphere and the crust of Titan [2] to determine the projectile fate, the cratering growth and the melt production after an impact of strongly disrupted and dispersed projectile, mixing of organic material with melt and their possible ejection into space. We also estimate cooling history of the melt layer and the total amount of melt on the surface, based on the Titan s impact rate [3].
Derived from text
Cratering; Crusts; Impact Melts; Titan; Cometary Collisions; Photochemical Reactions; Projectile Cratering

20040065764 Stockholm Univ., Sweden
Lockne Crater as a Result of Oblique Impact
Lindstroem, M.; Shuvalov, V.; Ivanov, B.; Lunar and Planetary Science XXXV: Impacts: Modeling and Observations; 2004; 2 pp.; In English; See also 20040065753; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The asymmetry of ejecta distribution around the Lockne crater suggests that the crater was formed due to an oblique impact directed approximately from East to West. In this paper we present the results of 3D numerical modeling conducted to give more theoretical constraints for the geologic data interpretation, and conversely, to control the numerical model assumption with the field observation. Based on previous results we consider a 45 degree oblique impact of a 600-m diameter asteroid (with density 2.63 grams per cubic centimeter) into a 500 m deep sea. The impact velocity is 15 kilometers per second. A 3D version of the SOVA multi-material hydrocode has been used to model the shock wave propagation in a double layer (water and basement rocks) target, transient crater growth, material ejection, and ejecta expansion. Our mechanical model for rocks includes dry friction behavior of disrupted rocks, thermal softening close to the melting point (zero strength for melt), and acoustic fluidization. Special efforts are undertaken to describe ejecta flight and deposition taking into account their interaction with air and water. When any part of a solid target material rises 200 m above the sea floor it is considered as ejecta and transforms into discrete particles. The size distribution of ejected material is defined from the data available for land craters. We consider 4 groups of particles with sizes: less than 0.1 m, 0.1/1 m, 1/10 m, and 10/100 m. The motion of particles is calculated taking into account ejection velocity, drag force (depends on water/air density and relative velocity), and gravity.
Derived from text
Mars Craters; Three Dimensional Models; Obliqueness; Hypervelocity Impact

20040065768 Tennessee Univ., Knoxville, TN, USA
Central Uplift Formation at the Middlesboro Impact Structure, Kentucky, USA
Milam, K. A.; Kuehn, K.; Deane, B.; Lunar and Planetary Science XXXV: Impacts: Modeling and Observations; 2004; 2 pp.; In English; See also 20040065753; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Processes responsible for central uplift formation in complex impact craters have been the focus of much scientific study and are still being resolved. Present models call for hydrodynamic rock movement following crater collapse resulting in a central uplift or peak. Near instantaneous changes in target rheology that produce fluidized movement are thought to result from extreme pressure variations and/or thermal softening during shock wave passage (referred to as acoustic fluidization). Geologic observations of the central uplifts in some smaller complex craters, however, suggest that fluidization may not be the only process responsible for central formation. Central peaks in some complex craters show preservation of original bedding and evidence of postcompressional stage faulting/fracturing, suggestive of a brittle component to central peak formation. Uplifted exposures in the center of the Middlesboro impact structure in southeastern KY, have allowed us to examine processes involved in central uplift formation. The uplift preserves a paragenesis that includes the impact event, shock metamorphic effects, and appears to record central uplift formation.
Derived from text
Petrography; Geochemistry; Lunar Craters; Structural Basins; Shock Waves; Structural Properties (Geology); Kentucky; Metamorphism (Geology)

20040065777 Lunar and Planetary Inst., Houston, TX, USA
Lunar and Planetary Science XXXV: Impact Experiments
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040065778 - 20040065784
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

This document covers the following topics: The Shock Compression Laboratory at Harvard: A New Facility for Planetary Impact Processes; What Controls the Intensity of Impact-induced Luminescence?; Isolating the Ricochet-induced Vaporization Process; An Experimental Study of Excavation Flow in Impact Cratering; Migration of the Cratering Flow-Field Center with Implications for Scaling Oblique Impacts; Raman Spectroscopy of Olivine in Dunite Experimentally Shocked to Pressures Between 5 and 59 GPa; and An Experimental Tomography Study of Impact-induced Damage Beneath Craters.
Derived from text
Impact Damage; Olivine; Luminescence; Cratering; Excavation; Craters; Vaporizing; Tomography; Flow Distribution

20040065782 Tokyo Univ., Japan
An Experimental Study of Excavation Flow in Impact Cratering
Yamamoto, S.; Okabe, N.; Matsui, T.; Lunar and Planetary Science XXXV: Impact Experiments; 2004; 2 pp.; In English; See also 20040065777; Copyright; Avail: CASI; Available from CASI on CD-ROM only as part of the entire parent document

Impact craters have been considered to be formed by two processes: excavation of target material and displacement of target material downward. The amount and region of excavation are important parameters for studies of internal structure and surface evolution of bodies in the solar system. However, there are few experimental data concerning the excavation process. Therefore, we conducted impact cratering experiments to measure the excavation region and amount of the excavated material.
Derived from text
Cratering; Excavation; Mathematical Models; Hypervelocity Impact; Fluid Flow

20040065783 Tokyo Univ., Japan
What Controls the Intensity of Impact-induced Luminescence?
Sugita, S.; Schultz, P. H.; Hasegawa, S.; Lunar and Planetary Science XXXV: Impact Experiments; 2004; 2 pp.; In English; See also 20040065777; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The intensity of optical emission during hypervelocity impacts is proportional to impact velocity raised to a power, the value of which varies from 4 to 8, depending on impacting materials. It is not yet well understood, however, what controls this power-law exponent value. Nevertheless, the exponent value is required for predicting the intensity of optical emissions from hypervelocity impacts. Such a prediction is particularly relevant when a Discovery-class mission, Deep Impact, produces a collision between a metallic projectile and a comet in July 2005. One reason why the basic mechanism controlling the emission intensity has not been understood is the absence of spectroscopic observation with high time resolution and wavelength resolution. Time-integrated and/or spectrally integrated spectra are difficult to interpret. Here we report a series

of impact experiments in order to obtain emission spectra of hypervelocity impacts with high resolution in both time and wavelength.
Derived from text
Impact Velocity; Luminescence; Hypervelocity Impact; Light Emission; Mathematical Models

20040065786 Budapest Planetarium, Budapest, Hungary
On the Possibility of a Crypto-Biotic Crust on Mars Based on Northern and Southern Ringed Polar Dune Spots
Horvath, A.; Pocs, T.; Ganti, T.; Berczi, S.; Szathmary, E.; Lunar and Planetary Science XXXV: Astrobiology; 2004; 2 pp.; In English; See also 20040065785
Contract(s)/Grant(s): MUI-TP-217/2003; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We developed our model of dark dune defrosting process by studies in two directions. Firstly, we compared the dark dune spots in the Southern and in the Northern Polar Regions. This study showed that the northern dark spots forming during early spring period have various shapes, only rarely circular, in contrast to those of southern one. Secondly, we analyzed terrestrial desert and dry rocky surfaces: they are frequently covered by cryptobiotic crust (CBC). This cover consists of consortia of various extremophilic bacteria (mostly cyanobacteria).
Derived from text
Crusts; Cryptography; Dunes; Polar Regions; Mars Surface

20040065789 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Laboratory Detection and Analysis of Organic Compounds in Rocks Using HPLC and XRD Methods
Dragoi, D.; Kanik, I.; Bar-Cohen, Y.; Sherrit, S.; Tsapin, A.; Kulleck, J.; Lunar and Planetary Science XXXV: Astrobiology; 2004; 2 pp.; In English; See also 20040065785; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In this work we describe an analytical method for determining the presence of organic compounds in rocks, limestone, and other composite materials. Our preliminary laboratory experiments on different rocks/limestone show that the organic component in mineralogical matrices is a minor phase on order of hundreds of ppm and can be better detected using high precision liquid chromatography (HPLC). The matrix, which is the major phase, plays an important role in embedding and protecting the organic molecules from the harsh Martian environment. Some rocks bear significant amounts of amino acids therefore, it is possible to identify these phases using powder x-ray diffraction (XRD) by crystallizing the organic. The method of detection/analysis of organics, in particular amino acids, that have been associated with life will be shown in the next section.
Derived from text
Detection; Liquid Chromatography; Organic Compounds; Rocks; X Ray Diffraction; Composite Materials

20040065795 Leiden Univ., Netherlands
Amino Acid Survival Under Ambient Martian Surface UV Lighting
Garry, J. R. C.; tenKate, I. L.; Ruiterkamp, R.; Peeters, Z.; Lehmann, B.; Foing, B. H.; Ehrenfreund, P.; Lunar and Planetary Science XXXV: Astrobiology; 2004; 2 pp.; In English; See also 20040065785; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We seek to characterize and understand the response of organic molecules to the conditions found near the surface of Mars. The presence and longevity of meteoritic organic matter in the martian environment places constraints on the resources available to form or sustain a putative martian biosphere. Experiments have been conducted in which thin layers of glycine have been irradiated with a UV lamp that gives a good match to the insolation spectrum at Mars surface. Transmission spectroscopy of the amino acid before and after irradiation provides vital data to establish a degradation rate for this material.
Author
Amino Acids; Organic Materials; Mars Surface; Survival; Mars Environment

20040065797 NASA Ames Research Center, Moffett Field, CA, USA
Short Time Scale Evolution of Microbiolites in Rapidly Receding Altiplanic Lakes: Learning How to Recognize Changing Signatures of Life
Cabrol, N. A.; Grin, E. A.; Borics, G.; Kiss, A.; Fike, D.; Kovacs, G.; Hock, A.; Kiss, K.; Acs, E.; Sivila, R., et al.; Lunar and Planetary Science XXXV: Astrobiology; 2004; 2 pp.; In English; See also 20040065785; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

As part of the exploration of high altitude lakes as analogs to Martian paleolakes environment, we are investigating a remarkably large and diverse field of lacustrine stromatolites located at 4,365m in the Bolivian Altiplano (22 deg 47 00 min S and 67 deg 47.00 min W).The field is composed of both early Holocene fossil structures located on paleoshorelines and present-day active cyanobacterial communities on the shore and at the bottom of the current Laguna Blanca and Verde. Its physical environment, broad diversity of morphologies, and their associated spatial heterogeneity, origin, and scale offer a unique opportunity to explore microbiolites in conditions reminiscent of early Earth and Mars. At this altitude and latitude, UV radiation levels are enhanced (40% higher than sea level) and harmful to microorganisms living in shallow waters which provide only minimal protection from UV. Similar conditions prevailed on early Earth when the ozone layer had yet to be formed in the atmosphere. Compared to those studied at sea levels, these stromatolites could yield new insights about the earliest terrestrial forms of life. Moreover, the combination of physical and geological environment of this site is exceptionally analogous to conditions believed to be prevalent on Mars at the end of the Noachian (3.5 Ga ago), allowing to test the potential for forming stromatolites in martian paleolakes and learn how to identify their fossil record remotely. Our overarching goal is to generate new astrobiological information on high-altitude stromatolites as clues to early biospheres with implications for Earth and Mars. Our two central objectives are: (1) characterize the biological, geological, and mineralogical features and significance of this field, and to identify geo-signatures such as morphology, geology, chronostratigraphy, mineralogy and biosignatures, and (2) to facilitate remote-sensing and ground robotic detection capabilities for future astrobiological missions to Mars.

Author

Evolution (Development); Time Functions; Microorganisms; Signatures; Life (Durability); Mars Surface

20040065798 NASA Ames Research Center, Moffett Field, CA, USA

Characterization of Two Microbial Isolates from Andean Lakes in Bolivia

Demergasso, C.; Blamey, J.; Escudero, L.; Chong, G.; Casamayor, E. O.; Cabrol, N. A.; Grin, E. A.; Hock, A.; Kiss, A.; Borics, G., et al.; Lunar and Planetary Science XXXV: Astrobiology; 2004; 1 pp.; In English; See also 20040065785; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We are currently investigating the biological population present in the highest and least explored perennial lakes on earth in the Bolivian and Chilean Andes, including several volcanic crater lakes of more than 6000 m elevation, in combination of microbiological and molecular biological methods. Our samples were collected in saline lakes of the Laguna Blanca Laguna Verde area in the Bolivian Altiplano and in the Licancabur volcano crater (27 deg. 47 min S/67 deg. 47 min. W) in the ongoing project studying high altitude lakes. The main goal of the project is to look for analogies with Martian paleolakes. These Bolivian lakes can be described as Andean lakes following the classification of Chong. We have attempted to isolate pure cultures and phylogenetically characterize prokaryotes that grew under laboratory conditions. Sediment samples taken from the Licancabur crater lake (LC), Laguna Verde (LV), and Laguna Blanca (LB) were analyzed and cultured using enriched liquid media under both aerobic and anaerobic conditions. All cultures were incubated at room temperature (15 to 20 C) and under light exposure. For the reported isolates, 36 hours incubation were necessary for reaching optimal optical densities to consider them viable cultures. Ten serial dilutions starting from 1% inoculum were required to obtain a suitable enriched cell culture to transfer into solid media. Cultures on solid medium were necessary to verify the formation of colonies in order to isolate pure cultures. Different solid media were prepared using several combinations of both trace minerals and carbohydrates sources in order to fit their nutrient requirements. The microorganisms formed individual colonies on solid media enriched with tryptone, yeast extract and sodium chloride. Cells morphology was studied by optical and electronic microscopy. Rodshape morphologies were observed in most cases. Total bacterial genomic DNA was isolated from 50 ml late-exponential phase culture by using the CTAB miniprep protocol. The 16S rRNA genes were amplified by PCR using both Bacteria- and Archaeauniversal primer sets: 27f and 1492r, 21f and 1492r respectively. Sequences of 16S rRNA gene were determined and initially compared with reference sequences contained in the EMBL nucleotide sequence database by using the BLAST program and were subsequently aligned with 16S rRNA reference sequences in the ARB package (http://www.mikro.biologie.tu-muenchen.de). Aligned sequences were inserted within a stable phylogenetic tree by using the ARB parsimony tool. In this work we report the morphology and phylogenetic characterization of two isolates belonged to Laguna Blanca sediments.

Derived from text

Bolivia; Lakes; Lunar Craters; Volcanology; Characterization; Microorganisms

20040065799 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Determination of Aromatic Ring Number Using Multi-Channel Deep UV Native Fluorescence

Bhartia, R.; McDonald, G. D.; Salas, E.; Conrad, P.; Lunar and Planetary Science XXXV: Astrobiology; 2004; 2 pp.; In English; See also 20040065785; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The in situ detection of organic material on an extraterrestrial surface requires both effective means of searching a relatively large surface area or volume for possible organic carbon, and a more specific means of identifying and quantifying compounds in indicated samples. Fluorescence spectroscopy fits the first requirement well, as it can be carried out rapidly, with minimal or no physical contact with the sample, and with sensitivity unmatched by any other organic analytical technique. Aromatic organic compounds with know fluorescence signatures have been identified in several extraterrestrial samples, including carbonaceous chondrites, interplanetary dust particles, and Martian meteorites. The compound distributions vary among these sources, however, with clear differences in relative abundances by number of aromatic rings and by degree of alkylation. This relative abundance information, therefore, can be used to infer the source of organic material detected on a planetary surface.

Derived from text

Aromatic Compounds; Ultraviolet Detectors; In Situ Measurement; Organic Materials; Carbonaceous Chondrites; Planetary Surfaces

20040065800 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Extraction of Organic Molecules from Terrestrial Material: Quantitative Yields from Heat and Water Extractions

Beegle, L. W.; Abbey, W. A.; Tsapin, A. T.; Dragoi, D.; Kanik, I.; Lunar and Planetary Science XXXV: Astrobiology; 2004; 2 pp.; In English; See also 20040065785; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In the robotic search for life on Mars, different proposed missions will analyze the chemical and biological signatures of life using different platforms. The analysis of samples via analytical instrumentation on the surface of Mars has thus far only been attempted by the two Viking missions. Robotic arms scooped relogith material into a pyrolysis oven attached to a GC/MS. No trace of organic material was found on any of the two different samples at either of the two different landing sites. This null result puts an upper limit on the amount of organics that might be present in Martian soil/rocks, although the level of detection for each individual molecular species is still debated. Determining the absolute limit of detection for each analytical instrument is essential so that null results can be understood. This includes investigating the trade off of using pyrolysis versus liquid solvent extraction to release organic materials (in terms of extraction efficiencies and the complexity of the sample extraction process.) Extraction of organics from field samples can be accomplished by a variety of methods such utilizing various solvents including HCl, pure water, supercritical fluid and Soxhelt extraction. Utilizing 6N HCl is one of the most commonly used method and frequently utilized for extraction of organics from meteorites but it is probably infeasible for robotic exploration due to difficulty of storage and transport. Extraction utilizing H2O is promising, but it could be less efficient than 6N HCl. Both supercritical fluid and Soxhelt extraction methods require bulky hardware and require complex steps, inappropriate for inclusion on rover spacecraft. This investigation reports the efficiencies of pyrolysis and solvent extraction methods for amino acids for different terrestrial samples. The samples studied here, initially created in aqueous environments, are sedimentary in nature. These particular samples were chosen because they possibly represent one of the best terrestrial analogs of Mars and they represent one of the absolute best case scenarios for finding organic molecules on the Martian surface.

Derived from text

Extraterrestrial Life; Robotics; Water; Molecules; Organic Compounds; Solvent Extraction; Heat; Quantitative Analysis

20040065801 NASA Johnson Space Center, Houston, TX, USA

Determination of the Three-Dimensional Morphology of ALH84001 and Biogenic MV-1 Magnetite: Comparison of Results from Electron Tomography and Classical Transmission Electron Microscopy

Thomas-Keprta, Kathie L.; Clemett, Simon J.; Schwartz, Cindy; Morphew, Mary; McIntosh, J. Richard; Bazylinski, Dennis A.; Kirschvink, Joseph L.; Wentworth, Susan J.; McKay, David S.; Vali, Hojatollah, et al.; Lunar and Planetary Science XXXV: Astrobiology; 2004; 2 pp.; In English; See also 20040065785; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Dated at approximately 3.9 billion years of age, carbonate disks, found within fractures of the host rock of Martian meteorite ALH84001, have been interpreted as secondary minerals that formed at low temperature in an aqueous medium. Heterogeneously distributed within these disks are magnetite nanocrystals that are of Martian origin. Approximately one

quarter of these magnetites have morphological and chemical similarities to magnetite particles produced by magnetotactic bacteria strain MV-1, which are ubiquitous in aquatic habitats on Earth. Moreover, these types of magnetite particles are not known or expected to be produced by abiotic means either through geological processes or synthetically in the laboratory. The remaining three quarters of the ALH84001 magnetites are likely products of multiple processes including, but not limited to, precipitation from a hydrothermal fluid, thermal decomposition of the carbonate matrix in which they are embedded, and extracellular formation by dissimilatory Fe-reducing bacteria. We have proposed that the origins of magnetites in ALH84001 can be best explained as the products of multiple processes, one of which is biological. Recently the three-dimensional (3-D) external morphology of the purported biogenic fraction of the ALH84001 magnetites has been the subject of considerable debate. We report here the 3-D geometry of biogenic magnetite crystals extracted from MV-1 and of those extracted from ALH84001 carbonate disks using a combination of high resolution classical and tomographic transmission electron microscopy (TEM). We focus on answering the following questions: (1) which technique provides adequate information to deduce the 3-D external crystal morphology?; and, (2) what is the precise 3-D geometry of the ALH84001 and MV-1 magnetites?

Derived from text

Crystal Morphology; Magnetite; Morphology; Tomography; Transmission Electron Microscopy; Three Dimensional Models; Biogeny; Nanocrystals

20040065802 Hernandez Engineering, Inc., Houston, TX, USA

Thermal Decomposition of Siderite-Pyrite Assemblages: Implications for Sulfide Mineralogy in Martian Meteorite ALH84001 Carbonate Globules

Golden, D. C.; Ming, D. W.; Lauer, H. V., Jr.; Morris, R. V.; Lunar and Planetary Science XXXV: Astrobiology; 2004; 2 pp.; In English; See also 20040065785; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Although magnetite crystals in ALH84001 have received considerable attention in the literature as a potential biomarker, the sulfide component is important because the coexistence of magnetite and sulfides has also been suggested as a marker for past biogenic activity. Very little research, however, has focused on the formation of sulfides in ALH84001. Early research on the sulfides in ALH84001 indicated that pyrite grains (greater than 10 m in size) are associated with chromite, maskelynite, and/or carbonate globules. Fine-grained sulfides, which are found in the black rims of the carbonate globules, were tentatively identified as pyrrhotite and greigite. The presence of greigite has not been confirmed but the presence of pyrrhotite has been confirmed. An alternative hypothesis to the biogenic origin for the carbonate-magnetite-sulfide assemblage in ALH84001 is the inorganic formation of this mineral assemblage by aqueous or hydrothermal precipitation of carbonate globules with Fe-sulfides followed by a heat pulse that was sufficient to decompose siderite to magnetite and pyrite to pyrrhotite. We have previously precipitated Fe-sulfides (pyrite and pyrrhotite) and magnetite along with synthetic carbonate globules in laboratory experiments. The pyrite precipitated along with the Fe-rich carbonate layers, and then was thermally converted to pyrrhotite upon heating to 470 C in a CO2 atmosphere. The thermal decomposition of pyrite-siderite assemblages to pyrrhotite-magnetite assemblages depends on a number of environmental variables, e.g., the partial pressure of S and CO2, presence/absence of volatile sinks, and open versus closed reaction environments. The objective of this paper is to report the effects of these environmental variables on the thermal decomposition of siderite-pyrite assemblages and to discuss their implications for the formation of the carbonate-sulfide-magnetite assemblage in ALH84001.

Derived from text

Carbonates; Globules; Mineralogy; Pyrites; Siderites; Sulfides; Thermal Decomposition; SNC Meteorites

20040065803 Texas Univ., El Paso, TX, USA

Comparative Planetology of the Terrestrial Inner Planets: Implications for Astrobiology

Schulze-Makuch, D.; Dohm, J. M.; Fairen, A. G.; Baker, V. R.; Strom, R.; Lunar and Planetary Science XXXV: Astrobiology; 2004; 2 pp.; In English; See also 20040065785; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Although all inner terrestrial planets originated from very similar material of the planetary nebula, the worlds that developed after 4.6 billion years of solar system history are very different. Mercury and the Moon are today inactive planetary bodies. Only Mercury s inner core appears to be still active, producing a significant geomagnetic field. On both planetary bodies, signs of surface activity include the emplacement of lava flows several billions of years ago. Mercury may have had some liquid water on its surface for a relatively short time period during its earliest stage of formation, and both planetary bodies appear to have some frozen water within impact basins near their poles. However, since Mercury and the Moon are without a protecting atmosphere and without significant amounts of liquid water, they are unlikely to ever have harbored life.

The terrestrial planets Venus, Earth, and Mars, on the other hand, show many signs of dynamic activities still occurring today. Dynamic features on the Venusian surface include coronae, igneous plateaus, large volcanoes, ridge and fracture belts, tesserae, and other volcanic and structural features. Earth is a dynamic, water-enriched planet where high erosion rates, magmatic-driven activity, and plate tectonism modify its surface over relatively short time periods. Earth transports heat through two primary modes, plate tectonism and plumes of diverse dimensions and origins ranging from superplumes to mantle plumes. Mars is primarily cold and dry, but these conditions are punctuated by volcanic eruptions that appear to have occurred until very recently and probably still occur. Episodic endogenic-driven activity also resulted in flooding in the northern plains and short-lived hydrological cycles. Orbital parameters such as changes in obliquity also are important factors concerning the surface modification of Mars.
Derived from text
Exobiology; Planetology; Terrestrial Planets; Mars Surface

20040065807 Max-Planck-Inst. fuer Chemie, Mainz, Germany
High Spatial Resolution Ion Microprobe Measurements Refine Chronology of Orgueil Carbonate Formation
Hoppe, P.; Macdougall, D.; Lugmair, G. W.; Lunar and Planetary Science XXXV: Early Solar System Chronology; 2004; 2 pp.; In English; See also 20040065806; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Carbonates in the CI meteorites occur as discrete crystals and multi-grain fragments and are generally believed to be remnants of hydrothermal vein networks that developed on the parent body and were subsequently disrupted by impacts. Measurements of the Sr isotopic compositions of dolomite and breunnerite from Orgueil first showed that the carbonate-forming episode(s) must have occurred very early in Solar System history [1], and subsequently the detection of 53Cr from in-situ decay of 53Mn (half life 3.7 Ma) in some CI carbonates allowed more precise documentation of the timescale of their formation and showed that it must be restricted to the first 15 to 20 Ma of Solar System history [2-4]. In this work we separated carbonate grains from small samples of Orgueil by ultrasonic disaggregation in ethanol followed by hand picking. After initial characterization using the SEM, grains were mounted in epoxy, polished, and Mn and Cr isotopes were measured using the Cameca NanoSIMS 50 at MPI for Chemistry, Mainz.
Derived from text
Carbonates; Chronology; Chromium Isotopes; High Resolution; Manganese Isotopes; Meteorites; Dolomite (Mineral); Ion Probes

20040065808 California Univ., San Diego, La Jolla, CA, USA
Calibration of the Galactic Cosmic Ray Flux
Mathew, K. J.; Marti, K.; Lunar and Planetary Science XXXV: Early Solar System Chronology; 2004; 2 pp.; In English; See also 20040065806
Contract(s)/Grant(s): NAG5-12983; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We report first Xe data on the cross-calibration of I-129-Xe-129(sub n) ages with conventional CRE ages, a method which is expected to provide information on the long-term constancy of the galactic cosmic ray (GCR) flux. We studied isotopic signatures of Xe released in stepwise heating, decomposition and melting of troilites in the Cape York iron meteorite to identify isotopic shifts in Xe-129 and Xe-131 due to neutron capture in Te-128 and Te-130. We also resolve components due to extinct 129I, spallation and fission Xe. There has recently been much speculation on the constancy of GCR over long time scales, as may be inferred from iron meteorites. If GCRs originate from supernova events, this provides the basis for postulating increased fluxes at locations with higher than average densities of supernovae, specifically in OB-associations. The solar system at present appears to be inside a local bubble between spiral arms and may experience an increased GCR flux.
Derived from text
Galactic Cosmic Rays; Star Clusters; Xenon 129; Calibrating; Flux (Rate)

20040065809 California Univ., Los Angeles, CA, USA
Mg Isotope Ratio Zonation in CAIs: New Constraints on CAI Evolution
Simon, J. I.; Tonui, E.; Russell, S. S.; Young, E. D.; Lunar and Planetary Science XXXV: Early Solar System Chronology; 2004; 2 pp.; In English; See also 20040065806; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We report in situ UV laser ablation MC-ICPMS measurements of Mg isotope ratios from two CV3 CAIs, Allende 3576B

and Leoville 144A. Sample-standard bracketing affords precision of less than 0.2 % (2 sigma) for delta (25)Mg and 0.3 % (2 sigma) for delta (26)Mg. The precision is sufficient to resolve mass dependent variations within distinct CAI domains that are difficult to obtain by bulk methods (e.g., TIMS) and are not presently achievable with other in situ methods due to instrumental fractionation (e.g., SIMS). The aim of this work is to provide tests of recently proposed models for the chemical and isotopic evolution of CAIs involving volatilization of precursor solids and melts in the solar nebula.
Author
Meteoritic Composition; Magnesium Isotopes; Isotope Ratios; Meteorites

20040065810 Toronto Univ., Ontario, Canada
Sm-Nd Systematics of Chondrites
Amelin, Y.; Rotenberg, E.; Lunar and Planetary Science XXXV: Early Solar System Chronology; 2004; 2 pp.; In English; See also 20040065806; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Here we report new Sm-Nd data for ordinary and carbonaceous chondrites. The approach adopted here differs from the previous studies of Sm-Nd system of chondrites in several ways: 1) We have analyzed individual components of meteorites: phosphate minerals and chondrules, rather than whole rocks. This allows us to evaluate the extent of internal fractionation of Sm and Nd. 2) Most of the fractions were also dated using U-Pb and Rb-Sr isotopes. This gives us an independent test of whether the studied phases were formed during the early stages of solar system evolution, and remained a closed system since then. 3) For the first time, we have detected the variations of (142)Nd/(144)Nd in chondrites, and determined the initial chondritic (146)Sm/(144)Sm.
Author
Chondrites; Meteoritic Composition; Samarium; Neodymium

20040065814 Chicago Univ., Chicago, IL, USA
Iron Isotopic Fractionation During Vacuum Evaporation of Molten Wustite and Solar Compositions
Dauphas, N.; Davis, A. M.; Mendybaev, R.; Richter, F. M.; Wadhwa, M.; Janney, P. E.; Foley, N.; Lunar and Planetary Science XXXV: Early Solar System Chronology; 2004; 2 pp.; In English; See also 20040065806; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The chemical compositions of planetary bodies are extremely diverse. In contrast, the isotopic compositions of most elements are uniform at large scales, indicating that the protosolar nebula was homogenized at some stage. The diversity of chemical compositions among undifferentiated meteorites must therefore reflect processes within the nebula such as gas-dust decoupling, partial condensation and evaporation, and metal-silicate differentiation. The abundance and oxidation of iron in chondrites has long been recognized as a valuable tool for classifying meteorites [1]. Iron isotopes add a third dimension to the already useful Urey-Craig diagram [2]. Among the processes that left their imprints on the chemical composition of solar system materials, evaporation is a major one. A simple system amenable to experimental investigation is evaporation of molten droplets, such as chondrules [3-6] and deepsea spherules [7-9].
Derived from text
Fractionation; Chemical Composition; Iron Isotopes; Meteoritic Composition; Cosmic Dust; Solar Nebula; Meteorites; Silicates

20040065816 Lunar and Planetary Inst., Houston, TX, USA
Lunar and Planetary Science XXXV: Dust: Theory and Experiments
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040065817 - 20040065824
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The titles in this section include: 1) Experimental Study of the Radiation Pressure Forces on Isolated Micron-size Dust Particles; 2) Migration of Dust Particles and Their Collisions with the Terrestrial Planets; 3) Chemical In-Situ Analysis of Interplanetary and Interstellar Meteoroids; 4) Mass Spectrometer Calibration of Cassini Cosmic Dust Analyzer for Methane Ice via Laser Ablation; 5) Comparative Effects of 10.2 eV Photon and 200 keV Proton Irradiation on Condensed CO; 6) Experimental Studies on Heated and Unheated He-Irradiated Olivine Grains at Moderate He-Ion Fluences: Analogues to

Radiation Damage in IDPs; 7) Impact Studies Using a One Stage Light Gas Gun; 8) Condensation Kinetics of Metallic Iron: An Experimental Study.
Author
Cosmic Dust; Experimentation; Planetology

20040065817 European Space Agency. European Space Operations Center, Darmstadt, Germany
Chemical In-Situ Analysis of Interplanetary and Interstellar Meteoroids
Landgraf, M.; Gruen, E.; Lunar and Planetary Science XXXV: Dust: Theory and Experiments; 2004; 2 pp.; In English; See also 20040065816; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In-situ measurements of cosmic dust grains (meteoroids) have given us a wealth of information about dynamic processes in and outside the Solar System. Central issues regarding the makeup of interstellar as well as interplanetary dust are less well established. For example unknown what fraction of the interplanetary dust population at Earth originates from comets and what from asteroids. Much work has been done on the isotopic and chemical composition of certain, identifiable, phases of interplanetary dust grains (IDPs). The chemical composition of the dust grains is indicative of their origin, but cannot unambiguously determine whether an individual dust grain originates from a comet, an asteroid, or from interstellar space. In order to establish a dust grain's source the simultaneous knowledge about its state of motion and its chemical makeup is required. For that purpose a dedicated space mission has been proposed. It is intended to carry a set of dust detection instruments to a disturbance-free, near-Earth position, like one of the colinear Lagrange points, 1.5 x 10(exp 6) km from Earth. The instrument set is comprised of a trajectory sensor, a large-area mass analyzer, and auxiliary payload such as a plasma monitor. The total sensitive area of the dust detectors is 0.1 sq m, one order of magnitude larger than current instruments. The spacecraft is three-axis stabilized and is able to point the instrument array in any direction with a relatively low precision requirement of 1 deg. The proposed name for the mission is DUNE, for DUst Near Earth. While the characteristics of the trajectory sensor are discussed in accompanying work, we focus here on the large area mass analyser (LAMA), the purpose of which is to find the elementary composition of interplanetary and interstellar dust grains by means of time-of-flight mass spectrometry.
Author
In Situ Measurement; Meteoritic Composition; Interplanetary Dust; Space Missions

20040065819 Baylor Univ., Waco, TX, USA
Impact Studies Using a One Stage Light Gas Gun
Carmona-Reyes, Jorge; Cook, Mike; Schmoke, Jimmy; Harper, Katie; Reay, Jerry; Matthews, Lorin; Hyde, Truell; Lunar and Planetary Science XXXV: Dust: Theory and Experiments; 2004; 2 pp.; In English; See also 20040065816; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Center for Astrophysics, Space Physics, and Engineering Research (CASPER) has completed construction and calibration of a Light Gas Gun (LGG), which is used for low velocity impact studies. At geosynchronous orbit, space debris can impact commercial satellites at velocities of 500 meters per second reducing their useful lifetime. Additionally, there is an ever-increasing population of abandoned nonoperational satellites and related debris in these orbits. Therefore, it is important to clearly understand the physics behind how such collisions can cause structural damage. This is most easily determined by measuring the damage incurred on representative material exposed to test collisions in the laboratory. Data collected in this manner will not only help illuminate the shock physics involved but can also aid in providing methods for designing advanced shielding for satellites.
Derived from text
Light Gas Guns; Impact Velocity; Hypervelocity Impact; Astrophysics

20040065820 Washington Univ., Seattle, WA, USA
Experimental Studies on Heated and Unheated He-Irradiated Olivine Grains at Moderate He-Ion Fluences: Analogues to Radiation Damage in IDPs
Joswiak, D. J.; Brownlee, D. E.; Schlutter, D. J.; Pepin, R. O.; Lunar and Planetary Science XXXV: Dust: Theory and Experiments; 2004; 2 pp.; In English; See also 20040065816; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Irradiation in the harsh environment of space from cosmic ray and solar wind bombardment can be a significant process inducing both chemical and textural changes in extraterrestrial materials. In lunar soils for example, solar wind implantation

in olivine and ilmenite grains produces amorphous rims containing nanophase Fe-metal inclusions [1]. In IDPs with their high surface to volume ratios and naturally high exposure to radiation, both large and small scale irradiation textures are often seen. Perhaps the ultimate end-texture from irradiation is exhibited by GEMS (Glass with Embedded Metal and Sulfides) which are completely altered due to the complete erasure of the original mineralogy by incident radiation over long periods of time [2]. Small-scale minor features that have commonly been seen in IDPs include amorphous rims on grains, cosmic ray tracks in minerals and void or bubble structures near edges of grains.
Derived from text
Cosmic Rays; Solar Wind; Irradiation; Extraterrestrial Matter; Amorphous Materials; Olivine; Lunar Soil; Radiation Damage

20040065822 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Migration of Dust Particles and Their Collisions with the Terrestrial Planets
Ipatov, S. I.; Mather, J. C.; Lunar and Planetary Science XXXV: Dust: Theory and Experiments; 2004; 2 pp.; In English; See also 20040065816
Contract(s)/Grant(s): NAG5-10776; INTAS-00-240; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Our review of previously published papers on dust migration can be found in [1], where we also present different distributions of migrating dust particles. We considered a different set of initial orbits for the dust particles than those in the previous papers. Below we pay the main attention to the collisional probabilities of migrating dust particles with the planets based on a set of orbital elements during their evolution. Such probabilities were not calculated earlier.
Derived from text
Dust; Migration; Collisions; Terrestrial Planets; Orbital Elements

20040065834 Lunar and Planetary Inst., Houston, TX, USA
Lunar and Planetary Science XXXV: Undergraduate Education and Research Programs, Facilities, and Information Access
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040065835 - 20040065847
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The titles in this section include: 1) GRIDVIEW: Recent Improvements in Research and Education Software for Exploring Mars Topography; 2) Software and Hardware Upgrades for the University of North Dakota Asteroid and Comet Internet Telescope (ACIT); 3) Web-based Program for Calculating Effects of an Earth Impact; 4) On-Line Education, Web- and Virtual-Classes in an Urban University: A Preliminary Overview; 5) Modelling Planetary Material's Structures: From Quasicrystalline Microstructure to Crystallographic Materials by Use of Mathematica; 6) How We Used NASA Lunar Set in Planetary and Material Science Studies: Textural and Cooling Sequences in Sections of Lava Column from a Thin and a Thick Lava-Flow, from the Moon and Mars with Terrestrial Analogue and Chondrule Textural Comparisons; 7) Classroom Teaching of Space Technology and Simulations by the Husar Rover Model; 8) New Experiments (In Meteorology, Aerosols, Soil Moisture and Ice) on the New Hunveyor Educational Planetary Landers of Universities and Colleges in Hungary; 9) Teaching Planetary GIS by Constructing Its Model for the Test Terrain of the Hunveyor and Husar; 10) Undergraduate Students: An Untapped Resource for Planetary Researchers; 11) Analog Sites in Field Work of Petrology: Rock Assembly Delivered to a Plain by Floods on Earth and Mars; 12) RELAB (Reflectance Experiment Laboratory): A NASA Multiuser Spectroscopy Facility; 13) Full Text Searching and Customization in the NASA ADS Abstract Service.
Author
Planetology; Planetary Geology; University Program; Students

20040065835 Arizona Univ., Tucson, AZ, USA
Web-based Program for Calculating Effects of an Earth Impact
Marcus, Robert; Melosh, H. J.; Collins, Gareth; Lunar and Planetary Science XXXV: Undergraduate Education and Research Programs, Facilities, and Information Access; 2004; 2 pp.; In English; See also 20040065834; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Periodically, stories concerning the possibility of a large extraterrestrial impact on earth enter the mainstream media. During these times, both scientists and non-scientists alike become interested in determining the effects that this impact would

cause on earth, often with a particular impact site and distance from impact in mind. For scientists, the trouble with determining these effects is merely the time it would take to find all of the equations and data necessary to calculate the effects. For non-scientists, these calculations are all but impossible. Presently, there is no reliable place where the interested person may obtain a clear and concise summary of the general effects created by an impact on earth. We currently maintain a popular crater diameter calculator online at http://www.lpl.arizona. edu/tekton/crater.html. This program uses scaling laws to derive crater size estimates from impact parameters such as impactor size, velocity and density. The goal of the Earth Impact Effects Program is to provide a similar, easy-to-use web-based program to calculate various pertinent environmental consequences of a given impact event on Earth at a specified distance away. So far, the environmental effects that we have considered are crater size, seismic effects (including Richter magnitude and damage assessment), and the thickness and average fragment size of the ejecta deposit. In the future, we intend to extend the program to include the effects of the shock wave and thermal radiation. In addition, the web page will include a description of our algorithm with citations to the scientific sources used. It is our intention for this program to be useful for not only casual users, but also those who require a deeper understanding of how the results were obtained.
Derived from text
Hypervelocity Impact; Earth Surface; Planetary Geology; Seismology; World Wide Web

20040065836 Harvard-Smithsonian Center for Astrophysics, Cambridge, MA, USA
Full Text Searching and Customization in the NASA ADS Abstract Service
Eichhorn, G.; Accomazzi, A.; Grant, C. S.; Kurtz, M. J.; Henneken, E. A.; Thompson, D. M.; Murray, S. S.; Lunar and Planetary Science XXXV: Undergraduate Education and Research Programs, Facilities, and Information Access; 2004; 2 pp.; In English; See also 20040065834
Contract(s)/Grant(s): NCC5-189; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

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Derived from text
Texts; NASA Programs; Astronomy; Search Profiles; Abstracts

20040065837 North Dakota Univ., Grand Forks, ND, USA
Software and Hardware Upgrades for the University of North Dakota Asteroid and Comet Internet Telescope (ACIT)
Gerszewski, M. T.; Cui, P.; Kanupuru, V,; Hardersen, Paul S.; Lunar and Planetary Science XXXV: Undergraduate Education and Research Programs, Facilities, and Information Access; 2004; 1 pp.; In English; See also 20040065834; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

After an additional two years of work, the Asteroid and Comet Internet Telescope (ACIT) has finally reached an operational status. Most of the upgrades that were envisioned have been implemented. Hardware upgrades to increase functionality and capabilities have been implemented, as well as software upgrades to increase usability and reliability. The overall software design has improved considerably since our initial implementation used from 1998-2001. Slight modifications have been made since 2002.
Derived from text
Asteroids; Comets; Computer Programs; Internets; Telescopes; Education

20040065838 Uniconstant Co., Budapest, Hungary

Modelling Planetary Material's Structures: From Quasicrystalline Microstructure to Crystallographic Materials by Use of Mathematica

Kabai, S.; Berczi, Sz; Lunar and Planetary Science XXXV: Undergraduate Education and Research Programs, Facilities, and Information Access; 2004; 2 pp.; In English; See also 20040065834; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In the last year we developed our interactive Mathematica in space materials studies and modelling. We focused on the structural hierarchy of materials and quasicrystals because impact materials may produce such semiordered structures. We used our system both to the classical structures like Widmannstadten texture of iron meteorites and to cryptocrystalline materials and also some industrial materials too.

Derived from text

Crystallography; Meteoritic Microstructures; Mathematical Models; Planetary Structure; Composite Materials

20040065839 Eotvos Lorand Univ., Budapest, Hungary

How We Used NASA Lunar Set in Planetary and Material Science Studies: Textural and Cooling Sequences in Sections of Lava Column from a Thin and a Thick Lava-Flow, from the Moon and Mars with Terrestrial Analogue and Chondrule Textural Comparisons

Berczi, Sz.; Jozsa, S.; Szakmany, Gy.; Kubovics, I.; Puskas, Z.; Fabricz, A.; Unger, Z.; Lunar and Planetary Science XXXV: Undergraduate Education and Research Programs, Facilities, and Information Access; 2004; 2 pp.; In English; See also 20040065834

Contract(s)/Grant(s): MUI-TP-190/2003; MUI-TP-154/2003; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

NASA Lunar sample set helps planetary petrology studies in the reconstruction of a lava column in a lava flow on a planetary surface. Lava flows with various depths were covered large areas on the planetary bodies in the Inner Solar System. Apollo samples in the NASA Lunar Set give examples for the upper section of a lava flow which we extended with nakhlites to show lower layers of a flow, earlier existed on Mars. Both types were also shown in terrestrial samples: pillow-lavas for the quenched outer crust of the lava column and Theo's flow's pyroxenites for nakhlites. For comparison the cooling rate sequence of the chondrule types were also involved in the comparison.

Author

Lunar Geology; Lunar Rocks; Lunar Soil; Meteoritic Composition

20040065840 Budapest Polytechnik, Szekesfehervar, Hungary

New Experiments (In Meteorology, Aerosols, Soil Moisture and Ice) on the New Hunveyor Educational Planetary Landers of Universities and Colleges in Hungary

Hudoba, Gy.; Kovacs, I.; Pinter, A.; Foldi, T.; Hegyi, S.; Toth, Sz.; Rosko, F.; Berczi, Sz.; Lunar and Planetary Science XXXV: Undergraduate Education and Research Programs, Facilities, and Information Access; 2004; 2 pp.; In English; See also 20040065834; Original contains color illustrations

Contract(s)/Grant(s): MUI-TP-190/2003; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Recently 7 Hunveyor are in construction in Hungarian universities and colleges. 3 new one were started last year in high schools. We developed 3 packages of new experiments on various Hunveyors: a) measurements of the main wind parameters, b) measuring the soil ice content and moisture level, and c) bacteria and aerosol collecting package for Martian studies.

Author

Meteorology; Aerosols; Soil Moisture; Ice

20040065841 Pecs Univ., Pecs, Hungary

Teaching Planetary GIS by Constructing Its Model for the Test Terrain of the Hunveyor and Husar

Gimesi, L.; Beres, Cs. Z.; Berczi, Sz.; Hegyi, S.; Cech, V.; Lunar and Planetary Science XXXV: Undergraduate Education and Research Programs, Facilities, and Information Access; 2004; 2 pp.; In English; See also 20040065834; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Geographical Information System in terrestrial databases can be applied when planetary data were collected by a lander and/or an orbiter. We made a course to follow the construction of a model planetary GIS starting at the Hunveyor university

lander and on its test-terrain board. Experimental and observational data of Hunveyor and its environment were arranged in the model planetary GIS and this way not only its use but its construction was gradually learned by students.
Author
Education; Terrain; Geographic Information Systems; Three Dimensional Models; Landing Sites; Robotics

20040065842 Pecs Univ., Pecs, Hungary
Classroom Teaching of Space Technology and Simulations by the Husar Rover Model
Hegyi, S.; Kovacs, B.; Imrek, Gy.; Csapo, L.; Berczi, Sz.; Lunar and Planetary Science XXXV: Undergraduate Education and Research Programs, Facilities, and Information Access; 2004; 2 pp.; In English; See also 20040065834; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We placed instruments onto the HUSAR (Hungarian University Surface Analyser Rover) of the Hunveyor (Hungarian University Surveyor) experimental educational space probe model. Design and construction was parallel topics of our university course of space technology. The complex system and its construction also have been analysed.
Author
Simulation; Aerospace Engineering; Hungary; Roving Vehicles; Telerobotics; Models; Education

20040065846 Eotvos Lorand Univ., Budapest, Hungary
Analog Sites in Field Work of Petrology: Rock Assembly Delivered to a Plain by Floods on Earth and Mars
Jozsa, S.; Berczi, Sz.; Lunar and Planetary Science XXXV: Undergraduate Education and Research Programs, Facilities, and Information Access; 2004; 2 pp.; In English; See also 20040065834; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Field work was organized in petrology to study rocks transported by Danube to Dunavars ny, Hungary. We compared analog site situation of Martian Pathfinder's rock observations where on the landing site the floods of the Ares Vallis river transported the rock types of the southern highlands onto the Chryse Planitia. The 3rd year geologists took part in this field work of petrologic study of pebbles of the polimict gravel in the Dunavars ny mine of U-Pleistocene age. The locality is south of Budapest. The surface gravel formation of the South Pest Plain Pliocene-Pleistocene Suite has 20-100 m thickness in this region. It consists of the sediments of the terraces of Danube [1]. It contains various rocks from the middle and upper flow of the Danube: quartzite from the Alps, (ca. 500 km of transporting distance), andesite (Miocene age, from the Borzsony Mts. ca. 50 km transp. dist.), and sedimentary rocks, however, it contains also eclogite, granulite, amphibolite of unknown locality, probably more than 500 or as far as 1000 kilometers of transporting distance. The samples were collected in the gravel pit of the Aqua Ltd., near Kisvars ny, on a gravel hill. Generally 5-10 cm sized pebbles can be found here, however sometimes some decimeter sized boulders were also found (Fig. 1.).
Derived from text
Sedimentary Rocks; Petrology; Planetary Geology; Mars Surface; Geological Surveys; Floods; Quartzite

20040065855 Lunar and Planetary Inst., Houston, TX, USA
Lunar and Planetary Science XXXV: Big Dust, Little Dust, and Aerogel
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040065856 - 20040065867
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The titles in this section include: 1) A First Look at Graphite Grains from Orgueil: Morphology, Carbon, Nitrogen and Neon Isotopic Compositions of Individual, Chemically Separated Grains; 2) Discovery of an In-Situ Presolar Silicate Grain with GEMS-Like Composition in the Bishumpur Matrix; 3) Revised Global Accretion Rates of Micrometeorites in the Last Glacial Period; 4) Isotopic Fractionation of Potassium in Stony Cosmic Spherules; 5) Crumbs from the Crust of Vesta: Achondritic Micrometeorites from the South Pole Water Well; 6) Preservation of Micrometeoroid Remains on Solar Cells Returned from Orbit; 7) High Input Rates of Micrometeoritic Sulfur, 'Smoke' Particles and Oligoelements on the Early Earth; 8) High Resolution Confocal Raman Imaging of an IDP; 9) A micro-Raman Survey of 10 IDPs and 6 Carbonaceous Chondrites; 10) Mid- and Far-Infrared Spectroscopy at the Advanced Light Source; 11) Hypervelocity Impact Energy Loss and Track Shape in Aerogels: Theory and Experiment; 12) Fiducial Marks for Location of Particles in Aerogel.
Author
Cosmic Dust; Aerogels; Meteoritic Composition; Micrometeorites

20040065856 Grenoble-1 Univ., France

A Micro-Raman Survey of 10 IDPs and 6 Carbonaceous Chondrites

Quirico, E.; Borg, J.; Raynal, P.-I.; dHendecourt, L.; Lunar and Planetary Science XXXV: Big Dust, Little Dust, and Aerogel; 2004; 2 pp.; In English; See also 20040065855; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Though many studies point to a pristine origine of Organic Matter (OM) in some stratospheric IDPs, the chemical and physical properties of this material remain largely unknown. Following the pioneering work of others, this study intended to provide new clues by using Raman microspectrometry.

Derived from text

Carbonaceous Chondrites; Raman Spectroscopy; Organic Materials; Stratosphere

20040065857 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Hypervelocity Impact Energy Loss and Track Shape in Aerogels: Theory and Experiment

Dominguez, G.; Westphal, A. J.; Jones, S. M.; Phillips, M. L. F.; Lunar and Planetary Science XXXV: Big Dust, Little Dust, and Aerogel; 2004; 2 pp.; In English; See also 20040065855; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We have developed and tested a theoretical model of impact cratering in aerogels that derives the impact crater dimensions directly from the energy and momentum deposition of the projectile. In this paper, our work is outlined.

Derived from text

Aerogels; Energy Dissipation; Hypervelocity Impact; Mathematical Models

20040065858 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Fiducial Marks for Location of Particles in Aerogel

Jurewicz, A. J. G.; Tsapin, A. I.; Jones, S. M.; Lunar and Planetary Science XXXV: Big Dust, Little Dust, and Aerogel; 2004; 2 pp.; In English; See also 20040065855; Original contains color illustrations

Contract(s)/Grant(s): RTOP 624-13-55-01; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

If an extraterrestrial sample is captured in aerogel as a collection of particles, it is important to be able to consistently locate individual grains when changing instruments or laboratories. We report on a feasibility study for applying fiducial marks to aerogel nondestructively so that the marks can eventually be used with optical, X-ray or other (manual or automated) location techniques.

Author

Aerogels; Position (Location); Nondestructive Tests; Feasibility Analysis

20040065859 Max-Planck-Inst. fuer Chemie, Mainz, Germany

Discovery of an In-Situ Presolar Silicate Grain with GEMS-Like Composition in the Bishumpur Matrix

Mostefaoui, S.; Marhas, K. K.; Hoppe, P.; Lunar and Planetary Science XXXV: Big Dust, Little Dust, and Aerogel; 2004; 2 pp.; In English; See also 20040065855; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The study of acid-resistant residues in meteorites revealed that the most abundant mineral among presolar O-rich dust is spinel (less than 1 ppm), followed by corundum (200 ppb). This contrasts with expectations from ISO observations which revealed that silicates are the major oxide phases around young stars and in outflows from evolved red giant stars. Interplanetary dust particles (IDPs), on the other hand, are found to contain presolar silicates. Messenger and co-workers estimated the abundance of presolar silicates in IDPs to be about 5500 ppm, which is considerably higher than the abundances of any other presolar mineral type in meteorites. We recently reported the discovery of in-situ Oisotopic anomalies associated with two O- and Si-rich grains in Semarkona (LL3.0) and Bishunpur (LL3.1). Their O/Si ratios are within the olivine/pyroxene range, suggesting that these grains are presolar silicates. Together they represent an abundance of about 20 ppm in the matrix of Semarkona and Bishunpur. This indicates that the abundance of presolar silicates is far below that in IDPs. Many IDPs are attributed to be of cometary origin. They thus represent very primitive matter that escaped high temperature events, providing best prerequisites for the survival of presolar silicates. The comparatively lower abundance of presolar silicates in ordinary chondrites implies that they may have been partly destroyed in the meteorite parent bodies. Alternatively, presolar silicates might not have been homogenously distributed in the solar nebula or might have been preferentially destroyed in certain regions of the solar nebula. Here, we report on continued in-situ NanoSIMS searches for presolar O-rich dust (oxides and

silicates) in Bishunpur, taking full profit of the high spatial resolution of the NanoSIMS for the detection of submicrometer-sized presolar O-rich dust.
Author
In Situ Measurement; Silicates; Grains; Meteoritic Composition; Interplanetary Dust

20040065862 Centre de Spectrometrie Nucleaire et de Spectrometrie de Masse, Orsay, France
High Input Rates of Micrometeoritic Sulfur, "Smoke" Particles and Oligoelements on the Early Earth
Maurette, M.; Brack, A.; Duprat, J.; Engrand, C.; Kurat, G.; Lunar and Planetary Science XXXV: Big Dust, Little Dust, and Aerogel; 2004; 2 pp.; In English; See also 20040065855; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Since the late 1990's, we have been investigating the effects of the accretion of juvenile micrometeorites on the Earth, during the post-lunar period of the "Late Heavy Bombardment". We use an "accretion" formula reported in a companion paper. It is based the following deductions: the giant Mars sized impact that formed the Moon also blew off the complex pre-lunar atmosphere of our blue planet; the composition of the micrometeorite flux has been invariant with time; the relative variation of lunar cratering rate with time, scales to that of the micrometeorite flux.
Derived from text
Lunar Atmosphere; Micrometeorites; Cratering

20040065863 Washington Univ., Saint Louis, MO, USA
A First Look at Graphite Grains from Orgueil: Morphology, Carbon, Nitrogen and Neon Isotopic Compositions of Individual, Chemically Separated Grains
Pravdivtseva, O.; Zinner, E.; Meshik, A. P.; Hohenberg, C. M.; Walker, R. W.; Lunar and Planetary Science XXXV: Big Dust, Little Dust, and Aerogel; 2004; 2 pp.; In English; See also 20040065855; Original contains color and black and white illustrations
Contract(s)/Grant(s): NAG5-12776; NAG5-10426; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Presolar graphite in Murchison has been extensively studied. It is characterized by a unique Ne isotopic composition, known as the Ne-E(L) component. According to studies by Huss and Lewis, the concentration of Ne-E(L) in Orgueil is about one order of magnitude higher than in Murchison, when normalized to the matrix. This could be due to a higher presolar graphite abundance in Orgueil, or due to a higher Ne-E concentrations per grain. The Ne isotopic compositions in individual presolar graphite grains from Murchison have been measured before. It was shown, that a third of the grains have detectable excesses in 22Ne, characteristic of the Ne-E(L) component. One grain in a hundred had a Ne-22 concentration two orders of magnitude higher than blank.
Derived from text
Graphite; Grains; Morphology; Carbon; Nitrogen; Isotopes

20040065864 Washington Univ., Saint Louis, MO, USA
Revised Global Accretion Rates of Micrometeorites in the Last Glacial Period
Yada, T.; Nakamura, T.; Takaoka, N.; Noguchi, T.; Terada, K.; Yano, H.; Nakazawa, T.; Kojima, H.; Lunar and Planetary Science XXXV: Big Dust, Little Dust, and Aerogel; 2004; 2 pp.; In English; See also 20040065855; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The accretion rate of extraterrestrial material onto the Earth is a fundamental parameter needed to understand how extraterrestrial material interacts with the Earth s environment. It has been estimated from various sources, for example, as (30000+/-15000) x10(exp 30) kg/a from Os isotopes in deep-sea sediments [1] or as (40000+/-20000) x10(exp 3) kg/a from the density of hypervelocity impact craters on the surface of the LDEF satellite [2]. Antarctic micrometeorites (AMMs), which are extraterrestrial dust particles 30-300 microns in size, are one of the available extraterrestrial samples on the Earth [3]. An accretion rate for micrometeorites was estimated to be (2700+/-1400) x10(exp 3) kg/a based on counting of spherules, melted AMMs, in sediments at the bottom of the South Pole water well [4]. Previously, we reported accretion rates based on numbers of handpicked AMMs; however, we didn't confirm whether some AMMs remained in the residues after handpicking [5]. Here, we present revised accretion rates for micrometeorites based on handpicked numbers of AMMs and noble gas concentrations in residues after handpicking [6].
Derived from text
Micrometeorites; Concentration (Composition); Rare Gases; Osmium Isotopes; Extraterrestrial Matter; Gas Composition; Hypervelocity Impact

20040065865 Rutgers Univ., Piscataway, NJ, USA

Crumbs from the Crust of Vesta: Achondritic Micrometeorites from the South Pole Water Well

Delaney, Jeremy S.; Herzog, G. F.; Taylor, S.; Lunar and Planetary Science XXXV: Big Dust, Little Dust, and Aerogel; 2004; 2 pp.; In English; See also 20040065855; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Appreciable numbers of micrometeorites (MM) may form when larger (>1 cm) bodies fragment in the Earth s atmosphere [1]. If fragmentation affects all incoming bodies similarly, then MM collections should resemble meteorite collections. Compositional and isotopic data support this inference in the broad sense that most MM appear to be "chondritic" [2-5]. Relative to conventional meteorites, however, micrometeorites comprise a larger fraction of carbonaceous material [3,5,6], few or no irons [7], and, to date, no achondrites. Several factors probably account for these differences. First, some MM may arrive as small bodies - dust - rather than as parts of larger bodies. The principal sources for dust are not necessarily the same as those for conventional meteoroids [8]. Second, the varying toughness of meteoroids and asteroids may influence their susceptibility to break-up. Third, our ability to search for achondritic MM is limited absolutely by the relatively small numbers of MM analyses available.

Derived from text

Micrometeorites; Crusts; Carbonaceous Materials; Achondrites; Asteroids; Fragmentation

20040065866 Army Cold Regions Research and Engineering Lab., Hanover, NH, USA

Isotopic Fractionation of Potassium in Stony Cosmic Spherules

Taylor, S.; Alexander, C. M. OD.; Delaney, J. S.; Ma, P.; Herzog, G. F.; Engrand, C.; Lunar and Planetary Science XXXV: Big Dust, Little Dust, and Aerogel; 2004; 2 pp.; In English; See also 20040065855; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Elemental concentrations can help link (or not) stony cosmic spherules (sCS) to known types of meteorites and their parent bodies. It is therefore worth knowing how faithfully elemental abundances measured in sCS represent the original, pre-atmospheric compositions. In the spherules that we have analyzed to date evaporative losses of the major elements O, Fe, Si, and Mg seldom exceed 30% and are usually less. Others, however, have reported large isotopic fractionation effects in numerous spherules, possibly due to evaporation, and in any case conditions in the melts may have allowed the loss of more volatile elements such as K. To test for evaporation of K, we measured the K-41/K-39 ratios of several sCS, on the supposition that such losses would have caused these ratios to increase.

Author

Isotopes; Fractionation; Potassium; Spherules; Meteorites

20040065867 Lawrence Livermore National Lab., Livermore, CA, USA

Mid- and Far-Infrared Spectroscopy at the Advanced Light Source

Bajt, S.; Graham, G. A.; Bradley, J.; Westphal, A. J.; Butterworth, A. L.; Martin, M. C.; Lunar and Planetary Science XXXV: Big Dust, Little Dust, and Aerogel; 2004; 2 pp.; In English; See also 20040065855; Original contains color illustrations

Contract(s)/Grant(s): W-7405-eng-48; DE-AC03-76F-00098; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Dust is an important constituent of the galaxy. Much of what we know about dust has been inferred from astronomical observations and from laboratory analysis of Interplanetary Dust Particles (IDPs), which are fragments of comets or asteroids collected in the Earth's stratosphere. In particular, infrared spectroscopy data of dust in space and of IDPs can be directly compared and matched with known mineral databases obtained in laboratories to deduce their chemical and mineralogical composition. We anticipate that in 2006 cometary dust particles collected during the recent successful encounter of STARDUST mission with comet Wild-2 will become available for study in the laboratory. In preparation we have formed the Bay Area Particle Analysis Consortium (BayPAC), whose main mission is to develop and investigate extraction and in-situ analysis techniques for cometary dust particles captured in aerogel. In this abstract we describe the efforts in improving and extending infrared spectroscopy techniques to analyze small particles.

Derived from text

Infrared Spectroscopy; Light Sources; Far Infrared Radiation; Interplanetary Dust; Astronomy; Galaxies

20040065868 Lunar and Planetary Inst., Houston, TX, USA
Lunar and Planetary Science XXXV: Impacts on Mars and Earth
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040065869 - 20040065881
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The session "Impacts on Mars and Earth" included the following reports:A Timescale for Major Events in Early Mars Crustal Evolution; Impact Craters in Arabia Terra, Mars; Ancient Giant Basin/Aquifer System in the Arabia Region, Mars; Small Crater Morphology Within Gusev Crater and Isidis Planitia: Evidence for Widespread Secondaries on Mars; Martian Surface Properties: Inferences from Resolved Differences in Crater Geometries; Asymmetric Ramparts of Secondary Craters in Cerberus, Mars: Interpretation and Implications for Local Stratigraphy; Depth to Diameter Relationships of Craters in the High Latitudes (70 -80) of Mars: Implications for Geologic History of Those Areas; Impact Cratering on Mars: Search for Target Influence on Morphology; Starting Conditions for Hydrothermal Systems Underneath Martian Craters: Hydrocode Modeling; Impact-induced Hydrothermal System at the Sudbury Crater: Duration, Temperatures, Mechanics, and Biological Implications; Major and Trace Element Variations in Impact Crater Clay from Chicxulub, Lonar, and Mistastin, Implications for the Martian Soil; Stable Isotopes and Hydrothermal Fluid Source in the Yaxcopoil-1 Borehole, Chicxulub Impact Structure, Mexico; and Chicxulub Impact Melts: Geochemical Signatures of Target Lithology Mixing and Post-Impact Hydrothermal Fluid Processes.
Derived from text
Mars Craters; Morphology

20040065869 University of Northern Arizona, Flagstaff, AZ, USA
Impact Craters in Arabia Terra, Mars
Barlow, N. G.; Dohm, J. M.; Lunar and Planetary Science XXXV: Impacts on Mars and Earth; 2004; 2 pp.; In English; See also 20040065868; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A number of geomorphic, structural, elemental, geophysical, geologic, thermal inertia, and albedo characteristics indicate that Arabia Terra is a unique region within the Martian highlands. Impact craters within Arabia also display a number of unusual characteristics. Our analysis unfolds a possible ancient 3000-km-diameter impact basin in this region [1] which has served as a repository for volatile-rich materials over much of Martian history.
Derived from text
Geomorphology; Mars Craters; Structural Design; Thermal Emission

20040065870 Arizona Univ., Tucson, AZ, USA
Stable Isotopes and Hydrothermal Fluid Source in the Yaxcopoil-1 Borehole, Chicxulub Impact Structure, Mexico
Zurcher, L.; Kring, D. A.; Dettman, D.; Rollog, M.; Lunar and Planetary Science XXXV: Impacts on Mars and Earth; 2004; 2 pp.; In English; See also 20040065868; Original contains black and white illustrations
Contract(s)/Grant(s): NSF EAR-01-26055; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We present new results of a detailed C, O, and H stable isotope survey on carbonate and silicate fractions of samples collected from the hydrothermally altered impactite units at Yaxcopoil-1 (Yax-1). Previous stable isotope studies on Chicxulub crater impactites are included. In this investigation, we treat stable isotopes in concert with mineralogical and geochemical data. Combined results allowed us to place constraints on the physico-chemical parameters of the hydrothermal fluid, which we used to deduce its most likely source.
Derived from text
Boreholes; Mexico; Hydrothermal Systems; Mineralogy; Petrography; Isotope Ratios; Stability

20040065871 Hawaii Univ., Honolulu, HI, USA
Depth to Diameter Relationships of Craters in the High Latitudes (70 deg -80 deg) of Mars: Implications for Geologic History of Those Areas
Boyce, Joseph M.; Mouginis-Mark, Peter; Garbeil, Harold; Lunar and Planetary Science XXXV: Impacts on Mars and Earth; 2004; 2 pp.; In English; See also 20040065868; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The characteristics of the d/D in each area are due mainly to the operation of surface processes (deposition and/or erosion, viscous relaxation), although target material properties may have had some minor effects. Consistent with our previous work, we suggest that the d/D relationships in the northern lowland plains are primarily the result of mantling by the Vastitis Borealis Formation. The d/D relationships of craters in the southern high-latitudes and Sinai Planum show no characteristics of mantling, but instead show characteristics of longterm, constant and continuous erosion. In addition, the large crater population in the southern high latitudes shows the effects of viscous relaxation of crater rims, possibly caused by abundant subsurface ice. Both high-latitude areas have no craters with fresh crater d/D ratios. This may be due to target material properties or the effects of recent thin dust-ice deposits on crater depths.
Derived from text
Craters; Depth; Geomagnetic Latitude; Mars Surface; Diameters; Geochronology

20040065872 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Small Crater Morphology Within Gusev Crater and Isidis Planitia: Evidence for Widespread Secondaries on Mars
Hurst, M.; Golombek, M. P.; Kirk, R.; Lunar and Planetary Science XXXV: Impacts on Mars and Earth; 2004; 2 pp.; In English; See also 20040065868; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Large (greater than 2 km diameter) impact craters on the martian surface have been extensively studied and modeled. Craters smaller than this were known to exist but the lack of high-resolution images prevented detailed measurements and descriptions. Images obtained by the Mars Orbiter Camera (MOC) on Mars Global Surveyor are of sufficient resolution to perform detailed studies on the morphology of small (less than 1 km diameter) craters. Previous workers have suggested that many of these small craters are secondary craters; while others maintain that they represent primary impacts. The difference is significant, however, because of implications for surface age, climate change, impact generated regolith, provenance of surface rocks, engineering considerations (landing safety and rover trafficability), and the origin of martian meteorites.
Derived from text
Craters; Morphology; SNC Meteorites; Mars Surface

20040065873 New Mexico Univ., Albuquerque, NM, USA
Major and Trace Element Variations in Impact Crater Clay from Chicxulub, Lonar, and Mistastin, Implications for the Martian Soil
Newsom, H. E.; Nelson, M. J.; Shearer, C. K.; Rietmeijer, F. J. M.; Gakin, R.; Lee, K.; Lunar and Planetary Science XXXV: Impacts on Mars and Earth; 2004; 2 pp.; In English; See also 20040065868; Original contains color illustrations
Contract(s)/Grant(s): NAG5-10143; NAG5-11496; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The catastrophic Chicxulub event should have generated a large hydrothermal system with volatile element mobilization, producing interesting alteration materials and clays. The Yaxcopoil-1 (YAX) drill hole is located in the annular trough, about 70 km southwest of the crater center, in an area where the impactite layers are relatively thin (approx. 100 m thick). We have analyzed samples from the YAX drill core and from other impact craters including Mistastin and Lonar to determine the nature of alteration and trace element mobilization.
Author
Meteorite Craters; Trace Elements; Clays; Meteoritic Composition

20040065874 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Ancient Giant Basin/Aquifer System in the Arabia Region, Mars
Dohm, James M.; Barlow, Nadine; Williams, Jean-Pierre; Baker, Victor R.; Anderson, Robert C.; Boynton, William V.; Fairen, Alberto G.; Hare, Trent M.; Lunar and Planetary Science XXXV: Impacts on Mars and Earth; 2004; 2 pp.; In English; See also 20040065868; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Ancient geologic/hydrologic phenomena on Mars observed through the magnetic data [1,2] provide windows to the ancient past through the younger Argyre and Hellas impacts [e.g., 3,4], the northern plains basement [5], and the Tharsis and Elysium magmatic complexes (recently referred to as superplumes [6,7]). These signatures, coupled with highly degraded macrostructures (tectonic features that are tens to thousands of km-long [8]), reflect an energetic planet during its embryonic development (.5 Ga or so of activity) with an active dynamo and magnetosphere [1,2,6]. One such window into the ancient past occurs northwest of the Hellas impact basin in Arabia Terra. Arabia Terra is one of the few water-rich equatorial regions

of Mars, as indicated through impact crater [9] and elemental [10,11] information. This region records many unique traits, including stratigraphy, topography, cratering record, structural character, geomorphology, and geophysical, elemental, albedo, and thermal inertia signatures. We interpret these to collectively indicate a possible ancient giant impact basin that later became an important aquifer, as it provided yet another source of water for the formation of putative water bodies that occupied the northern plains [12,13] and addresses possible water-related characteristics that may be observed at the Opportunity landing site. This basin is antipodal to Tharsis and estimated to be at least 3,000 km in diameter.
Derived from text
Geomorphology; Planetary Geology; Structural Basins; Thermal Emission; Mars Surface; Cratering; Geophysics; Topography

20040065875 NASA Goddard Space Flight Center, Greenbelt, MD, USA
A Timescale for Major Events in Early Mars Crustal Evolution
Frey, H. V.; Lunar and Planetary Science XXXV: Impacts on Mars and Earth; 2004; 2 pp.; In English; See also 20040065868; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The population of visible and buried impact basins greater than 200 km diameter revealed by high resolution gridded MOLA data and the cumulative frequency curves derived for these provide a basis for a chronology of major events in early martian history. The relative chronology can be given in terms of N(200) crater retention ages; absolute ages can be assigned using the Hartmann-Neukum (H&N) model chronology. In terms of billions of H&N years, the crustal dichotomy formed by large impact basins at 4.12 +/- 0.08 BYA [N(200) = 3.0 - 3.2] and the global magnetic field died at about or slightly before the same time (4.15 +/- 0.08 BYA) [N(200) = 3.5]. In this chronology, the buried lowlands are ~120 my younger than the buried highlands), approx. 160 my younger than the highlands overall and approx. 340 my younger than the oldest crater retention surface we see, defined by the largest impact basins.
Author
Time Functions; Scale (Ratio); Mars (Planet); Crusts; Planetary Evolution; Chronology

20040065876 NASA Johnson Space Center, Houston, TX, USA
Chicxulub Impact Melts: Geochemical Signatures of Target Lithology Mixing and Post-Impact Hydrothermal Fluid Processes
Kring, David A.; Zurcher, Lukas; Horz, Freidrich; Mertzmann, Stanley A.; Lunar and Planetary Science XXXV: Impacts on Mars and Earth; 2004; 2 pp.; In English; See also 20040065868; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Impact melts within complex impact craters are generally homogeneous, unless they differentiated, contain immiscible melt components, or were hydrothermally altered while cooling. The details of these processes, however, and their chemical consequences, are poorly understood. The best opportunity to unravel them may lie with the Chicxulub impact structure, because it is the world s most pristine (albeit buried) large impact crater. The Chicxulub Scientific Drilling Project recovered approx. 100 meters of impactites in a continuous core from the Yaxcopoil-1 (YAX-1) borehole. This dramatically increased the amount of melt available for analyses, which was previously limited to two small samples N17 and N19) recovered from the Yucatan-6 (Y-6) borehole and one sample (N10) recovered from the Chicxulub-1 (C-1) borehole. In this study, we describe the chemical compositions of six melt samples over an approx. 40 m section of the core and compare them to previous melt samples from the Y-6 and C-1 boreholes.
Author
Lithology; Signatures; Impact Melts; Geochemistry; Chemical Composition; Boreholes

20040065877 Lancaster Univ., UK
Asymmetric Ramparts of Secondary Craters in Cerberus, Mars: Interpretation and Implications for Local Stratigraphy
Mitchell, K. L.; Lunar and Planetary Science XXXV: Impacts on Mars and Earth; 2004; 2 pp.; In English; See also 20040065868; Original contains color and black and white illustrations
Contract(s)/Grant(s): PPARC-PPA/G/S/2000/00521; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Cerberus region exhibits some of the youngest volcanic and fluvial landforms on Mars, most notably at Athabasca Valles, where dyke emplacement and cryospheric cracking released an over-pressured aquifer in one or more flood events.

Crater counting studies have demonstrated that both water and lava flowed there recently, probably within the past few Ma, which has been used to support the argument that Mars may not be volcanically dead, but merely in a period of dormancy. I have mapped out a number of small craters associated with unusual, asymmetric exterior deposits, all oriented in the same direction and exhibiting a high degree of fluidization. They are present in only 5 MOC NA images, all within a few km of some overlapping sections of fossa a few hundred km to the east of Athabasca. Following a rapid global survey of MOC NA imagery, I have been unable to find craters with similar deposits elsewhere, and therefore conclude that they are probably unique to this region.
Derived from text
Mars Craters; Stratigraphy; Planetary Geology

20040065878 Harvard Univ., Cambridge, MA, USA
Martian Surface Properties: Inferences from Resolved Differences in Crater Geometries
Valiant, G. J.; Stewart, S. T.; Lunar and Planetary Science XXXV: Impacts on Mars and Earth; 2004; 2 pp.; In English; See also 20040065868
Contract(s)/Grant(s): NAG5-13474; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Impact craters are a natural probe of planetary sub-surfaces, both from the excavated material and from crater geometries, which are sensitive to material properties of the target. One of the most intriguing aspects of Martian craters is the morphology of the ejecta blankets. All fresh and many older Martian craters larger than a few km are surrounded by ejecta blankets which appear fluidized, with morphologies believed to form by entrainment of liquid water. In addition to the ejecta morphology, quantitative information about the subsurface composition may be derived from geometrical measurements, e.g., rim uplift height and ejecta blanket volumes. In order to use craters to derive subsurface composition or test rampart morphology formation hypotheses, accurate measurements with quantified error estimates are required. We have developed and tested a toolkit for measurements of crater geometry using the MOLA altimetry data. Here, we present the results from geometry measurements on fresh craters in Lunae Planum and Utopia Planitia.
Author
Mars Surface; Craters; Morphology; Ejecta

20040065880 Planetary Science Inst., Tucson, AZ, USA
Starting Conditions for Hydrothermal Systems Underneath Martian Craters: Hydrocode Modeling
Pierazzo, E.; Artemieva, N. A.; Ivanov, B. A.; Lunar and Planetary Science XXXV: Impacts on Mars and Earth; 2004; 2 pp.; In English; See also 20040065868; Original contains color illustrations
Contract(s)/Grant(s): NAG5-12688; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Mars is the most Earth-like of the Solar System s planets, and the first place to look for any sign of present or past extraterrestrial life. Its surface shows many features indicative of the presence of surface and sub-surface water, while impact cratering and volcanism have provided temporary and local surface heat sources throughout Mars geologic history. Impact craters are widely used ubiquitous indicators for the presence of sub-surface water or ice on Mars. In particular, the presence of significant amounts of ground ice or water would cause impact-induced hydrothermal alteration at Martian impact sites. The realization that hydrothermal systems are possible sites for the origin and early evolution of life on Earth has given rise to the hypothesis that hydrothermal systems may have had the same role on Mars. Rough estimates of the heat generated in impact events have been based on scaling relations, or thermal data based on terrestrial impacts on crystalline basements. Preliminary studies also suggest that melt sheets and target uplift are equally important heat sources for the development of a hydrothermal system, while its lifetime depends on the volume and cooling rate of the heat source, as well as the permeability of the host rocks. We present initial results of two-dimensional (2D) and three-dimensional (3D) simulations of impacts on Mars aimed at constraining the initial conditions for modeling the onset and evolution of a hydrothermal system on the red planet. Simulations of the early stages of impact cratering provide an estimate of the amount of shock melting and the pressure-temperature distribution in the target caused by various impacts on the Martian surface. Modeling of the late stage of crater collapse is necessary to characterize the final thermal state of the target, including crater uplift, and distribution of the heated target material (including the melt pool) and hot ejecta around the crater.
Derived from text
Hydrothermal Systems; Mars Surface; Mars Craters; Mathematical Models; Planetary Geology

20040065881 Freie Univ., Berlin, Germany

Impact Cratering on Mars: Search for Target Influence on Morphology

Werner, S. C.; Ivanov, B. A.; Neukum, G.; Lunar and Planetary Science XXXV: Impacts on Mars and Earth; 2004; 2 pp.; In English; See also 20040065868; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Within the framework of the project "Chronostratigraphy of Mars" the investigation of morphologies of differently sized craters superposed on different geological units has been started. The aim is to assess the role of the projectile nature (asteroid vs. comet) and the target properties (water or ice content) in the crater formation process and thus in the morphological appearance and size parameters of craters. Objects that may reflect the volatile content are craters with fluidized ejecta blankets (FEB) varying in their morphology of interiors and some quantitative parameters such as crater depth/diameter, rim height/diameter ratios and additionally the diameter ratios of the crater cavities to their ejecta blankets. It is widely believed that FEBs manifest the presence of water or ice. Comparing crater morphology and morphometry for various FEB appearances may give us a key to the amount of volatiles in the target, crater scaling laws and, finally, the improvement of the absolute Mars cratering chronology transferred from the moon.

Derived from text

Mars Craters; Morphology; Hypervelocity Impact; Geochronology; Mathematical Models

20040065882 Lunar and Planetary Inst., Houston, TX, USA

Lunar and Planetary Science XXXV: Martian Aeolian and Mass Wasting Processes: Blowing and Flowing

2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040065883 - 20040065895

Contract(s)/Grant(s): NCC5-679

Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The session Martian Aeolian and Mass Wasting Processes: BLowing and Flowing included the following topics: 1) Three Decades of Martian Surface Changes; 2) Thermophysical Properties of Isidis Basin, Mars; 3) Intracrater Material in Eastern Arabia Terra: THEMIS, MOC, and MOLA Analysis of Wind-blown Deposits and Possible High-Inertia Source Material; 4) Thermal Properties of Sand from TES and THEMIS: Do Martian Dunes Make a Good Control for Thermal Inertia Calculations? 5) A Comparative Analysis of Barchan Dunes in the Intra-Crater Dune Fields and the North Polar Sand Sea; 6) Diluvial Dunes in Athabasca Valles, Mars: Morphology, Modeling and Implications; 7) Surface Profiling of Natural Dust Devils; 8) Martian Dust Devil Tracks: Inferred Directions of Movement; 9) Numerical Simulations of Anastomosing Slope Streaks on Mars; 10) Young Fans in an Equatorial Crater in Xanthe Terra, Mars; 11) Large Well-exposed Alluvual Fans in Deep Late-Noachian Craters; 12) New Evidence for the Formation of Large Landslides on Mars; and 13) What Can We Learn from the Ages of Valles Marineris Landslides on Martian Impact History?

Derived from text

Mars Surface; Planetary Geology; Blowing; Geomorphology; Planetary Mass

20040065883 Planetary Science Inst., Tucson, AZ, USA

A Comparative Analysis of Barchan Dunes in the Intra-Crater Dune Fields and the North Polar Sand Sea

Bourke, M. C.; Balme, M.; Zimbelman, J.; Lunar and Planetary Science XXXV: Martian Aeolian and Mass Wasting Processes: Blowing and Flowing; 2004; 2 pp.; In English; See also 20040065882; Original contains color and black and white illustrations

Contract(s)/Grant(s): NAG5-11075; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Martian sand dunes have the potential to contribute data on geological history through a study of their form. Recognition of the characteristics of both recent and ancient dunes is the first step towards understanding the present as well as past aeolian systems, and by proxy, climatic conditions on Mars. Dunes studied in detail in Viking 1 and 2 Orbiter images have been classified as barchan, barchanoid, transverse, and complex. Regionally, they are concentrated in four locations: The North and South Polar regions, in intra crater dune fields and in troughs and valleys. Here we present the results of a morphometric analysis of barchan dunes in two of these locations: the North Polar Sand Sea (NPSS) and intra-crater dunes.

Author

Dunes; Mars Surface; Planetary Geology; Geomorphology

20040065884 Geological Survey, Flagstaff, AZ, USA

Three Decades of Martian Surface Changes

Geissler, Paul E.; Lunar and Planetary Science XXXV: Martian Aeolian and Mass Wasting Processes: BLowing and Flowing; 2004; 2 pp.; In English; See also 20040065882; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The face of Mars has changed dramatically during the three decades spanned by spacecraft exploration. Comparisons of Mars Global Surveyor images with Viking and Mariner 9 data suggest that more than one third of Mars surface area has brightened or darkened by at least 10%. Such albedo changes could produce significant effects on solar insolation and the global circulation of winds on Mars.

Author

Mars Surface; Mars Atmosphere; Albedo; Insolation

20040065885 Colorado Univ., Boulder, CO, USA

Thermophysical Properties of Isidis Basin, Mars

Murphy, N.; Hynek, B. M.; Jakosky, B. M.; Martinez-Alonzo, S.; Putzig, N. E.; Mellon, M. T.; Pelkey, S.; Lunar and Planetary Science XXXV: Martian Aeolian and Mass Wasting Processes: BLowing and Flowing; 2004; 2 pp.; In English; See also 20040065882; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Isidis Planitia was the chosen landing site of the European Space Agency's Beagle 2 lander. We have examined the thermophysical properties of the landing ellipse in the context of the rest of Isidis Basin and the surrounding region using data from the Thermal Emission Imaging System (THEMIS) and Thermal Emission Spectrometer (TES). These results, in conjunction with other remotely-sensed data, allow a better understanding of the surficial geologic history of this region of Mars.

Author

Mars Landing Sites; Structural Basins; Thermophysical Properties; Mars (Planet); Mars Surface; Planetary Geology

20040065886 Geological Survey, Flagstaff, AZ, USA

Diluvial Dunes in Athabasca Valles, Mars: Morphology, Modeling and Implications

Burr, D. M.; Carling, P. A.; Beyer, R. A.; Lancaster, N.; Lunar and Planetary Science XXXV: Martian Aeolian and Mass Wasting Processes: BLowing and Flowing; 2004; 2 pp.; In English; See also 20040065882; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A set of linear, flow-transverse periodic bedforms lies on the floor of the main channel of Athabasca Valles, Mars, near 9N 156E. The channel appears very young and originates at one of the Cerberus Fossae volcanotectonic fissures. Investigations into the surface channel flow should therefore provide information on recent subsurface groundwater flow. We analyzed the transverse periodic bedforms to determine the flow regime and estimate the discharge that formed them.

Author

Dunes; Ground Water; Mars Surface; Morphology

20040065887 Arizona State Univ., Tempe, AZ, USA

Martian Dust Devil Tracks: Inferred Directions of Movement

Whelley, P. L.; Greeley, R.; Neakrase, L.; Lunar and Planetary Science XXXV: Martian Aeolian and Mass Wasting Processes: BLowing and Flowing; 2004; 2 pp.; In English; See also 20040065882; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Inferred dust devil tracks are seen in many parts of Mars, including the floor of Gusev crater, the landing site for the Mars Exploration Rover, Spirit. In most cases, the directions of motion of the dust devils that formed the tracks are not known. Wind tunnel experiments simulating dust devil processes reveal a distinctive "scalloping" pattern on the surface left by some tracks that enable the direction of movement to be determined. The pattern consists of a series of overlapping (and progressively superposed) circular patches that result from the clearing of particles beneath the dust devil vortex core, and partial deposition over the previously cleared patch as the dust devil moves forward. Similar patterns are seen in some dust devils tracks on Mars, including those in the Argyre Planitia and Hellas Basin regions.

Author

Dust; Mars Surface; Structural Basins; Deposition; Craters

20040065888 Arizona Univ., Tucson, AZ, USA

Numerical Simulations of Anastomosing Slope Streaks on Mars

Miyamoto, H.; Dohm, J. M.; Beyer, R. A.; Baker, V. R.; Lunar and Planetary Science XXXV: Martian Aeolian and Mass Wasting Processes: BLowing and Flowing; 2004; 2 pp.; In English; See also 20040065882; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Slope streak formation is an active, transient process on the surface of Mars. Slope streaks form exclusively in regions of slopes and low thermal inertia, suggesting the presence of unconsolidated air-fall dust deposits, and only where peak temperatures exceed 275K, implying that the presence of water plays a critical role in their formation. Slope streaks have been hypothesized to originate from a range of processes from completely dry to aqueous. Most slope streaks were believed to be formed by dust avalanches, though the difficulty in explaining all details of slope streaks by a single mechanism was also recognized. Sullivan et al. proposed a dust avalanche model in which dust accumulates as air fall and periodically slides down a hillslope, allowing the entrainment of additional materials from the ground that are subsequently transferred to the atmosphere. This model aptly explains many streak characteristics and is most successful in explaining linear slope streaks. However, other streaks with flow-like morphologies remain problematic because internal deformation of the streak-forming materials becomes more important for the generative flow processes, so that these streaks are most easily explained by a flow mechanism. We caution that flow does not necessarily mean a liquid flow, since dry grains can also behave like a viscous flow. In this paper, we attempt to find a physical condition of material whose properties match those required by the results of modeling a plastic flow without assuming any particular material hypothesis.

Derived from text

Mars Surface; Slopes; Numerical Analysis; Simulation; Geomorphology

20040065889 NASA Ames Research Center, Moffett Field, CA, USA

Large Well-exposed Alluvial Fans in Deep Late-Noachian Craters

Moore, J. M.; Howard, A.D.; Lunar and Planetary Science XXXV: Martian Aeolian and Mass Wasting Processes: BLowing and Flowing; 2004; 2 pp.; In English; See also 20040065882; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Large, fresh-appearing alluvial fans (typically greater than 10 km long) have been identified during a systematic search of 100 m/pixel low-sun daylight THEMIS IR imaging in deep late-Noachian or early- Hesperian craters. Our study of these fans was augmented with MOLA-derived topography and high-resolution MOC and THEMIS VIS images where available. The influence of alluvial fan deposition on the topography of crater floors has been recognized in previous topographic studies. Recent Mars Odyssey-era studies have also identified and described in detail a fluvial delta or fan of approximately the same age as the alluvial fans of this study. Our results, at the time of this writing, indicate that these fans are only found in less than 5% of all craters = 70 km in diameter within a large study region. In every case the fan-containing craters were restricted to a latitude belt between 20 deg S and 30 deg S. All of which had significant topographic relief and appeared morphologically younger than typical mid-Noachian craters in the size range. However, large fans were not found in the most pristine (and presumably youngest) craters in this size range. Most Martian fans have morphologies consistent with terrestrial debris-flow-dominated fans.

Author

Craters; Debris; Deposition; Mars Surface; Size Distribution; Topography

20040065890 Maryland Univ. Baltimore County, Catonsville, MD, USA

New Evidence for the Formation of Large Landslides on Mars

Bulmer, M. H.; Zimermann, B. A.; Lunar and Planetary Science XXXV: Martian Aeolian and Mass Wasting Processes: BLowing and Flowing; 2004; 2 pp.; In English; See also 20040065882; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Landslides in the Valles Marineris were first examined using Viking Orbiter (VO) images. They were interpreted to be large volume (greater than 106 cu m) catastrophic failures with long runouts and a range of emplacement models have been proposed to explain their apparent high mobility. However, the limited resolution of VO data meant that no models could be conclusively validated. The resolutions of MOC images (9 to 1.4 m/pixel), and THEMIS images (100 m/pixel infrared and 19 m/pixel visible), plus the MOLA dataset (less than 1m horizontal and vertical resolution at 300 m horizontal spacing) show new details of the slope forming materials and the processes that govern the triggering, failure, and deposition of landslides.

Here we report on analysis of a land-side site on the southern wall of Gangis Chasma in the Valles Marineris using MOC, THEMIS and MOLA data.
Derived from text
Slopes; Mars Surface; Mars Photographs; Landslides

20040065891 Metzger Geoscience, Reno, NV, USA
Surface Profiling of Natural Dust Devils
Metzger, S. M.; Balme, M.; Greeley, R.; Ringrose, T.; Towner, M.; Zarnecki, J.; Lunar and Planetary Science XXXV: Martian Aeolian and Mass Wasting Processes: BLowing and Flowing; 2004; 2 pp.; In English; See also 20040065882; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Although once thought of as interesting but inconsequential desert oddities, dust devils are now understood to be a major contributor to airborne dust loading in the arid regions of Earth and Mars. The vortex process(es) responsible for soil erosion, however, remain poorly articulated. Dust devils have complex, intense, and highly variable wind fields at their base due to changes in boundary layer meteorologic, geologic, and surface aerodynamic conditions.
Derived from text
Velocity Distribution; Surface Properties; Soil Erosion; Mars Surface; Dust

20040065893 Arizona State Univ., Tempe, AZ, USA
Intracrater Material in Eastern Arabia Terra: THEMIS, MOC, and MOLA Analysis of Wind-blown Deposits and Possible High-Inertia Source Material
Fergason, R. L.; Christensen, P. R.; Lunar and Planetary Science XXXV: Martian Aeolian and Mass Wasting Processes: Blowing and Flowing; 2004; 2 pp.; In English; See also 20040065882; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Intracrater deposits in eastern Arabia Terra contain sand-sized particles and high-inertia outcrops. This observation challenges both the current hypothesis that these sands originated from a global source from the north, and that dust is currently accumulating in this region. Low-inertia dust blankets eastern Arabia, effectively masking the composition and thermophysics of much of this region. Within this area are several craters containing material identifiable by their relatively high inertia and low albedo. Similar deposits to the west are located in a region with minimal dust allowing compositional and particle-size analyses to be performed, and have been studied by many previous authors using Viking, TES, and MOC data. The characteristics of the intracrater deposits in eastern and western Arabia Terra are similar, and it is possible that the origin of the deposits in these two regions are comparable in nature. This study focuses on the eastern Arabia materials only, in an effort to better understand these deposits and their origin. This study incorporates many different data sets to observe the chemical and physical characteristics of these materials and understand the origin of these deposits. Topographic information was obtained using MOLA data, and is used to understand the role the depth of the craters is playing in trapping sand in the crater floors. MOC and THEMIS visible images are used to study the physical characteristics and geomorphic relationships of these materials and the surrounding area. THEMIS day and night infrared images were also used, and provide information that enables us to derive the thermophysical properties of the deposits and surrounding material. THEMIS nighttime temperature data was used to calculate the thermal inertia of these materials.
Author
Mars Surface; Dust; Topography; Mars Craters; Planetary Geology

20040065894 Arizona State Univ., Tempe, AZ, USA
Thermal Properties of Sand from TES and THEMIS: Do Martian Dunes Make a Good Control for Thermal Inertia Calculations?
Fenton, L. K.; Fergason, Robin L.; Lunar and Planetary Science XXXV: Martian Aeolian and Mass Wasting Processes: Blowing and Flowing; 2004; 2 pp.; In English; See also 20040065882; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Thermal inertia is a measure of a material's thermal response to the diurnal heating cycle. Loose, fine-grained sediments lose heat rapidly after sunset, leading to low thermal inertia values. Increasingly consolidated sediments and coarser-grained materials (i.e., sand, gravel, boulders, and bedrock) lead to successively weaker diurnal extrema from higher heat retention and therefore they produce progressively higher thermal inertia values. In ideal situations where all other factors are accounted

for, thermal inertia can be used to estimate the average grain size of a particulate surface material. Dune fields are composed of well-sorted unconsolidated particulates of a known grain size, making them ideal targets for verification of thermal models. In some sense, dune fields may be regarded as 'ground truth' for thermal inertia calculations, because their thermal properties are well constrained. Because of this predictability, the thermal inertia of martian dunes has been studied since the first thermal models were produced for Mars. In particular, the Proctor Crater dune field of the Helluspontus area in Noachis Terra has been used as a basis for comparison between different models and between different dune fields. Thermal data from TES and THEMIS provide a much higher resolution view of the surface of Mars. With these data sets, we look once again at the thermal properties of the Proctor Crater dune field in Noachis Terra. We find that there are thermal variations present within the dune field. Some variations correspond to exposed underlying surfaces in the interdunes, but others occur even in areas of complete sand cover. We put forth a hypothesis that may explain the observed thermal variations within the dune sand. We then discuss the potential implications of using dune sand as a control for thermal inertia studies, given the observed range of thermal properties.
Author
Thermodynamic Properties; Sands; Mars Surface; Dunes

20040065895 Malin Space Science Systems, San Diego, CA, USA
Young Fans in an Equatorial Crater in Xanthe Terra, Mars
Williams, R. M. E.; Edgett, K. S.; Malin, M. C.; Lunar and Planetary Science XXXV: Martian Aeolian and Mass Wasting Processes: BLowing and Flowing; 2004; 2 pp.; In English; See also 20040065882; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In recent years, the Mars Global Surveyor (MGS) Mars Orbiter Camera (MOC) investigation has largely focused on NASA s Mars Exploration Program "Follow the Water" theme. We report here on MOC narrow angle (NA) images obtained in 2003 following observations from 1999 that show a specific, un-named, approx. 60 km-diameter impact crater at an equatorial latitude (7.6 deg. N, 33.0 deg. W) that exhibits well-preserved landforms similar in planimetric form and morphology to alluvial fans of arid environments such as the Mojave Desert of southern California. The principal question is whether these fans represent the products of water and gravity-driven alluvial sedimentation. The landforms in the Xanthe Terra crater are unique among MOC images of martian impact craters, with the exception of some features in middle latitude Hale Crater and its central peak (35.9 deg. S, 36.6 deg. W). The purpose of this paper is to present an initial, brief description of these landforms and explore their implications.
Author
Mars Exploration; Mars Global Surveyor; Water; Mars Craters; Landforms; Gravitation; Craters

20040065896 Lunar and Planetary Inst., Houston, TX, USA
Lunar and Planetary Science XXXV: Early Solar System Chronology
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040065897 - 20040065909
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The titles in this section discuss: 1) Mg Isotopic Systematics in Eutectites; 2) Diffusion Kinetics of Cr in Olivine; 3) The W Isotope Composition of Eucrite Metals; 4) U-Pb and Hf-W Chronometry; 5) Fe-60 in Silicate from a Semarkona Chondrule; 6) The Isotope Geochemistry of Nickel in Chondrites and Iron Meteorites; 7) Iron-60 in the Early Solar System; 8) Endemic Mo Isotopic Anomalies in Iron and Carbonaceous Meteorites; 9) Solar System Iron and Tungsten Isotope Abundances; 10) Li and B Isotope Variations in CAI; 11) Short-lived Radionuclides and Early Solar System Irradiation; Ru Endemic Isotope Anomalies in Meteorites; 12) Cl-36 in Ca-Al rich inclusions from a carbonaceous chondrite.
Author
Solar System Evolution; Meteoritic Composition; Chronology

20040065897 Chicago Univ., Chicago, IL, USA
Testing the Homogeneity of the Solar System for Iron (54, 56, 57, and 58) and Tungsten (182, 183, 184, and 186) Isotope Abundances
Dauphas, N.; Foley, N.; Wadhwa, M.; Davis, A. M.; Goepel, C.; Birck, J.-L.; Janney, P. E.; Gallino, R.; Lunar and Planetary Science XXXV: Early Solar System Chronology; 2004; 2 pp.; In English; See also 20040065896; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Due to the huge abundance contrast between Fe-56 and Fe-58, measuring all the isotopes of Fe simultaneously is technically challenging. In most configurations, when Fe-58 ion intensity is high enough to be measured at high precision, Fe-56 saturates its collector. For this reason, most high precision investigations of iron isotope abundances have focused on the 3 most abundant isotopes, 54, 56, and 57. The results obtained on a variety of objects, all fall on the terrestrial mass fractionation line. This is not unexpected because the isotope that is the most likely to vary is also the rarest, Fe-58. Because of analytical difficulties, all the measurements of this isotope obtained so far have been plagued by large uncertainties (approximately 5 epsilon at 2 sigma). The conclusion of these studies is that, at this level of precision and at a large scale, the solar system must have been homogenized for Fe-58. Our ability to judge the degree of homogenization depends ultimately on the precision that is attainable during analysis. What is qualified as homogeneous today may prove to be heterogeneous as analytical capabilities improve. Here, we report the accurate composition of all iron isotopes in terrestrial samples and meteorites, with a precision that is one order of magnitude better than what had been obtained before for Fe-58 (0.5 epsilon at 2 sigma).
Derived from text
Homogeneity; Iron 58; Solar System; Iron 57; Iron Isotopes; Abundance; Tungsten Isotopes

20040065898 Arizona Univ., Tucson, AZ, USA
Diffusion Kinetics of Cr in Olivine and 53Mn-53Cr Thermo-Chronology of Early Solar System Objects
Ito, M.; Ganguly, J.; Stimpfl, M.; Lunar and Planetary Science XXXV: Early Solar System Chronology; 2004; 2 pp.; In English; See also 20040065896; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The short lived 53Mn-53Cr decay system (t(sub 1/2) = 3.7 Myr) has emerged as an important chronometer for the study of time scales of processes in the early history of the solar system when 53Mn was still extant [1,2,3]. Excess 53Mn relative to the terrestrial values has been detected in olivines from different types of meteorites. The interpretation of Mn-Cr mineral ages of olivine requires quantitative understanding of its closure temperature, which can be calculated from the diffusion kinetic property of Cr. In addition, if the latter is known, the extent of resetting of 53Mn-53Cr age of olivine during cooling can be used to retrieve the cooling rate, thereby providing a new planetary thermo-chronometer that is applicable to the early solar system processes. We have, thus, determined the diffusion coefficient of Cr in olivine as a function of temperature at controlled fO2 condition, and applied these data to calculate the closure temperature of this decay system in olivine, the closure (Mn-Cr) age profile in single crystals, and cooling rate of pallasite from the available data on the resetting of the Mn-Cr mineral age [1].
Derived from text
Olivine; Stony-Iron Meteorites; Planetary Evolution; Chronology; Chronometers; Diffusion; Minerals

20040065899 Field Museum of Natural History, Chicago, IL, USA
Mg Isotopic Systematics in Eucrites: Implications for the 26Al-26Mg Chronometer
Wadhwa, M.; Foley, C. N.; Janney, P. E.; Spivak-Birndorf, L.; Lunar and Planetary Science XXXV: Early Solar System Chronology; 2004; 2 pp.; In English; See also 20040065896; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The applicability of the 26Al-26Mg system (half-life approx.0.74 Ma) towards obtaining a high-resolution chronology of early solar system events has been debated for over two decades (e.g., [1] and references therein). Additionally, 26Al has long been suggested as a potential heat source for melting and differentiation of planetesimals in the early solar system [2]. However, it was only recently that definitive evidence for its presence was found in a differentiated meteorite, the Piplia Kalan eucrite, in which the 26Al/27Al ratio was inferred to be (1.6+/-0.6)x10(exp -6) [3]. Subsequently, evidence for live 26Al has been reported in only two other eucrites (26Al/27Al approx. 1-2x10(exp -6) [4,5] and two angrites (26Al/27Al approx. 2x10(exp -7) [6]. While some recent studies provide support for the viability of the 26Al-26Mg chronometer for age dating early solar system events (e.g., [7,8]), others cast doubt on the significance of 26Al as a heat source for planetesimal differentiation as well on its applicability as a chronometer (e.g., [9]).
Derived from text
Chronometers; Magnesium Isotopes; Meteoritic Composition; Meteorites; Chronology; Heat Sources

20040065900 Muenster Univ., Germany

The W Isotope Composition of Eucrite Metals: Constraints on Timing and Cause of the Thermal Metamorphism of Eucrites

Kleine, T.; Mezger, K.; Palme, H.; Muenker, C.; Lunar and Planetary Science XXXV: Early Solar System Chronology; 2004; 2 pp.; In English; See also 20040065896; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Eucrites are meteorites of basaltic composition that formed as a result of igneous activity on a differentiated parent body, which generally is considered to be asteroid 4 Vesta [e.g., 1]. After formation at or near the surface of Vesta most eucrites have been affected by thermal metamorphism [e.g., 2], the timing and origin of which is enigmatic. In addition to the thermal overprint, eucrites show evidence for shock deformation, brecciation, and melting that are related to impacts on the surface of Vesta [e.g., 3]. This has led some to suggest that the thermal metamorphism is related to heating by these impacts [e.g., 3, 4], the timing of which has been constrained by K-Ar ages to approx. 4.1-3.5 Ga [5,6]. However, other authors attribute the thermal metamorphism to deep burial in the parent body [7,8]. The major differentiation of Vesta s mantle has been dated to within the first approx. 5 Myr of the solar system [9,10], and models describing the thermal overprint of eucrites to be the result of magma ocean crystallization into layers or rapid burial of crust, imply that the thermal metamorphism occurred within the first approx. 5 Myr of the solar system.

Derived from text

Metamorphism (Geology); Vesta Asteroid; Melting; Basalt; Crusts; Breccia; Isotopes

20040065901 Toronto Univ., Ontario, Canada

U-Pb and Hf-W Chronometry of Zircons from Eucrite A881467

Srinivasan, G.; Whitehouse, M. J.; Weber, I.; Yamaguchi, A.; Lunar and Planetary Science XXXV: Early Solar System Chronology; 2004; 2 pp.; In English; See also 20040065896; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The decay of 182Hf to 182W with a half-life of approx. 9 million years has been used to constrain the core formation event in Earth, Mars, Moon and Vesta (the parent body of eucrites). The deficit of 182W in iron meteorites has been used to argue for the early separation of metal from silicate-rich material before the decay of 182Hf. This is possible because Hf and W show extremely strong affinities for silicate and sulphide/iron-rich material respectively. Core formation which is a product of planetary differentiation process resulted from large scale melting event separating a silicate reservoir into a mantle and metallic reservoir into the core. This event would have naturally separated the Hf and W into mantle and core respectively. If the core formation event took place before all 182Hf had completely decayed then it would result in excess 182W in the silicate reservoir and depletion in 182W in the core. Compared to primitive meteorites iron meteorites which sample the core of planetary bodies show depleted 182W abundance [1-3] while the silicate reservoir of the earth shows an enriched value [4-5]. Hf-W data has demonstrated that Earth had differentiated within the first few tens of million years of the formation of solar system, but to date these measurements have relied on bulk samples of meteorites and mineral isochron for Hf-W has remained elusive.

Derived from text

Iron Meteorites; Silicates; Vesta Asteroid; Depletion; Minerals

20040065902 Centre de Spectrometrie Nucleaire et de Spectrometrie de Masse, Orsay, France

The Origin of Short-lived Radionuclides and Early Solar System Irradiation

Gounelle, M.; Shu, F. H.; Shang, H.; Glassgold, A. E.; Rehm, K. E.; Lee, T.; Lunar and Planetary Science XXXV: Early Solar System Chronology; 2004; 2 pp.; In English; See also 20040065896; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The wealth of new experimental data can be accounted for by our irradiation model. We note that we calculated in 2003 a value Be-7/Be-9 approximately equal to 3 x 10(exp -3), close to the value found experimentally some months later. Our model emphasizes the importance in distinguishing between impulsive and gradual flares. While impulsive flares can account for the distribution of short-lived radionuclides in rare FUN-like CAIs. In addition, we will discuss at the conference the implications for our model of the discovery of Fe-60 in ordinary chondrites.

Derived from text

Irradiation; Radioactive Isotopes; Solar System; Radiative Lifetime

20040065903 Centre de Recherches Petrographiques et Geochimiques, Nancy, France

Li and B Isotopic Variations in Allende Type B1 CAI 3529-41: Traces of Incorporation of Short-lived Be-7 and Be-10

Chaussidon, M.; Robert, F.; McKeegan, K. D.; Lunar and Planetary Science XXXV: Early Solar System Chronology; 2004; 2 pp.; In English; See also 20040065896; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We present here a detailed study of Li and B isotopic variations in another Allende type B CAI (3529-41) in which Be-10 can be easily detected and in which the systematics of the Li-Be-B distribution seems more simple than in USNM 3515. In 3529-41, it is possible to discriminate the effects of secondary post-magmatic perturbations on the Li and Be distribution from correlations between concentrations of Li-Be and major elements.

Derived from text

Boron Isotopes; Lithium Isotopes; Allende Meteorite; Aluminum; Inclusions; Beryllium 7; Beryllium 10; Calcium

20040065904 Arizona State Univ., Tempe, AZ, USA

Clear Evidence for Fe-60 in Silicate from a Semarkona Chondrule

Huss, G. R.; Tachibana, S.; Lunar and Planetary Science XXXV: Early Solar System Chronology; 2004; 2 pp.; In English; See also 20040065896; Original contains black and white illustrations

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Fe-60 (t(sub 1/2) = 1.5 Ma) is key to understanding the sources of short-lived radionuclides in the early solar system because it is the only one among those known from meteoritic material that is produced only in stars [1]. Within the last year, it has become clear that Fe-60 was present in sulfides from primitive ordinary and enstatite chondrites in amounts sufficient to require a recent stellar input [2-5]. The sulfide data indicate an initial Fe-60/Fe-56 ratio for the early solar system of between approx. 3 10(exp -7) and approx. 1.6 10(exp -6) [2-4]. However, iron (and nickel?) in sulfides is easily mobilized by very mild heating [e.g., 6], so there is considerable uncertainty over the true initial ratio. To resolve this uncertainty, we have begun a search for evidence of Fe-60 in silicates from primitive chondrites. In olivine from type 3.0-3.1 ordinary chondrites, diffusive exchange of iron and magnesium has not occurred to any significant degree, and diffusive exchange in pyroxene is slower [7]. However, the relatively small elemental fractionation of iron from nickel in silicates, coupled with the fact that the daughter nuclide, Ni-60, makes up approx. 26 % of normal nickel, make detection of excesses of radiogenic Ni-60 very difficult. Fortunately, we have found a fine-grained radiating-pyroxene chondrule in Semarkona (LL3.0) with a very high Fe/Ni ratio that gives clear evidence of Fe-60.

Derived from text

Silicates; Iron Isotopes; Meteoritic Composition; Enstatite; Chondrites; Radioactive Isotopes; Nuclides

20040065905 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

More on Ru Endemic Isotope Anomalies in Meteorites

Papanastassiou, D. A.; Chen, J. H.; Wasserburg, G. J.; Lunar and Planetary Science XXXV: Early Solar System Chronology; 2004; 2 pp.; In English; See also 20040065896; Original contains color illustrations

Contract(s)/Grant(s): RTOP 344-31-55-01; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We reported last year on endemic isotope anomalies for Ru in iron meteorites, pallasites, ordinary chondrites, and on a whole-rock sample of Allende. We have extended the Ru measurements to more meteorites, to refractory Ca-Al-rich inclusions (CAI) from Allende, and to a whole rock sample of Murchison (CM2). In a companion abstract we report on new measurements for the Mo isotopes, in some of the same samples. There has been a renewed interest in searching for isotope anomalies in this nuclide region, as Ru and Mo include many isotopes from r-, s-, and p-process nucleosynhesis. Furthermore, the Ru and Mo p-process isotopes show atypically high abundances, which have been hard to explain through the standard nucleosynthetic processes. Effects are possible in Ru-98 and Ru-99 from Tc-98 (with a poorly known t(sub 1/2)=4.2 to 10Ma) and from Tc-99 (t(sub 1/2)=0.21Ma). Natural Tc is now extinct on Earth due to the short half-lives, but may have been present in the early solar system. Both radiogenic and general isotope anomalies are important in understanding the processes for the formation of the early solar system. The current emphasis on Ru and Mo is also the result of the development of Negative-ion Thermal Ionization Mass Spectrometry and of Multiple-Collector, Inductively-Coupled-Mass-Spectrometry. We have also developed specific chemical siparation techniques for Ru, which eliminated mass interference effects.

Derived from text

Ruthenium Isotopes; Anomalies; Stony-Iron Meteorites; Meteoritic Composition

20040065906 Academia Sinica, China

Evidence for Live Cl-36 in Ca-Al-rich Inclusions from the Ningqiang Carbonaceous Chondrite

Lin, Y.; Guan, Y.; Leshin, L. A.; Ouyang, Z.; Wang, D.; Lunar and Planetary Science XXXV: Early Solar System Chronology; 2004; 2 pp.; In English; See also 20040065896

Contract(s)/Grant(s): NAG5-10523; NFSC-40232026; NFSC-40025311; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The short-lived radionuclide Cl-36 decays to either Ar-36 (98.1%, beta(sup -)) or S-36 (1.9%, epsilon and beta(sup +)), with a half life of 3.01 x 10(exp 5) yr. Both the nucleosynthetic and spallation models suggest high initial Cl-36/Cl-35 ratios ((Cl-36/Cl-35)o up to approximately 10(exp -4)) in the early solar system. Previous observed excess Ar-36 in Efremovka matrix has been interpreted to represent a much lower (Cl-36/Cl-35)o ratio of approximately 1 x 10(exp -6). From the observed S-36 excesses in sodalite in calcium aluminum-rich inclusions (CAIs), we report in this study the first direct evidence of the presence of Cl-36 in primitive meteorites. The inferred (Cl-36/Cl-35)o ratios range from approximately 5 x 10(exp -6) to approximately 1 x 10(exp -5).

Derived from text

Carbonaceous Chondrites; Chlorine; Calcium; Aluminum; Radioactive Isotopes

20040065907 Ecole Normale Superieure, Lyon, France

The Isotope Geochemistry of Nickel in Chondrites and Iron Meteorites

Moynier, F.; Telouk, P.; Blichert-Toft, J.; Albarede, F.; Lunar and Planetary Science XXXV: Early Solar System Chronology; 2004; 2 pp.; In English; See also 20040065896; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Difficulties with chemical separation and mass spectrometry combined with little expectation of isotopic fractionation at high temperature left the stable isotope geochemistry of nickel unattended. The quest for 60Ni excess resulting from the decay of the radioactive nuclide 60Fe (T(sub 1/2) = 1.5 My) was, however, successful but the small amount of data produced to date attests to the particularly difficult measurement by TIMS (Birck and Lugmair, 1988; Shukolyukov and Lugmair, 1993a,b) and SIMS (Kita et al., 2000). The potential of MC-ICPMS techniques is strong (Quitt et al., 2002) but has not been fully explored. This preliminary report describes evidence of mass-dependent fractionation of the stable Ni isotopes 58 (68.1%), 61 (1.14%), 62 (3.63%), and 64 (0.93%) as measured by MC-ICPMS in the metal phase of ordinary chondrites, in some of their coexisting silicate phases, and in iron meteorites.

Derived from text

Iron Meteorites; Chondrites; Inductively Coupled Plasma Mass Spectrometry; Nickel Isotopes; Mass Spectroscopy; Fractionation

20040065908 Max-Planck-Inst. fuer Chemie, Mainz, Germany

In-Situ Evidence for Live Iron-60 in the Early Solar System: A Potential Heat Source for Planetary Differentiation from a Nearby Supernova Explosion

Mosetefaoui, S.; Lugmair, G. W.; Hoppe, P.; Lunar and Planetary Science XXXV: Early Solar System Chronology; 2004; 2 pp.; In English; See also 20040065896; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Fe-60 is a short-lived radionuclide, which is mainly produced in supernovae. Its existence at relatively high abundance within meteorites would serve as evidence for a supernova (SN) explosion in close proximity to the solar system (SS) during its birth. The first resolvable excess of Ni-60 (the decay product of Fe-60) was shown to exist in the Chervony Kut (CK) eucrite, suggesting that live Fe-60 had existed in the early SS. Considering its short half-life (approximately 1.5 x 10(exp 6) years) and the high Fe contents of meteorites, Fe-60 would be a potential heat source for planetary melting and differentiation. Here we report new results on Ni-60 isotopic anomalies in Semarkona (LL3.0).

Derived from text

Heat Sources; Iron Isotopes; Radioactive Isotopes; Solar System; Supernovae; Explosions; Planetary Geology

20040065909 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Endemic Mo Isotopic Anomalies in Iron and Carbonaceous Meteorites

Chen, J. H.; Papanastassiou, D. A.; Wasserburg, G. J.; Ngo, H. H.; Lunar and Planetary Science XXXV: Early Solar System Chronology; 2004; 2 pp.; In English; See also 20040065896; Original contains color illustrations

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Mo in refractory interstellar grains shows large isotope anomalies. Recent Mo studies showed isotope effects in Allende and Murchison, and in iron meteorites, mesosiderites, and pallasites. Excesses of p- and r-process isotopes (or depletion of sprocess isotopes) of up to 3.5 epsilon units (epsilon u=parts in 10(exp 4)) were reported. We have reported on endemic isotope anomalies in Ru. Other workers have resolved no isotope anomalies for Mo or Ru and have claimed that the work by others is incorrect. Because Ru isotopes can interfere at Mo-96, Mo-98, Mo-100, we improved the chemical separations and eliminated interferences. For Mo work, we used the same solutions from which we separated and analyzed Ru. Three of the iron meteorites (Coahuila, Cape York, and Cape of Good Hope) were chosen for their large Mo isotopic effects. Mo was loaded on outgassed Re filaments, and then reduced; we used Ba(OH)2-NaOH as emitter, and measured Mo in static mode, as MoO3(-). We used Mo-98/Mo-96 for the mass fractionation correction (exponential law). No interferences from Ru or Zr isotopes were detected using the electron multiplier and no corrections were needed. For results on Mo standards we show 2 sigma(not 2 sigma mean) external precision better than: 0.7 epsilon u for Mo-94/Mo-96 and Mo-95/Mo-96; 1.0 epsilon u for Mo-92/Mo-96 and Mo-97/Mo-96; 1.4 epsilon u for Mo-100/Mo-96. Reproducibility for Mo standards is shown as contours (blue lines).

Derived from text

Anomalies; Carbonaceous Meteorites; Iron Meteorites; Molybdenum Isotopes

20040065912 Lawrence Livermore National Lab., Livermore, CA, USA

Focused Ion Beam Recovery and Analysis of Interplanetary Dust Particles (IDPs) and Stardust Analogues

Graham, G. A.; Bradley, J. P.; Bernas, M.; Stroud, R. M.; Dai, Z. R.; Floss, C.; Stadermann, F. J.; Snead, C. J.; Westphal, A. J.; Lunar and Planetary Science XXXV: Interplanetary Dust and Aerogel; 2004; 2 pp.; In English; See also 20040065911; Original contains black and white illustrations

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Meteoritics research is a major beneficiary of recent developments in analytical instrumentation [1,2]. Integrated studies in which multiple analytical techniques are applied to the same specimen are providing new insight about the nature of IDPs [1]. Such studies are dependent on the ability to prepare specimens that can be analyzed in multiple instruments. Focused ion beam (FIB) microscopy has revolutionized specimen preparation in materials science [3]. Although FIB has successfully been used for a few IDP and meteorite studies [1,4-6], it has yet to be widely utilized in meteoritics. We are using FIB for integrated TEM/NanoSIMS/synchrotron infrared (IR) studies [1].

Derived from text

Interplanetary Dust; Ion Beams; Stardust Mission; Analogs; Meteoritic Composition

20040065913 Lawrence Livermore National Lab., Livermore, CA, USA

An Analytical SuperSTEM for Extraterrestrial Materials Research

Bradley, J. P.; Dai, Z. R.; Wall, M.; Erni, R.; Browning, N.; Lunar and Planetary Science XXXV: Interplanetary Dust and Aerogel; 2004; 2 pp.; In English; See also 20040065911; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A next generation analytical transmission electron microscope known generically as SuperSTEM is being funded jointly by NASA s SRLIDAP program and Lawrence Livermore National Laboratory (LLNL). Anticipated key features of the SuperSTEM are a monochromator, high-resolution electron energy-loss spectrometer, dual spherical aberration (Cs) correctors, novel solid-state x-ray detector technology, and specimen stage compatibility with the nanoSIMS. The monochromator reduces energy spread in the electron probe from approx. 1 eV to approx. 0.1 eV (Figs. 1-3), while Cs correctors improve image resolution and increase probe current (approx. 10X) in atom-sized probes [1,2]. Analytical capabilities of the Super-STEM will include atomic-resolution Z-contrast imaging, atomic-scale mineralogical and petrographic mapping, and electron spectroscopy with energy resolution comparable to synchrotron XANES (less than or equal to 0.1 eV) but with >100X improved spatial resolution. An interim 200 keV instrument equipped with a monochromator will be installed at LLNL in May 2004, and a final 200 or 300 keV instrument with monochromator and Cs correctors will be installed in early 2006. The SuperSTEM, NanoSIMS, dual beam focused ion beam (FIB) instrument, ultramicrotome, and a cleanroom at LLNL will be available to the meteoritics community for analysis of meteoritic materials, cometary and interstellar dust particles from the Stardust mission, and returned samples from other current and planned missions.

Derived from text

Extraterrestrial Matter; Electron Microscopes; High Resolution; Monochromators; Thematic Mapping; Synchrotrons; Mineral Deposits

20040065914 New Mexico Univ., Albuquerque, NM, USA

First Report of Taenite in an Asteroidal Interplanetary Dust Particle: Flash-heating Simulates Nebular Dust Evolution

Rietmeijer, F. J. M.; Lunar and Planetary Science XXXV: Interplanetary Dust and Aerogel; 2004; 2 pp.; In English; See also 20040065911; Original contains black and white illustrations

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Metallic iron with a taenite structure rimmed by Fe3C carbide, kamacite with a magnetite rim, both approximately 200 nm in size, and les than 15 nm kamacite crystals embedded in equilibrated aggregates (or GEMS) were reported in IDPs. Here I report the first g-(Fe,Ni), taenite, in sulfide fragment -F6 particle with adhered patches of thermally modified aggregate IDP-like material belonging to cluster IDP L2011#21.

Derived from text

Asteroids; Interplanetary Dust; Meteoritic Composition; Simulation; Planetary Evolution; Nebulae

20040065915 Paris-Sud Univ., Orsay, France

In-Situ Analyses of Earth Orbital Grains Trapped in Aerogel, Using Synchrotron X-Ray Microfluorescence Techniques

Borg, J.; Djouadi, Z.; Matrajt, G.; Martinez-Criado, G.; Snead, C. J.; Somogyi, A.; Westphal, A. J.; Lunar and Planetary Science XXXV: Interplanetary Dust and Aerogel; 2004; 2 pp.; In English; See also 20040065911; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In January 2006, the Stardust mission will return, trapped in aerogel, the first samples of cometary and contemporary interstellar dust origins. Their analyses will require high spatial resolution techniques, among which Synchrotron X-rays MicroFluorescence (SR-XRF) can be an excellent candidate. It has shown the capability of identifying grains in the micron range, trapped in low density material, while the grains are still in the collector. This method allows to identify the chemical and mineralogical composition of the grains [1]. In the case of aerogel, it is possible to optically scan the samples and locate the grain, which can then be extracted very carefully using techniques developed at Berkeley [2]. Pieces of aerogel a few hundreds of microns large that contain an incident grain and its penetration track, called "aerogel keystones", can now be produced self supported on microforklifts [3]. The non-destructive identification of the material distributed inside a keystone by SR-XRF can then be followed by other analyses, like, for instance a spectroscopic identification that can also be partly performed in situ, such as Raman, and, in some conditions infrared. The extraction of the grain from the aerogel is not always possible if the grain is too small or has disintegrated and has been distributed along the entrance track.

Derived from text

Cosmic Dust; Aerogels; Interstellar Matter; Synchrotrons; Chemical Composition; Mineralogy

20040065916 NASA Johnson Space Center, Houston, TX, USA

On the Origin of GEMS

Keller, L. P.; Messenger, S.; Lunar and Planetary Science XXXV: Interplanetary Dust and Aerogel; 2004; 2 pp.; In English; See also 20040065911; Original contains color illustrations

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GEMS (glass with embedded metal and sulfides) are a major component of anhydrous interplanetary dust particles (IDPs) their physical and chemical characteristics show marked similarities to contemporary interstellar dust. Recent oxygen isotopic measurements confirm that at least a small fraction (less than 5%) of GEMS are demonstrably presolar, while the remainder have ratios that are indistinguishable from solar values. GEMS with solar oxygen isotopic compositions either (1) had their isotopic compositions homogenized through processing in the interstellar medium (ISM), or (2) formed in the early solar system. Isotopic homogenization necessarily implies chemical homogenization, so (interstellar) GEMS compositions should reflect the average composition of dust in the local ISM. We performed a systematic examination of the bulk chemistry of GEMS in primitive IDPs in order to test this hypothesis.

Derived from text

Glass; Sulfides; Metals; Solar System; Interplanetary Dust; Embedding

20040065917 Washington Univ., Saint Louis, MO, USA

Isotopically Primitive Interplanetary Dust Particles of Cometary Origin: Evidence from Nitrogen Isotopic Compositions

Floss, C.; Stadermann, F. J.; Lunar and Planetary Science XXXV: Interplanetary Dust and Aerogel; 2004; 2 pp.; In English; See also 20040065911; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The presence of large and variable H and N isotopic anomalies in interplanetary dust particles (IDPs) is well-established and attests to the primitive nature of the material present in IDPs. Last year we reported on the C, N and O isotopic systematics of two unusual IDPs. Both contain grains with highly anomalous O isotopic compositions, indicative of a presolar origin, and exhibit N isotopic anomalies, in the form of N-15 enriched bulk compositions as well as more localized enrichments in N-15 (up to +1270 ‰). Moreover, a N-15-rich hotspot in one IDP contains the first C isotopic anomaly reported in IDPs. With the extension of our isotopic imaging survey to additional IDPs, we confirm the existence of a subgroup of IDPs with primitive isotopic characteristics.

Derived from text

Interplanetary Dust; Nitrogen 15; Particles; Comets; Isotopic Labeling

20040065918 California Univ., Berkeley, CA, USA

Technique for Concentration of Carbonaceous Material from Aerogel Collectors Using HF-Vapor Etching

Westphal, A. J.; Butterworth, A. L.; Snead, C. J.; Dominguez, G.; Weber, P. K.; Hutcheon, I. D.; Huss, G. R.; Nguyen, C. V.; Graham, G. A.; Ryerson, F., et al.; Lunar and Planetary Science XXXV: Interplanetary Dust and Aerogel; 2004; 2 pp.; In English; See also 20040065911; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Extraction of fine residues of hypervelocity impacts in aerogel collectors is a major challenge. The problem is likely to be especially severe for the Stardust mission. If cometary dust particles are similar to IDPs, they are unlikely to survive as structurally intact particles, but will instead break up into their fine-grained (micron to sub-micron) constituents. Large, refractory grains (e.g., olivines) that can be extracted relatively easily are likely to survive completely intact. But recovery of fine-grained material, distributed along the impact tracks[1,2], is required for comprehensive analysis of cometary material. The recovery and analysis of organics and carbonaceous material is a particular priority for Stardust.

Derived from text

Carbonaceous Materials; Aerogels; Extraction; Olivine; Accumulators

20040065919 NASA Johnson Space Center, Houston, TX, USA

Mineralogical Study of Hydrated IDPs: X-Ray Diffraction and Transmission Electron Microscopy

Nakamura, K.; Keller, L. P.; Nakamura, T.; Noguchi, T.; Zolensky, M. E.; Lunar and Planetary Science XXXV: Interplanetary Dust and Aerogel; 2004; 2 pp.; In English; See also 20040065911; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Chondritic hydrated interplanetary dust particles (IDPs) comprise up to 50% of all IDPs collected in the stratosphere [1]. Hydrated IDPs are generally believed to be derived from asteroidal sources that have undergone aqueous alteration. However, the high C contents of hydrated IDPs (by 2 to 6X CI levels [2,3]) indicate that they are probably not derived from the same parent bodies sampled by the known chondritic meteorites. Some hydrated IDPs exhibit large deuterium enrichments [4] similar to those observed in anhydrous IDPs. Both anhydrous and hydrated IDPs contain a variety of anhydrous minerals such as silicates, sulfides, oxides, and carbonates. Controversies on hydrated IDPs still exist regarding their formation, history, and relationship to other primitive solar system materials, because of the lack of a systematic series of analysis on individual hydrated IDPs. In this study, we combine our observations of the bulk mineralogy, mineral/ organic chemistry in order to derive a more complete picture of hydrated IDPs.

Derived from text

Chondrites; X Ray Diffraction; Transmission Electron Microscopy; Mineralogy; Interplanetary Dust; Asteroids; Deuterium; Carbonates

20040065920 Washington Univ., Seattle, WA, USA

The Solar Nebula's First Accretionary Particles (FAPs): Are They Preserved in Collected Interplanetary Dust Samples?

Brownlee, D. E.; Joswiak, D. J.; Lunar and Planetary Science XXXV: Interplanetary Dust and Aerogel; 2004; 2 pp.; In English; See also 20040065911; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

All collected IDPs are composed of components bonded to each other, a necessary requirement for intact survival of atmospheric entry. Some are very strongly bonded, perhaps related to their distant history or in some cases to atmospheric entry heating. In our search for FAPs, we have endeavored to find ideal IDPs that are not strongly bonded and to develop means for gently tearing them apart into their original accretional components (FAPs). We purposely select cluster particles that severely fragment during collection and then we attempt to fully disaggregate them into individual grains. It is a challenge to just pull the components apart with enough pressure to separate billion year old contacts but without enough pressure to fracture silicate or sulfide grains. We have been successful at this task using the shear forces in ultrahigh viscosity silicone oil between two closely spaced moving plates. After separating the components, we wash them to remove oil and then mount them on carbon films using a collodion transfer method. We then analyze the submicron components by a variety of imaging and analysis techniques, including SEM for surface detail and the full range of TEM and STEM techniques for transmitted electrons- including high angle annular dark field and zero loss energy filtered imaging. Compositional imaging is done by EDX and EELS. So far, the analyses have been done on unsectioned grains. The traditional means of doing TEM studies of IDPs is by examination of microtome sections but this approach has limitations for study of potential FAPs. Examination of whole submicron grains enables study of surface detail, by FESEM, and provides access to all of the components of a particle, not just the ones in a section plane. A good analogy for the limitations of sections would be the difficulty of understanding the true structure of a city merely by examination of only a few thin-sections taken parallel to the ground. High resolution SEM observation of surfaces, in combination with all TEM/STEM techniques, provides a powerful means to evaluate these samples.
Derived from text
Interplanetary Dust; Solar Nebula; Accretion Disks; Imaging Techniques

20040065921 NASA Johnson Space Center, Houston, TX, USA
Sub-Micrometer Scale Minor Element Mapping in Interplanetary Dust Particles: A Test for Stratospheric Contamination
Flynn, G. J.; Keller, L. P.; Sutton, S. R.; Lunar and Planetary Science XXXV: Interplanetary Dust and Aerogel; 2004; 2 pp.; In English; See also 20040065911; Original contains color illustrations
Contract(s)/Grant(s): W-31-eng-10; NAG5-12976; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Combined X-ray microprobe (XRM), energy dispersive x-ray fluorescence using a Transmission Electron Microscope (TEM), and electron microprobe measurements have determined that the average bulk chemical composition of the interplanetary dust particles (IDPs) collected from the Earth s stratosphere is enriched relative to the CI meteorite composition by a factor of 2 to 4 for carbon and for the moderately volatile elements Na, K, P, Mn, Cu, Zn, Ga, Ge, and Se, and enriched to approximately 30 times CI for Br. However, Jessberger et al., who have reported similar bulk enrichments using Proton Induced X-ray Emission (PIXE), attribute the enrichments to contamination by meteor-derived atmospheric aerosols during the several weeks these IDPs reside in the Earth s atmosphere prior to collection. Using scanning Auger spectroscopy, a very sensitive surface analysis technique, Mackinnon and Mogk have observed S contamination on the surface of IDPs, presumably due to the accretion of sulfate aerosols during stratospheric residence. But the S-rich layer they detected was so thin (approximately 100 angstroms thick) that the total amount of S on the surface was too small to significantly perturb the bulk S-content of a chondritic IDP. Stephan et al. provide support for the contamination hypothesis by reporting the enrichment of Br on the edges of the IDPs using Time-of-Flight Secondary-Ion Mass-Spectrometry (TOFSIMS), but TOF-SIMS is notorious for producing false edge-effects, particularly on irregularly-shaped samples like IDPs. Sutton et al. mapped the spatial distribution of Fe, Ni, Zn, Br, and Sr, at the approximately 2 m scale, in four IDPs using element-specific x-ray fluorescence (XRF) computed microtomography. They found the moderately volatile elements Zn and Br, although spatially inhomogeneous, were not concentrated on the surface of any of the IDPs they examined, suggesting that the Zn and the Br enrichments in the IDPs are not due to contamination during stratospheric residence.
Derived from text
Contamination; Interplanetary Dust; Stratosphere; Mapping; Chemical Elements

20040065922 Imperial Coll. of Science, Technology and Medicine, London, UK
Igneous Rims on Micrometeorites and the Sizes of Chondrules in Main Belt Asteroids
Genge, M. J.; Lunar and Planetary Science XXXV: Interplanetary Dust and Aerogel; 2004; 2 pp.; In English; See also 20040065911; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Micrometeorites (MMs) are that fraction of the extraterrestrial dust flux that survives atmospheric entry to be recovered from the Earth s surface. Two general types of MM are observed amongst those collected by melting and filtering of Antarctic

blue ice: (1) fine-grained MMs (fgMMs) that have textures and compositions with affinities to the fine-grained matrices of C1, C2 and C3 chondrites, and (2) coarse-grained MMs (cgMMs) that are dominated by anhydrous silicates within glassy mesostasis. Coarse-grained MMs, as fragments of chondritic igneous objects, have been suggested to be samples of chondrules from primitive main belt asteroids [1]. Composite MMs consisting of igneous objects within fine-grained matrix have been reported by Genge [2]. The textural and compositional similarity between the fine-grained matrices of such composite particles and fgMMs, and the similarity between the igneous objects within composites and cgMMs represents strong evidence that cgMM are present as small, chondrule-like igneous objects on the same parent asteroids as at least a proportion of fgMMs [1].
Derived from text
Micrometeorites; Meteoritic Composition; Chondrites; Asteroids; Melting; Grain Size

20040065923 California Univ., Berkeley, CA, USA
Synchrotron X-Ray Analysis of Captured Particle Residue in Aerogel Keystones
Butterworth, A. L.; Westphal, A. J.; Snead, C. J.; Tamura, N.; Bajt, S.; Graham, G. A.; Bradley, J. P.; Lunar and Planetary Science XXXV: Interplanetary Dust and Aerogel; 2004; 2 pp.; In English; See also 20040065911; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

On January 2nd this year, Stardust successfully passed through the trail of Comet Wild-2 and harvested cometary particles. These particles, in addition to the contemporary interstellar grains captured during the spacecraft's journey to Wild-2 will be returned to Earth in 2006 [1]. In preparation for this return it is important to evaluate and develop suitable sample analysis techniques for these unique particles. The micrometeoroids and orbital debris captured by NASA Orbital Debris Collector Experiment (ODCE) exposed on the Mir space station has provided suitable analogues of the typical impact features that maybe preserved in the Stardust collectors [2]. Detailed optical microscopy of impact features in the ODCE aerogel collectors has indicated that particles can undergo fragmentation during capture (Fig. 1).
Derived from text
Aerogels; Cosmic Dust; Interstellar Matter; Micrometeoroids; Space Debris; X Ray Analysis; Synchrotrons; Residues

20040065924 Paris-Sud Univ., Orsay, France
FTIR Analyses of IDPs: Comparison with the InfraRed Spectra of the Interstellar Medium
Matrajt, G.; Munoz-Caro, G.; Dartois, E.; dHendecourt, L.; Borg, J.; Lunar and Planetary Science XXXV: Interplanetary Dust and Aerogel; 2004; 2 pp.; In English; See also 20040065911; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Interplanetary dust particles (IDPs) are extraterrestrial particles collected in the stratosphere by the high altitude aircrafts of the collection facility established by NASA. These particles are composed of different mineral phases and by a carbonaceous material frequently forming the matrix where are distributed the mineral grains. Several infrared investigations of IDPs and the comparison of their spectra to infrared astrophysical data have been done in the past, including infrared investigation of the carbonaceous matter and the silicate component. Flynn et al put in evidence the presence of aliphatic hydrocarbons and of a ketone group in IDPs, by detecting with FTIR the CH3, CH and C=O functional groups. Bradley et al compared the infrared spectrum of glassy (GEMS) silicates to the broad 9.5 m feature of the interstellar silicate and found there is a good match. Furthermore, Bradley et al compared the infrared signature of the crystalline small silicates embedded in the GEMS to the 10 mfeature observed in the dust of the coma of comets Halley and Hale Bopp and found again a good match. On the other hand, Keller et al found a good match between pyrrhotite, a common sulfide in IDPs, and the 23.5 m feature observed in the dust of cold clouds of the circumstellar environment. In this work we investigate the aliphatic functional groups CH2, CH3 in the spectral region around 3000 cm(sup 1) of several IDPs, using micro Fourier Transformed Infrared (FTIR). Then, we compare the bands observed in the IDPs with the bands observed in similar spectral regions of the Diffuse Interstellar Medium (DISM).
Derived from text
Infrared Spectra; Interstellar Matter; Fast Fourier Transformations; Interplanetary Dust

20040065936 Lunar and Planetary Inst., Houston, TX, USA
Lunar and Planetary Science XXXV: Astrobiology Stew: Pinch of Microbes, Smidgen of UV, Touch of Organics, and Dash of Meteorites
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040065937 - 20040065944
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The session Astrobiology Stew: Pinch of Microbes, Smidgen of UV, Touch of Organics, and Dash of Meteorites includes the following topics: 1) Investigating the Impact of UV Radiation on High-Altitude Shallow Lake Habitats, Life Diversity, and Life Survival Strategies: Clues for Mars' Past Habitability Potential? 2) An Analysis of Potential Photosynthetic Life on Mars; 3) Radiation Inactivation of Bacterial spores on Mars; 4) Hydrophobic Surfaces of Spacecraft Components Enhance the Aggregation of Microorganisms and May Lead to Higher Survival Rates of Bacteria on Mars Landers; 5) Optical Detection of Organic Chemical Biosignatures at Hydrothermal Vents; 6) Signs of Life in Meridiani Planum-What Might Opportunity See (or Miss)? 7) Isolation of PUrines and Pyrimidines from the Murchison Meteorite Using Sublimation; and 8) Relative Amino Acid Composition of CM1 Carbonaceous Chondrites.
Derived from text
Exobiology; Meteorites; Microorganisms; Ultraviolet Radiation; Organic Materials

20040065937 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Optical Detection of Organic Chemical Biosignatures at Hydrothermal Vents
Conrad, P. G.; Lane, A. L.; Bhartia, R.; Hug, W. H.; Lunar and Planetary Science XXXV: Astrobiology Stew: Pinch of Microbes, Smidgen of UV, Touch of Organics, and Dash of Meteorites; 2004; 2 pp.; In English; See also 20040065936; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We have developed a non-contact, optical life detection instrument that can detect organic chemical biosignatures in a number of different environments, including dry land, shallow aqueous, deep marine or in ice. Hence, the instrument is appropriate as a biosignature survey tool both for Mars exploration or in situ experiments in an ice-covered ocean such as one might wish to explore on Europa. Here, we report the results we obtained on an expedition aboard the Russian oceanographic vessel Akademik Mstislav Keldysh to hydrothermal vent sites in the Pacific Ocean using our life detection instrument MCDUVE, a multichannel, deep ultraviolet excitation fluorescence detector. MCDUVE detected organic material distribution on rocks near the vent, as well as direct detection of organisms, both microbial and microscopic. We also were able to detect organic material issuing directly from vent chimneys, measure the organic signature of the water column as we ascended, and passively observe the emission of light directly from some vents.
Derived from text
Optical Measurement; Microorganisms; Excitation; Signatures; Mars Exploration

20040065938 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Isolation of Purines and Pyrimidines from the Murchison Meteorite Using Sublimation
Glavin, D. P.; Bada, J. L.; Lunar and Planetary Science XXXV: Astrobiology Stew: Pinch of Microbes, Smidgen of UV, Touch of Organics, and Dash of Meteorites; 2004; 2 pp.; In English; See also 20040065936; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The origin of life on Earth, and possibly on other planets such as Mars, would have required the presence of liquid water and a continuous supply of prebiotic organic compounds. The exogenous delivery of organic matter by asteroids, comets, and carbonaceous meteorites could have contributed to the early Earth s prebiotic inventory by seeding the planet with biologically important organic compounds. A wide variety of prebiotic organic compounds have previously been detected in the Murchison CM type carbonaceous chondrite including amino acids, purines and pyrimidines. These compounds dominate terrestrial biochemistry and are integral components of proteins, DNA and RNA. Several purines including adenine, guanine, hypoxanthine, and xanthine, as well as the pyrimidine uracil, have previously been detected in water or formic acid extracts of Murchison using ion-exclusion chromatography and ultraviolet spectroscopy. However, even after purification of these extracts, the accurate identification and quantification of nucleobases is difficult due to interfering UV absorbing compounds. In order to reduce these effects, we have developed an extraction technique using sublimation to isolate purines and pyrimidines from other non-volatile organic compounds in Murchison acid extracts.
Derived from text
Isolation; Murchison Meteorite; Purines; Pyrimidines; Sublimation; Extraterrestrial Life

20040065939 NASA Johnson Space Center, Houston, TX, USA
Signs of Life in Meridiani Planum: What Might Opportunity See (Or Miss)?
Allen, C. C.; Probst, L. W.; Flood, B. E.; Longazo, T. G.; Schelble, R. T.; Westall, F.; Lunar and Planetary Science XXXV: Astrobiology Stew: Pinch of Microbes, Smidgen of UV, Touch of Organics, and Dash of Meteorites; 2004; 2 pp.; In English; See also 20040065936; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Meridiani Planum hematite deposit has been designated as the prime landing site for Opportunity, one of the two Mars Exploration Rover (MER) spacecraft. Iron oxide and hydroxide minerals, including hematite, can mineralize and preserve microfossils and physical biomarkers. Previous research by ourselves and others, summarized below, has demonstrated such mineralization in a variety of terrestrial hematite deposits. Our most recent study has focused on the mineralization of microorganisms in rock varnish, the iron- and manganese-rich layers that coat rocks in many arid environments.
Author
Mars Landing Sites; Biomarkers; Exobiology; Hematite

20040065940 College of William and Mary, Williamsburg, VA, USA
An Analysis of Potential Photosynthetic Life on Mars
Sakon, John J.; Burnap, Robert L.; Lunar and Planetary Science XXXV: Astrobiology Stew: Pinch of Microbes, Smidgen of UV, Touch of Organics, and Dash of Meteorites; 2004; 2 pp.; In English; See also 20040065936; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

As a combined result of these arguments, we theorize that photosynthetic organisms, under the right conditions and with the properly adapted surroundings, have the necessary requisites for life and can still exist on Mars. Synechocystis sp. WT 6803 is a particularly adaptive form of cyanobacteria. We believe a bacterium similar to this strain would have the best chance for survival in the Martian conditions described above. However, while extremophiles such as Synechocystis have been studied within their diverse, severe environments on Earth [7,12], there is no specific terrestrial environment that can properly simulate Martian conditions. Therefore, we feel much can be learned about this bacteria s adaptability to the effects of such conditions by putting it under various stresses similar to those it would experience on Mars. This project studied how Synechocystis responded to some of these various stresses, including Martian simulant soil, UV radiation, low pressure and Martian atmospheric composition.
Derived from text
Atmospheric Composition; Extraterrestrial Life; Mars Atmosphere; Mars Surface; Organisms; Ultraviolet Radiation

20040065941 European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands
Radiation Inactivation of Bacterial Spores on Mars
Bada, J. L.; Kminek, G.; Lunar and Planetary Science XXXV: Astrobiology Stew: Pinch of Microbes, Smidgen of UV, Touch of Organics, and Dash of Meteorites; 2004; 2 pp.; In English; See also 20040065936; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The conditions on Mars are thought to have been more conducive for life during its early history, about 3 billion years ago. If life ever evolved on Mars, would it be possible to see the remnants of a long-extinct biosphere today? Or even more interesting, would it be possible to find Martian bacterial spores that survived for billions of years on Mars?
Derived from text
Extraterrestrial Life; Mars (Planet); Mars Environment

20040065942 NASA Ames Research Center, Moffett Field, CA, USA, NASA Ames Research Center, Moffett Field, CA, USA
Investigating the Impact of UV Radiation on High-Altitude Shallow Lake Habitats, Life Diversity, and Life Survival Strategies: Clues for Mars' Past Habitability Potential?
Cabrol, A.; Grin, E. A.; Hock, A.; Kiss, A.; Borics, G.; Kiss, K.; Acs, E.; Kovacs, G.; Chong, G.; Demergasso, C., et al.; Lunar and Planetary Science XXXV: Astrobiology Stew: Pinch of Microbes, Smidgen of UV, Touch of Organics, and Dash of Meteorites; 2004; 2 pp.; In English; See also 20040065936; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We present data and results from an ongoing project of astrobiological high-altitude expeditions investigating the highest and least explored perennial lakes on Earth in the Bolivian and Chilean Andes, including several volcanic crater lakes nearing and beyond 6,000 m in elevation. In the next five years, they will provide the first integrated long-term astrobiological characterization and monitoring of lacustrine environments and their biology for such altitude. These extreme lakes are natural laboratories. They provide the field data missing beyond 4,000 m to complete our understanding of terrestrial lakes and biota. Research on the effects of UV has been performed in lower altitude lakes and models of UV flux over time are being developed. Lakes showing a high content of dissolved organic material (DOM) shield organisms from UV. DOM acts as a natural sunscreen as it influences the water transparency, therefore is a determinant of photic zone depth. In sparsely vegetated

alpine areas, lakes are clearer and offer less protection from UV to organisms living in the water. Transparent water and high UV irradiance may maximize the penetration and effect of UV radiation. Shallow-water communities in these lakes are particularly sensitive to UV radiation. The periphyton can live on various susbtrates. While on rocks, it includes immobile species that cannot seek low UV refuges unlike sediment-dwelling periphyton or alpine phytoflagellates which undergo vertical migration. Inhibition of algal photosynthesis by UV radiation has been documented in laboratory and showed that phytoplankton production is reduced by formation of nucleic acid lesions or production of peroxides and free oxygen radicals. of peroxides and free oxygen radicals. Our project is providing the field data that is missing from natural laboratories beyond 4,000 m and will complement the vision of the effects of UV on life and its adaptation modes (or lack thereof).
Derived from text
Habitats; High Altitude; Lakes; Ultraviolet Radiation; Mars Surface; Shallow Water

20040065943 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Hydrophobic Surfaces of Spacecraft Components Enhance the Aggregation of Microorganisms and May Lead to Higher Survival Rates of Bacteria on Mars Landers
Schuerger, Andrew C.; Kern, Roger G.; Lunar and Planetary Science XXXV: Astrobiology Stew: Pinch of Microbes, Smidgen of UV, Touch of Organics, and Dash of Meteorites; 2004; 2 pp.; In English; See also 20040065936; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In order to minimize the forward contamination of Mars, spacecraft are assembled under cleanroom conditions that require several procedures to clean and sterilize components. Surface characteristics of spacecraft materials may contribute to microbial survival on the surface of Mars by protecting spores from sterilizing agents, including UV irradiation. The primary objective of this study was to evaluate the effects of surface characteristics of several spacecraft materials on the survival of Bacillus subtilis spores under simulated Martian conditions.
Derived from text
Hydrophobicity; Microorganisms; Surface Properties; Mars Environment; Spacecraft Contamination

20040065944 Leiden Univ., Netherlands
Relative Amino Acid Composition of CM1 Carbonaceous Chondrites
Martins, Z.; Botta, O.; Ehrenfreund, P.; Lunar and Planetary Science XXXV: Astrobiology Stew: Pinch of Microbes, Smidgen of UV, Touch of Organics, and Dash of Meteorites; 2004; 2 pp.; In English; See also 20040065936; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A comparison of chromatograms of the MET01070, ALH88045 and Murchison meteorites is shown. Absolute amino acid abundances were measured and relative amino acids concentrations were calculated. Based on these, it is possibly to verify that the relative (glycine= 1) concentrations of beta-alanine and AIB of the CM1's ALH88045 and MET01070 falls between that of CM2 Murchison and the CI1 Orgueil, suggesting a link between CM2 and CI1 meteorites. The values for the beta-alanine/glycine ratio are 0.764, 1.991, 1.258 and 2.902, and for the AIB/glycine ratio are 1.826, 0.431, 0.221, and 0.055, respectively for Murchison, ALH88045, MET01070 and Orgueil. The most abundant D-amino acid in meteorites, D-alanine, could give us important information. Yet, D-alanine/glycine ratios of CM1's ALH88045 and MET01070 do not fit between this pattern. We will discuss the processes which occurred in the parent bodies of CIs and CMs carbonaceous meteorites. We will elucidate the link between these chondrites.
Derived from text
Amino Acids; Carbonaceous Meteorites; Meteoritic Composition; Planetary Geology

20040065951 Lunar and Planetary Inst., Houston, TX, USA
Lunar and Planetary Science XXXV: The Future of Mars Surface Exploration
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040065952 - 20040065958
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The session The Future of Mars Surface Exploration includes the following topics: 1) High Resolution Laser Scanning Techniques for Rock Abrasion and Texture Analyses on Mars and Earth; 2) Definitive Mineralogical Analysis of Mars Analog Rocks Using the CheMin XRD/XRF Instrument; 3) Quantitative Mineralogical Analysis of Mars Analogues Using CHEMIN Data and Rietveld Refinement; 4) In Situ Analytical Strategy for Mars Combining X-Ray and Optical Techniques; 5) In-Situ

Dating on Mars: The Potential of OSL Dating; 6) Experiment of Dynamic Albedo of Neutrons (DAN): Searching for Water-rich Spots from the Rover on the Surface of Mars; and 7) Developing an Automated Science Analysis System for Mars Surface Exploration for MSL and Beyond.
Derived from text
Mars Surface; Mars Exploration; Planetary Geology; Topography

20040065952 NASA Ames Research Center, Moffett Field, CA, USA
Developing an Automated Science Analysis System for Mars Surface Exploration for MSL and Beyond
Gulick, V. C.; Hart, S. D.; Shi, X.; Siegel, V. L.; Lunar and Planetary Science XXXV: The Future of Mars Surface Exploration; 2004; 2 pp.; In English; See also 20040065951; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We are developing an automated science analysis system that could be utilized by robotic or human explorers on Mars (or even in remote locations on Earth) to improve the quality and quantity of science data returned. Three components of this system (our rock, layer, and horizon detectors) [1] have been incorporated into the JPL CLARITY system for possible use by MSL and future Mars robotic missions. Two other components include a multi-spectral image compression (SPEC) algorithm for pancam-type images with multiple filters and image fusion algorithms that identify the in focus regions of individual images in an image focal series [2]. Recently, we have been working to combine image and spectral data, and other knowledge to identify both rocks and minerals. Here we present our progress on developing an igneous rock detection system.
Derived from text
Data Compression; Mars Surface; Image Processing; Emission Spectra; Algorithms; Igneous Rocks

20040065953 Jet Propulsion Lab., California Inst. of Tech., Wrightwood, CA, USA
High Resolution Laser Scanning Techniques for Rock Abrasion and Texture Analyses on Mars and Earth
Bridges, N. T.; Razdan, A.; Greeley, R.; Laity, J. E.; Lunar and Planetary Science XXXV: The Future of Mars Surface Exploration; 2004; 2 pp.; In English; See also 20040065951; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Aeolian abrasion is operative in many arid locations on Earth and is probably the dominant rock erosion process in the current Martian environment. Therefore, understanding the controlling parameters and rates of aeolian abrasion provides 1) insight into the stability of rocks on planetary surfaces and the environments under which the rocks abrade, and 2) a link between ventifact (a rock abraded by windblown particles) morphology and: a) abrasion conditions, b) possible ancient environments under which the rocks were abraded, and c) rock properties. promising and we plan further investigations in the wind tunnel and field. Our intent here is to discuss the basic technique, initial results, and upcoming plans.
Derived from text
Abrasion; Mars Environment; Erosion; Mars Surface; Planetary Surfaces; Morphology

20040065954 Academy of Sciences (Russia), Moscow, Russia
Experiment of Dynamic Albedo of Neutrons (DAN): Searching for Water-rich Spots from the Rover on the Surface of Mars
Litvak, M. L.; Mitrofanov, I. G.; Kozyrev, A. S.; Sanin, A. B.; Tretyakov, V. I.; Ryzhkov, V. I.; Shvetsov, V. N.; Lunar and Planetary Science XXXV: The Future of Mars Surface Exploration; 2004; 2 pp.; In English; See also 20040065951; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

After global neutron mapping of Mars by Odyssey from the orbit [1-4], the next step of shallow water detection should be measurements of neutrons directly on the surface. If the orbital measurements present the global picture of shallow water distribution on Mars with resolution of 200-300 km, the surface data may provide the spatial resolution of 1-3 meters both along the surface and into depth, and therefore may support the direct access to water bearing soil and/or to water ice. The technical condition for these searching for water is the surface mobility, which could be provided either by future NASA Martian Science Laboratory of 2009, of by another future Rovers on the surface of Mars. The concept of the experiment of Dynamic Albedo of Neutrons (DAN) on the Mars rover is presented below, and expected results of these measurements are discussed.
Derived from text
Mars Surface; 2001 Mars Odyssey; Albedo; Planetary Mapping; Roving Vehicles; Shallow Water

20040065955 NASA Ames Research Center, Moffett Field, CA, USA

Definitive Mineralogical Analysis of Mars Analog Rocks Using the CheMin XRD/XRF Instrument

Blake, D. F.; Sarrazin, P.; Bish, D. L.; Feldman, S.; Chipera, S. J.; Vaniman, D. T.; Collins, S.; Lunar and Planetary Science XXXV: The Future of Mars Surface Exploration; 2004; 2 pp.; In English; See also 20040065951; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Mineral identification is a critical component of Mars Astrobiological missions. Chemical or elemental data alone are not definitive because a single elemental or chemical composition or even a single bonding type can represent a range of substances or mineral assemblages. Minerals are defined as unique structural and compositional phases that occur naturally. There are about 15,000 minerals that have been described on Earth, all uniquely identifiable via diffraction methods. There are likely many minerals yet undiscovered on Earth, and likewise on Mars. If an unknown phase is identified on Mars, it can be fully characterized by structural (X-ray Diffraction, XRD) and elemental analysis (X-ray Fluorescence, XRF) without recourse to other data because XRD relies on the principles of atomic arrangement for its determinations. XRD is the principal means of identification and characterization of minerals on Earth.

Derived from text

Chemical Analysis; Mineralogy; Planetary Geology; Mineral Deposits; Mars Surface; Chemical Composition

20040065956 NASA Ames Research Center, Moffett Field, CA, USA

Quantitative Mineralogical Analysis of Mars Analogues Using CHEMIN Data and Rietveld Refinement

Bish, D. L.; Sarrazin, P.; Chipera, S. J.; Vaniman, D. T.; Blake, D.; Lunar and Planetary Science XXXV: The Future of Mars Surface Exploration; 2004; 2 pp.; In English; See also 20040065951; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Mineralogical analysis is a critical component of planetary surface exploration. Chemical data alone leave serious gaps in our understanding of the surfaces of planets where complex minerals may form in combination with H, S, and halogens. On such planets (e.g., Mars) a single chemical composition may represent a range of mineral assemblages. For example, Viking chemical analyses of excavated duricrust indicate that Mg and S are correlated and ~10% MgSO4 (anhydrous weight) is a likely cementing agent. Pathfinder chemical data support a similar abundance of MgSO4 in the most altered materials. However, there are many possible Mg-sulfates with widely varying hydration states (including dehydrated and 1-, 2-, 3-, 4-, 5-, 6-, and 7-hydrates). In addition, other sulfate minerals such as gypsum (CaSO4 .2H2O) and other salts containing Cl may also exist. X-ray diffraction (XRD) has the ability to decipher mixtures of these phases that would be difficult, if not impossible to unravel using only chemical or spectral data.

Derived from text

Quantitative Analysis; Mineralogy; Mars (Planet); Mineral Deposits; Mars

20040065957 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

In-Situ Dating on Mars: The Potential of OSL Dating

Blair, M. W.; Kalchgruber, R.; Yukihara, E. G.; Bulur, E.; Kim, S. S.; McKeever, W. S.; Lunar and Planetary Science XXXV: The Future of Mars Surface Exploration; 2004; 2 pp.; In English; See also 20040065951; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

More and more evidence is being accumulated that Mars has experienced aeolian, fluvial, and periglacial activity in the (relatively) recent past [1, 2, 3]. However, the temporal scale on which these processes took place is very poorly constrained since crater counting has errors comparable to the age for younger terrains (approx. 1 Ma). Consequently, many researchers have called for methods to establish the climatic and geomorphic history of Mars [4]. Lepper and McKeever [5] suggested developing optically stimulated luminescence (OSL) dating techniques for in-situ dating of martian sediments. Electron paramagnetic resonance (EPR) is closely related to OSL and could easily be incorporated on the same instrument platform [6]. These two methods can aid in developing a geological and climatic history of Mars over the last approx. one million years. Since the initial investigations, work has been carried out to develop OSL instrumentation and dating procedures that are suitable to the unique challenges of the martian environment. In this paper, we highlight the advances made in this project, focusing on OSL dating principles, assumptions, and procedures.

Derived from text

Electron Paramagnetic Resonance; Climatology; Chronology; Mars Environment; Luminescence; Geomorphology

20040065958 Search for Extraterrestrial Intelligence Inst., Mountain View, CA, USA

In Situ Analytical Strategy for Mars Combining X-Ray and Optical Techniques

Marshall, J.; Martin, J. P.; Mason, L. W.; Williamson, D. L.; Lunar and Planetary Science XXXV: The Future of Mars Surface Exploration; 2004; 2 pp.; In English; See also 20040065951; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Geological samples on earth rarely arrive "sight-unseen" in a laboratory before being analyzed by sophisticated instrumentation. Rather, the samples are carefully chosen by a geologist in the field using primarily optical methods. In the process of sample selection in the field, most samples are rejected in preference for a few which appear to warrant further scrutiny in the lab. But before their journey to the lab, the rocks have already been identified in some detail as to which basic geological category they belong to, and many mineral species within the rocks have been identified. Such information is gathered by the eyes and handlens of the geologist which establish geological context, structures, and sample color, texture, crystallinity, granularity, etc.

Derived from text

Geological Surveys; Planetary Geology; Mars Surface; Minerals; X Ray Optics

20040065960 Lunar and Planetary Inst., Houston, TX, USA

Lunar and Planetary Science XXXV: Concerning Chondrites

2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040065961 - 20040065968

Contract(s)/Grant(s): NCC5-679

Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The Lunar and Planetary Science XXXV session entitled "Concerning Chondrites" includes the following topics: 1) Petrology and Raman Spectroscopy of Shocked Phases in the Gujba CB Chondrite and the Shock History of the CB Parent Body; 2) The Relationship Between CK and CV Chondrites: A Single Parent Body Source? 3) Samples of Asteroid Surface Ponded Deposits in Chondritic Meteorites; 4) Composition and Origin of SiO2-rich Objects in Carbonaceous and Ordinary Chondrites; 5) Re-Os Systematics and HSE distribution in Tieschitz (H3.6); Two Isochrons for One Meteorite; 6) Loss of Chromium from Olivine During the Metamorphism of Chondrites; 7) Very Short Delivery Times of Meteorites After the L-Chondrite Parent Body Break-Up 480 Myr Ago; and 8) The Complex Exposure History of a Very Large L/LL5 Chondrite Shower: Queen Alexandra Range 90201.

Derived from text

Planetary Geology; Chondrites; Mineralogy; Meteoritic Composition

20040065961 Carnegie Institution of Washington, Washington, DC, USA

Re-Os Systematics and HSE Distribution in Tieschitz (H3.6): Two Isochrons for One Meteorite

Smoliar, M. I.; Horan, M. F.; Alexander, C. M. OD.; Walker, R. J.; Lunar and Planetary Science XXXV: Concerning Chondrites; 2004; 2 pp.; In English; See also 20040065960; Original contains color illustrations

Contract(s)/Grant(s): NAG5-10425; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Tieschitz is an ordinary chondrite that displays some unique features. So called "white matrix" and "bleached chondrules" are found in only few chondrites, while in Tieschitz they are significant components. These phases have been the object of numerous studies, and are generally considered to be formed by secondary alteration or even redeposition. A Sm-Nd study of selected chondrules from Tieschitz yielded a surprisingly young apparent age of 2.0 Ga, which most likely reflects the time of the alteration process. This makes Tieschitz very interesting with respect to providing a record of a young alteration event.

Author

Rhenium; Osmium; Meteoritic Composition

20040065962 Open Univ., Milton Keynes, UK

The Relationship Between CK and CV Chondrites: A Single Parent Body Source?

Greenwood, R. C.; Franchi, I. A.; Kearsley, A. T.; Alard, O.; Lunar and Planetary Science XXXV: Concerning Chondrites; 2004; 2 pp.; In English; See also 20040065960; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

CK chondrites are highly oxidized meteorites containing abundant magnetite and trace amounts of Fe,Ni-metal [1,2]. The

group is dominated by equilibrated meteorites (types 4 to 6), whereas all other carbonaceous chondrite groups contain only unequilibrated material [3]. This is in marked contrast to ordinary chondrites in which equilibrated and unequilibrated meteorites form a continuum within each of the main groups (H,L,LL) [3].
Derived from text
Carbonaceous Chondrites; Chondrites; Magnetite

20040065963 City Univ. of New York, Brooklyn, NY, USA
Petrology and Raman Spectroscopy of Shocked Phases in the Gujba CB Chondrite and the Shock History of the CB Parent Body
Weisberg, M. K.; Kimura, M.; Lunar and Planetary Science XXXV: Concerning Chondrites; 2004; 2 pp.; In English; See also 20040065960; Original contains color and black and white illustrations
Contract(s)/Grant(s): NAG5-11546; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The CB chondrites are metal-rich chondritic meteorites having characteristics that sharply distinguish them from other chondrites [1], including (1) high metal abundances (60-80 vol.% metal), (2) most chondrules have cryptocrystalline or barred textures, (3) moderately volatile lithophile elements are highly depleted and (4) nitrogen is enriched in the heavy isotope. Similarities in mineral composition, as well as oxygen and nitrogen isotopic compositions of the CB to CR and CH chondrites are consistent with derivation of these chondrite groups from a common nebular reservoir, hence their grouping in the CR clan [1, 2, 3, 4]. CB chondrites have been divided into CBa (Gujba, Bencubbin, Weatherford) and CBb (Hammadah al Hamra 237 and QUE 94411) subgroups based on petrologic characteristics.
Derived from text
Meteoritic Composition; Petrology; Chondrule; Metallicity; Meteorites

20040065964 NASA Johnson Space Center, Houston, TX, USA
Samples of Asteroid Surface Ponded Deposits in Chondritic Meteorites
Zolensky, M. E.; Lee, R.; Le, L.; Lunar and Planetary Science XXXV: Concerning Chondrites; 2004; 2 pp.; In English; See also 20040065960; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

One of the many unexpected observations of asteroid 433 Eros by the Near Earth Asteroid Rendezvous (NEAR) mission was the many ponds of fine-grained materials [1-3]. The ponds have smooth surfaces, and define equipotential surfaces up to 10's of meters in diameter [4]. The ponds have a uniformly sub-cm grain size and appear to be cohesive or indurated to some degree, as revealed by slumping. The ponds appear to be concentrated within 30 degrees of the equator of Eros, where gravity is lowest. There is some insight into the mineralogy and composition of the ponds surfaces from NEAR spectroscopy [2,4,5,6]. Compared to the bulk asteroid, ponds: (1) are distinctly bluer (high 550/760 nm ratio), (2) have a deeper 1um mafic band, (3) have reflectance elevated by 5%.
Derived from text
Asteroids; Meteorites; Chondrites; Deposits; Equipotentials; Grain Size; Gravitation

20040065965 Cologne Univ., Germany
Composition and Origin of SiO2-rich Objects in Carbonaceous and Ordinary Chondrites
Hezel, D. C.; Palme, H.; Brenker, F. E.; Lunar and Planetary Science XXXV: Concerning Chondrites; 2004; 2 pp.; In English; See also 20040065960; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Typical chondrules in all types of chondritic meteorites have SiO2-concentrations between 45 and 55 wt.%. However, most types of chondrites also contain chondrules and fragments with bulk SiO2-concentrations from 65 wt.% up to nearly pure SiO2. These SiO2-rich objects (SRO) are very rare and are more frequently observed in ordinary than in carbonaceous chondrites. The typical paragenesis of SROs is a high temperature polymorph of SiO2 and pyroxene or pyroxene normative glass. SROs in carbonaceous chondrites (CC) are most common in the CH-type. There, SROs are usually depleted in refractory elements such as Ca, Al and Ti but no fractionation among these elements is observed. The Si/Mg-ratios in CC SROs are up to 3 4 times the Cl-ratio.
Derived from text
Silicon Dioxide; Carbonaceous Chondrites; Fragments; Meteoritic Composition

20040065966 California Univ., Berkeley, CA, USA

The Complex Exposure History of a Very Large L/LL5 Chondrite Shower: Queen Alexandra Range 90201

Welten, K. C.; Nishiizumi, K.; Caffee, M. W.; Hillegonds, D. J.; Leya, I.; Wieler, R.; Mararik, J.; Lunar and Planetary Science XXXV: Concerning Chondrites; 2004; 2 pp.; In English; See also 20040065960; Original contains color illustrations

Contract(s)/Grant(s): W-7405-eng-48; NAG5-12846; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Compared to iron meteorites, large stony meteorites (less than 100 kg) are relatively rare. Most large stony meteoroids fragment during atmospheric entry, producing large meteorite showers. Interestingly, many of these large chondrites, such as Bur Gheluai, Gold Basin, Jilin and Tsarev appear to have a complex exposure history with a first-stage exposure on the parent body. The question is whether complex exposure histories are simply more readily detected in large objects or large objects are more likely to experience a complex exposure. Investigation of these two hypotheses is the motivation for this work in which we report on the exposure history of QUE 90201, a large L/LL5 chondrite shower found near Queen Alexandra Range, Antarctica. Previous cosmogenic nuclide studies have led to the consensus that most of the approx. 2000 L5 and LL5 chondrites from the QUE area are derived from a single object with a pre-atmospheric radius of 1-2 m. The terrestrial age of the QUE 90201 shower was determined at 125 20 kyr. Here, we present a more complete set of cosmogenic radionuclide results in the metal and stone fractions of eleven L/LL5 chondrites from the QUE stranding area, as well as noble gases in seven of these samples. The main goal of this work is to unravel the cosmic-ray exposure history of the QUE 90201 meteoroid. In addition, we will discuss the pre-atmospheric size and exposure history of QUE 93013 (H5) and 93081 (H4) with similar shielding conditions as the QUE 90201 shower and a terrestrial age of 145 +/- 25 kyr.

Author

Atmospheric Entry; Chondrites; Exposure; Fragments; Iron Meteorites; Radioactive Isotopes

20040065967 Eidgenoessische Technische Hochschule, Zurich, Switzerland

Very Short Delivery Times of Meteorites After the L-Chondrite Parent Body Break-Up 480 Myr Ago

Heck, R.; Baur, H.; Wieler, R.; Schmitz, B.; Lunar and Planetary Science XXXV: Concerning Chondrites; 2004; 2 pp.; In English; See also 20040065960; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Cosmic-ray exposure ages of 480 million year old fossil meteorites found in Southern Sweden constrain delivery times of meteorites from a large collision in the asteroid belt. Chromite grains from seven meteorites from four stratigraphic layers define an exposure age gradient as expected if the meteorites originated from the well-known L-chondrite parent body break-up event. The very short delivery times of a few 10(exp 5) years for the earliest fragments reaching Earth are in the range predicted by dynamical models.

Author

Meteoritic Composition; Time Lag; Fragments; Exposure; Asteroid Belts; Chondrites; Time

20040065968 Geological Survey, Reston, VA, USA

Loss of Chromium from Olivine During the Metamorphism of Chondrites

Grossman, J. N.; Lunar and Planetary Science XXXV: Concerning Chondrites; 2004; 2 pp.; In English; See also 20040065960; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Identifying chondrites that have experienced the least parent-body processing is an important goal of meteorite research. The current classification scheme for ordinary chondrites (OCs) assigns the most primitive meteorites to type 3.0, whereas those showing limited evidence of metamorphism are designated as type 3.1 or higher. Distinguishing between type 3.0 and 3.1 OCs is challenging. The primary thermoluminescence (TL) parameters used do not resolve 3.0 from 3.1, as both types have very low TL sensitivity and similar TL vs. temperature profiles. Other methods that can be used to distinguish among these types include measuring the abundance of presolar grains, the distribution of minor elements in kamacite and associated phases, and cathodoluminenscence plus compositional properties of chondrule mesostases. These methods are labor intensive and are not always possible on small or weathered meteorites, resulting in confusion over which meteorites are the most primitive.

Derived from text

Chromium; Olivine; Metamorphism (Geology); Chondrites; Meteoritic Composition

20040065980 Loma Linda Univ., CA, USA

Proton and Electron Threshold Energy Measurements for Extravehicular Activity Space Suits, Chapter 2

Moyers, M. F.; Nelson, G. D.; Saganti, P. B.; December 2003; 15 pp.; In English

Contract(s)/Grant(s): NCC9-79; No Copyright; Avail: CASI; A03, Hardcopy

Construction of ISS will require more than 1000 hours of EVA. Outside of ISS during EVA, astronauts and cosmonauts are likely to be exposed to a large fluence of electrons and protons. Development of radiation protection guidelines requires the determination of the minimum energy of electrons and protons that penetrate the suits at various locations. Measurements of the water-equivalent thickness of both US. and Russian EVA suits were obtained by performing CT scans. Specific regions of interest of the suits were further evaluated using a differential range shift technique. This technique involved measuring thickness ionization curves for 6-MeV electron and 155-MeV proton beams with ionization chambers using a constant source-to-detector distance. The thicknesses were obtained by stacking polystyrene slabs immediately upstream of the detector. The thicknesses of the 50% ionizations relative to the maximum ionizations were determined. The detectors were then placed within the suit and the stack thickness adjusted until the 50% ionization was reestablished. The difference in thickness between the 50% thicknesses was then used with standard range-energy tables to determine the threshold energy for penetration. This report provides a detailed description of the experimental arrangement and results.

Author

Protons; Electrons; Radiation Measurement; Extravehicular Mobility Units

20040065991 Lunar and Planetary Inst., Houston, TX, USA

Lunar and Planetary Science XXXV: Mars Geophysics

2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040065992 - 20040066001

Contract(s)/Grant(s): NCC5-679

Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The titles in this section include: 1) Distribution of Large Visible and Buried Impact Basins on Mars: Comparison with Free-Air Gravity, Crustal Thickness, and Magnetization Models; 2) The Early Thermal and Magnetic State of Terra Cimmeria, Southern Highlands of Mars; 3) Compatible Vector Components of the Magnetic Field of the Martian Crust; 4) Vertical Extrapolation of Mars Magnetic Potentials; 5) Rock Magnetic Fields Shield the Surface of Mars from Harmful Radiation; 6) Loading-induced Stresses near the Martian Hemispheric Dichotomy Boundary; 7) Growth of the Hemispheric Dichotomy and the Cessation of Plate Tectonics on Mars; 8) A Look at the Interior of Mars; 9) Uncertainties on Mars Interior Parameters Deduced from Orientation Parameters Using Different Radio-Links: Analytical Simulations; 10) Refinement of Phobos Ephemeris Using Mars Orbiter Laser Altimetry Radiometry.

CASI

Mars (Planet); Geophysics

20040065992 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Distribution of Large Visible and Buried Impact Basins on Mars: Comparison with Free-Air Gravity, Crustal Thickness and Magnetization Models

Frey, H. V.; Lunar and Planetary Science XXXV: Mars Geophysics; 2004; 2 pp.; In English; See also 20040065991; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A comparison of the distribution of visible and buried impact basins (Quasi-Circular Depressions or QCDs) on Mars > 200 km in diameter with free air gravity, crustal thickness and magnetization models shows some QCDs have coincident gravity anomalies but most do not. Very few QCDs have closely coincident magnetization anomalies, and only the oldest of the very large impact basins have strong magnetic anomalies within their main rings. Crustal thickness data show a large number of Circular Thinned Areas (CTAs). Some of these correspond to known impact basins, while others may represent buried impact basins not always recognized as QCDs in topography data alone. If true, the buried lowlands may be even older than we have previously estimated.

Author

Mars Craters; Planetary Geology; Structural Basins; Geographic Distribution

20040065993 Coimbra Univ., Coimbra, Portugal

Rock Magnetic Fields Shield the Surface of Mars from Harmful Radiation

Alves, E. I.; Baptista, A. R.; Lunar and Planetary Science XXXV: Mars Geophysics; 2004; 2 pp.; In English; See also 20040065991; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Mars has had a dipolar magnetic field but the dynamo which produced it was terminated about 3.5 Gy ago. The strong rock-remanent magnetic anomalies that were measured at 200Km altitude by the MAG-ER instrument (Magnetometer and Electron Reflectometer) of the Mars Global Surveyor mission are strong evidence that such magnetic field has existed. Since 2001 the MARIE detector (Martian Radiation Environment Experiment) onboard the 2001 Mars Odyssey mission satellite is measuring space radiation in the ionosphere of Mars. The present work addresses the correlation of data from those two instruments. It may be possible to understand if the places where such anomalies are located are being protected from the solar wind and cosmic rays, on a planet lacking a permanent dipolar magnetic field. As stated, the crustal magnetic fields may be a major factor limiting erosion of the atmosphere, protecting it from the galactic radiation, and consequently, also protecting the surface.
Derived from text
Extraterrestrial Radiation; Magnetic Fields; Mars Atmosphere; Mars Surface; Rocks

20040065994 Northwestern Univ., Evanston, IL, USA
Vertical Extrapolation of Mars Magnetic Potentials
Jurdy, Donna M.; Stefanick, Michael; Lunar and Planetary Science XXXV: Mars Geophysics; 2004; 2 pp.; In English; See also 20040065991; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Mars Global Surveyor MAG/ER measured strongly magnetized crust; despite Mars weak field at present, the intensity reaches about 10 times that of Earth's magnetic lineations. We analyze the magnetic lineations in an octant centered at 40 degree S, 180 degrees W plus or minus 40 degrees, concentrated in the more heavily cratered Southern hemisphere. Data was used form the mapping phase of Mars Global Surveyor, MAG/ER magnetic measurements at altitudes of 404 plus or minus 34 kilometers (made available by Connerney conveniently binned into degree boxes)
Derived from text
Extrapolation; Mars Global Surveyor; Mars Surface; Magnetic Fields

20040065995 Institut de Physique du Globe, Paris, France
A Look at the Interior of Mars
Khan, A.; Mosegaard, K.; Lognonne, P.; Wieczorek, M.; Lunar and Planetary Science XXXV: Mars Geophysics; 2004; 2 pp.; In English; See also 20040065991; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The existence of a martian core has been widely accepted for some time now and even more so now given its ability to explain in a natural way the presence of the strong, spatially variable magnetic fields found by the MGS spacecraft. An ancient internal dynamo in analogy to the Earth is assumed to have been present which has magnetised the crustal material as it cooled through the Curie temperature [1, 2]. Other supporting evidence for a core comes from the SNC meteorites. These are found to be highly depleted in siderophile elements which, like on Earth, is attributed to their removal during core formation [3].
Derived from text
Magnetic Fields; Mars (Planet); SNC Meteorites; Crusts

20040065996 Belgian Royal Observatory, Brussels, Belgium
Uncertainties on Mars Interior Parameters Deduced from Orientation Parameters Using Different Radio-Links: Analytical Simulations
Yseboodt, M.; Barriot, J. P.; Dehant, V.; Rosenblatt, P.; Lunar and Planetary Science XXXV: Mars Geophysics; 2004; 2 pp.; In English; See also 20040065991; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Information on Martian interior can be deduced from its rotation. For example, the precession rate is inversely proportional to the planet moment of inertia; nutations amplifications will be different if the core is liquid or solid. Four motions are investigated here: precession, nutation, polar motion and variations of the rotation rate (length-of-the-day). Each of these motions, if monitored with sufficient precision, can give information on Mars interior or surface (atmosphere and ice-caps). These motions can be deduced from different kind of data. Range and Doppler RadioLinks data between Martian landers and tracking stations on Earth have been acquired, for example during Viking and Pathfinder missions. Another type of link can also be used: a Martian orbiter, tracked from the Earth, communicate with Martian landers and give LanderOrbiter

Doppler or Range data. This is planned for example for the NEIGE experiment (NEtwork Ionosphere and Geodesy Experiment).
Author
Mars Surface; Geodesy; Moments of Inertia; Parameter Identification

20040065997 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Refinement of Phobos Ephemeris Using Mars Orbiter Laser Altimeter Radiometry
Neumann, G. A.; Bills, B. G.; Smith, D. E.; Zuber, M. T.; Lunar and Planetary Science XXXV: Mars Geophysics; 2004; 2 pp.; In English; See also 20040065991; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Radiometric observations from the Mars Orbiter Laser Altimeter (MOLA) can be used to improve the ephemeris of Phobos, with particular interest in refining estimates of the secular acceleration due to tidal dissipation within Mars. We have searched the Mars Orbiter Laser Altimeter (MOLA) radiometry data for shadows cast by the moon Phobos, finding 7 such profiles during the Mapping and Extended Mission phases, and 5 during the last two years of radiometry operations. Preliminary data suggest that the motion of Phobos has advanced by one or more seconds beyond that predicted by the current ephemerides, and the advance has increased over the 5 years of Mars Global Surveyor (MGS) operations.
Derived from text
Mars Global Surveyor; Radiometers; Moon; Phobos; Data Acquisition

20040065998 McGill Univ., Montreal, Quebec, Canada
Compatible Vector Components of the Magnetic Field of the Martian Crust
Arkani-Hamed, J.; Lunar and Planetary Science XXXV: Mars Geophysics; 2004; 2 pp.; In English; See also 20040065991; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A highly repeatable and reliable magnetic anomaly map of Mars is essential for the investigation of the relationship between the tectonic features and the magnetization of the Martian crust. After the first phase of the analysis of the magnetic anomalies of Mars that provided the major characteristics of the magnetic field, it is now the time to resume the second phase by correlating the anomalies with tectonic features on a relatively smaller scale. I use the immense amount of the magnetic data acquired during the mapping phase of the Mars Global Surveyor to derive a high-resolution spherical harmonic model of the radial component of the magnetic field specified by spherical harmonics of degree up to 80. The radial component is least contaminates by non-crustal sources and the resulting model is highly repeatable. This makes it possible to determine the tangential components of the model field and assess the quasi-static external field contribution to the measured data. The minimum noise level also allows safely downward continue the model field to the surface and delineate detailed features of small-scale anomalies, and their correlation with tectonic formations of the planet.
Author
Magnetic Fields; Mars Surface; Planetary Crusts; Magnetization

20040065999 Universidad Complutense, Madrid, Spain
The Early Thermal and Magnetic State of Terra Cimmeria, Southern Highlands of Mars
Ruiz, Javier; McGovern, Patrick J.; Tejero, Rosa; Lunar and Planetary Science XXXV: Mars Geophysics; 2004; 2 pp.; In English; See also 20040065991; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The heavy cratered highlands are the oldest terrain on Mars, with basement dating from the early Noachian. Inversions of topography and gravity data indicate the existence of long wavelength crustal thickness variations; these probably have survived throughout Martian history and therefore require ancient lower crust temperatures cold enough to prevent their relaxation until present day. Furthermore, some regions of the highlands (principally in Terra Cimmeria and Terra Sirenum) display strong, likely remnant, magnetization, requiring that temperatures at substantial depths in the crust have not exceeded the Curie temperature for the mineral(s) that carries the magnetization. On the other hand, crustal (and upper mantle) temperatures must have been warm enough to allow mechanically weak responses to loading in these regions, as inferred from gravity/topography admittances. Previous workers have calculated ancient heat flows for diverse places on Mars from the effective elastic thickness of the lithosphere. Such studies used linear thermal gradients, which is equivalent to ignoring the existence of heat sources within the crust, and for that reason the obtained lower limits on heat flow values. Here we take into account crustal heat sources in the calculation of surface heat flows for Terra Cimmeria. Indeed, from geochemical arguments it has been proposed that a high percentage (maybe over 50%) of radioactive heat sources in Mars are located in the crust;

moreover, in the Earth, roughly half of the heat flow lost in continental areas originates from crustal heat sources.
Author
Mars Surface; Magnetization; Heat Transmission; Temperature Gradients; Heat Sources

20040066000 Lunar and Planetary Inst., Houston, TX, USA
Loading-induced Stresses near the Martian Hemispheric Dichotomy Boundary
McGovern, P. J.; Watters, T. R.; Lunar and Planetary Science XXXV: Mars Geophysics; 2004; 2 pp.; In English; See also 20040065991; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The dichotomy between the northern and southern hemispheres of Mars is one of the fundamental physiographic features of the planet. The dichotomy is manifested in the topography, geology, tectonics, cratering record, magnetic field, and crustal structure. The origin of the crustal dichotomy between northern (relatively thin, constant thickness) and southern (relatively thick and thickening southward) crustal provinces appears to date to the earliest Noachian, a period with scant remaining traces in the geologic record. However, subsequent geologic and tectonic events may contain clues as to the nature of the hemispheric dichotomy. The Eastern Hemisphere Dichotomy Boundary (or of the hemispheric dichotomy. The Eastern Hemisphere Dichotomy Boundary (or EHDB) of Mars between 40 degrees E (western Arabia Terra) and 160 degrees E (Terra Cimmeria) is characterized by a prominent topographic scarp (several km in height), compressional features on the highlands side and extensional features on the boundary ramp. Loading of the lithosphere due to emplacement of volcanic or sedimentary material on the lowlands side may be responsible for the observed highlands tectonics. A broken-plate flexural model with elastic lithosphere thickness T(sub e) = 31-36 km provided a good fit to Mars Orbiter Laser Altimeter (MOLA) topography data across the EHDB. We use the finite element code Tekton to model the response of the Martian crust and mantle to surface loads emplaced near the hemispheric dichotomy boundary.
Derived from text
Dichotomies; Loads (Forces); Planetary Geology; Stress Measurement; Mars Surface; Tectonics; Eastern Hemisphere

20040066001 Rice Univ., Houston, TX, USA
Growth of the Hemispheric Dichotomy and the Cessation of Plate Tectonics on Mars
Lenardic, A.; Collier, M.; Nimmo, F.; Moresi, L.; Lunar and Planetary Science XXXV: Mars Geophysics; 2004; 1 pp.; In English; See also 20040065991; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Plate tectonics may have operated early in Martian history, with important consequences for the history of both melt production and magnetic field generation. However, the mechanism by which plate tectonics stopped is unclear. Here we show that the growth of a thick crust, which renders the lithosphere buoyant, will shut plate tectonics off once the fraction of positively buoyant lithosphere exceeds approximately 50 %. This effect occurs because the insulating properties of the lithosphere reduce the mantle viscosity, so that the convective stresses no longer exceed the lithospheric yield strength, and plate tectonics stops. We develop a model that relates crustal insulation to convective stress within the mantle and use it with the constraints above to test the conditions under which our hypothesis is viable. Conceptually, our model assumes a plate tectonic-like mode of mantle convection to have operated early in Mars history at a time when the southern highlands were forming. At some stage the southern highlands grew beyond a critical extent. At this stage, the mantle insulation and resulting higher mantle temperature caused convective stresses to drop below the level required to cause lithospheric failure and the early stage of active-lid mantle convection was, effectively, locked. We have quantified these ideas via a scaling theory and tested our scaling arguments against numerical simulation results. We will discuss the uncertainties and application of our scaling and numerical simulation results to Mars and to other planets, particularly Earth. The implications for melt generation within the Martian mantle, subsequent to the end of an early stage of active-lid mantle convection, will also be explored.
Author
Mars (Planet); Planetary Geology; Tectonics; Hemispheres

20040066002 Lunar and Planetary Inst., Houston, TX, USA
Lunar and Planetary Science XXXV: Moon and Mercury
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040066003 - 20040066021
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The session" Moon and Mercury" included the following reports:Helium Production of Prompt Neutrinos on the Moon; Vapor Deposition and Solar Wind Implantation on Lunar Soil-Grain Surfaces as Comparable Processes; A New Lunar Geologic Mapping Program; Physical Backgrounds to Measure Instantaneous Spin Components of Terrestrial Planets from Earth with Arcsecond Accuracy; Preliminary Findings of a Study of the Lunar Global Megaregolith; Maps Characterizing the Lunar Regolith Maturity; Probable Model of Anomalies in the Polar Regions of Mercury; Parameters of the Maximum of Positive Polarization of the Moon; Database Structure Development for Space Surveying Results by Moon -Zond Program; CM2-type Micrometeoritic Lunar Winds During the Late Heavy Bombardment; A Comparison of Textural and Chemical Features of Spinel Within Lunar Mare Basalts; The Reiner Gamma Formation as Characterized by Earth-based Photometry at Large Phase Angles; The Significance of the Geometries of Linear Graben for the Widths of Shallow Dike Intrusions on the Moon; Lunar Prospector Data, Surface Roughness and IR Thermal Emission of the Moon; The Influence of a Magma Ocean on the Lunar Global Stress Field Due to Tidal Interaction Between the Earth and Moon; Variations of the Mercurian Photometric Relief; A Model of Positive Polarization of Regolith; Ground Truth and Lunar Global Thorium Map Calibration: Are We There Yet?;and Space Weathering of Apollo 16 Sample 62255: Lunar Rocks as Witness Plates for Deciphering Regolith Formation Processes.
Derived from text
Lunar Soil; Lunar Maps; Mercury (Planet)

20040066003 Sternberg Astronomical Inst., Moscow, USSR
Lunar Prospector Data, Surface Roughness and IR Thermal Emission of the Moon
Pugacheva, S. G.; Shevchenko, V. V.; Lunar and Planetary Science XXXV: Moon and Mercury; 2004; 2 pp.; In English; See also 20040066002; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In the previous papers we considered correlation the Lunar Prospector thorium contents with structure of the lunar surface. The surface roughness was estimated by means comparison of the local phase function and the average integrated lunar indicatrix. The average integrated lunar indicatrix was used as a background photometry model. The great difference between the modeled and observed phase functions for phase angle in range about 18 degrees demonstrates a high degree of the surface roughness. The value of this difference of intensities was used as a photometry parameter of the surface roughness. Comparison of the local cumulative number of the particles (N per 10(exp 4) square meters) and photometry roughness parameter (delta I) is shown. In this report we take data of the IR thermal radiation (10-12 micron), the rough structure of the lunar regolith and mineralogy characteristics upper layer of the surface.
Derived from text
Lunar Prospector; Moon; Surface Roughness; Thermal Emission; Infrared Radiation; Data Processing

20040066004 Lancaster Univ., UK
The Influence of a Magma Ocean on the Lunar Global Stress Field Due to Tidal Interaction Between the Earth and Moon
Scott, R. S.; Wilson, L.; Lunar and Planetary Science XXXV: Moon and Mercury; 2004; 2 pp.; In English; See also 20040066002; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We address the influence a magma ocean has on the tidally induced stress field acting on a growing lunar crust. Normal and strike-slip faulting are shown to operate to great depths within the crust.
Derived from text
Magma; Moon; Oceans; Tides; Earth (Planet); Lunar Surface; Stress Distribution

20040066005 California Univ., Los Angeles, CA, USA
Ground Truth and Lunar Global Thorium Map Calibration: Are We "There" Yet?
Warren, Paul H.; Lunar and Planetary Science XXXV: Moon and Mercury; 2004; 2 pp.; In English; See also 20040066002; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

No lunar science issue is more important than the calibration of the global-surface thorium data set obtained by Lunar Prospector. Of all the elements amenable to analysis by orbital gamma-ray spectrometry, Th should be the easiest to determine. Also (and not coincidentally radioactivity is exploited in the orbital measurements), Th is one of the three main sources of radioactive heat, and strongly correlates with the other two (K and U). Th is almost ideally incompatible during igneous

differentiation. In high-K KREEP, Th and U are enriched over CI chondrites by a factor (approximately 750) greater than for any other element (Ba, approximately 570x , is third). Since Th is also cosmochemically refractory (i.e., coherent with other refractory lithophile elements, including the major elements Al and Ca), by constraining Th atop (and indirectly within) the lunar crust, we go a long way towards constraining the whole-Moon composition.
Derived from text
Calibrating; Ground Truth; Lunar Maps; Thorium; Lunar Geology

20040066006 Lancaster Univ., UK
The Significance of the Geometries of Linear Graben for the Widths of Shallow Dike Intrusions on the Moon
Petrycki, Jennifer A.; Wilson, Lionel; Head, James W.; Lunar and Planetary Science XXXV: Moon and Mercury; 2004; 2 pp.; In English; See also 20040066002; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We show that there are statistically significant differences between the widths and depths of lunar graben that do and do not have volcanic features associated with them. Graben associated with volcanic features are deeper and narrower. The differences in horizontal crustal displacement implied by the differences in depth suggest that within several km of the surface the dikes feeding eruption deposits were typically approx. 50 m to approx. 100 m wide. These widths suggest dikes rising mainly from shallow depths in the mantle through a crust progressively invaded by intrusions.
Author
Deposits; Depth; Displacement; Geological Faults; Moon

20040066007 Geological Survey, Flagstaff, AZ, USA
A New Lunar Geologic Mapping Program
Gaddis, L.; Tanaka, K.; Hare, T.; Skinner, J.; Hawke, B. R.; Spudis, P.; Bussey, B.; Pieters, C.; Lawrence, D.; Lunar and Planetary Science XXXV: Moon and Mercury; 2004; 2 pp.; In English; See also 20040066002; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We describe a new pilot program for systematic, global lunar geologic mapping that flexibly incorporates and integrates data from a variety of remote sensing sources at several spatial scales. To define and test digital mapping tools and methods for this new mapping program, a 1:2.5 M mapping scale will be used to map a single quad encompassing the Copernicus crater region. The Moon has not been geologically mapped in a systematic fashion in more than 25 years, and yet major advances in lunar science have occurred in the last 10 years. Current ideas about major lunar science issues such as the spatial and temporal distribution of ancient lunar maria and highland volcanism, ages and compositions of major basin impact melt sheets, and the dating of the lunar cataclysm have developed and evolved substantially since the last period of lunar geologic mapping. These advances have largely been achieved because of recent acquisitions of global compositional and geophysical data, and these data will be integrated into a new view of the geology of the Moon.
Derived from text
Lunar Geology; Lunar Maps; Moon; Mars Surface; Lunar Topography

20040066008 Kharkov Univ., Kharkov, Ukraine
A Model of Positive Polarization of Regolith
Velikodsky, Y. I.; Korokhin, V. V.; Akimov, L. A.; Lunar and Planetary Science XXXV: Moon and Mercury; 2004; 2 pp.; In English; See also 20040066002; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

There are a lot of observations of positive polarization and its maximum. A lot of works were published about this property of light reflecting by surfaces of atmosphereless bodies. But there is not satisfactory model to describe this effect including its dependence on albedo and wavelength. There is a hypothesis that the positive polarization is due to a mirror reflection on surfaces of regolith particles. This reflection is described by Fresnel's formulas, which, however, yield too large angle of maximum polarization, that is not observed. Some additional mechanisms are needed to reduce this angle. We propose another approach. We suppose that surfaces of atmosphereless bodies (Moon, asteroids, etc.) are mature and contain too small quantity of large (in comparison with a wavelength) facets giving Fresnel's reflection. And a principal part of surface brightness is light scattered on particles, which are comparable with wavelength. However, we permit presence of small

deposit of Fresnel's reflection and consider this case parallel with only scattering case.
Derived from text
Mathematical Models; Polarization; Regolith; Approximation

20040066010 Kharkov National Aerospace Univ., Ukraine
Parameters of the Maximum of Positive Polarization of the Moon
Korokhin, V. V.; Velikodsky, Y. I.; Lunar and Planetary Science XXXV: Moon and Mercury; 2004; 2 pp.; In English; See also 20040066002; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The maps of positive polarization degree maximum and its phase angle for lambda(sub eff) = 461nm and lambda(sub eff) = 669nm for the east semisphere of the Moon have been constructed. The maps of spectral indices Cp(sub max) = P(sub max)(669nm)/P(sub max)(461nm) and C(lpha)(sub max) = lpha(sub max)(669nm)/ lpha(sub max)(461nm) have been constructed also. The analysis of relationships between various optical parameters of lunar surface was carried out. It was established that " lpha(sub max) - albedo" dependence shows significant linear anticorrelation. " lpha(sub max) - P(sub max)" dependence has nonlinear character. Correlation diagram "specropolarimetric index Cp(sub max) - albedo" has typical fork-like shape: there is anticorrelation for mares and correlation for highlands.
Author
Moon; Phase Shift; Polarization

20040066011 NASA Johnson Space Center, Houston, TX, USA
Space Weathering of Apollo 16 Sample 62255: Lunar Rocks as Witness Plates for Deciphering Regolith Formation Processes
Wentworth, S. J.; McKay, D. S.; Keller, L. P.; Lunar and Planetary Science XXXV: Moon and Mercury; 2004; 2 pp.; In English; See also 20040066002; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Space weathering, or alteration that occurs at the surfaces of materials exposed directly to space, has been one of the primary areas of focus of lunar studies for the past several years. It is caused by processes such as micrometeorite impacts and solar wind bombardment, and effects can include microcraters, spall zones, and vapor deposits. Much of the recent work on space weathering has been concentrated on nanoscale features, especially the amorphous rims commonly found on individual lunar soil grains. The rims typically contain nanophase Fe metal globules, which, along with Fe metal globules in agglutinates, have a profound effect on optical properties of lunar soils. The nanophase metallic iron globules cause the characteristic optical changes (reddening and darkening) found in mature lunar soils.
Derived from text
Space Weathering; Apollo 16 Flight; Lunar Rocks; Regolith

20040066012 NASA Johnson Space Center, Houston, TX, USA
Helium Production of Prompt Neutrinos on the Moon
Andersen, V.; Wilson, T. L.; Pinsky, L. S.; Lunar and Planetary Science XXXV: Moon and Mercury; 2004; 2 pp.; In English; See also 20040066002; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The subject of conducting fundamental physics and astronomy experiments on the lunar surface continues to be of interest in the planetary science community. Such an inquiry necessarily requires an analysis of the backscatter albedos produced by Galactic cosmic rays (GCRs) when they directly impact the lunar regolith. Unlike the Earth, this happens because the Moon has only a tenuous exosphere. Such secondary radiation constitutes a background that obscures and interferes with measurements conducted in the normal sense of laboratory physics on Earth. Our previous investigations using recent enhancements in the Monte Carlo program known as FLUKA included the production of charged particles, neutrons, photons, and neutrinos by the impact of Galactic protons. That investigation is extended here to include the effect of ionized helium, He-4, or a particles. Because high-energy GCRs excite planetary regoliths into giving rise to charmed mesons, neutrinos are produced. Thus a connection is established for the GCR helium production of prompt neutrinos on the Moon using the physics of charm.
Derived from text
Helium Isotopes; Moon; Neutrinos; Lunar Surface; Charm (Particle Physics); Astrophysics

20040066013 NASA Johnson Space Center, Houston, TX, USA

Vapor Deposition and Solar Wind Implantation on Lunar Soil-Grain Surfaces as Comparable Processes

Basu, A.; Wentworth, S. J.; McKay, D. S.; Lunar and Planetary Science XXXV: Moon and Mercury; 2004; 2 pp.; In English; See also 20040066002; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Vapor deposited patinas (VDP) on lunar soil grains consist of a thin (less than 1 micron) layer of amorphous silicate (glass) embedded with nanoscale Fe(sup 0) globules as seen in many TEM images. VDPs are also present on larger space-weathered lunar rocks; these larger samples will not be discussed here although the process of vapor deposition is common to exposed grains of all sizes. Whether or not the majority of the Fe(sup 0) globules present in lunar soils reside in vapor deposited patina is a matter of some concern. Some Fe(sup 0) globules are clearly seen to reside within the glass of agglutinates and might represent remobilized Fe(sup 0) in agglutinitic melts. remobilized Fe(sup 0) in agglutinitic melts. We argue that because VDP coatings are present only on the surfaces of lunar soil grains, their distribution as a surface correlated component (SCC) of lunar soils should parallel those of Solar Wind Elements (SWE) implanted in the outermost rinds of lunar soil grains. SWE residing in the interior of soils grains make up the volume correlated component (VCC). Relative to Fe(sup 0) in VDP, the distribution of various SWE have been studied well. The reason is understandable because instrumentation for nanoscale imaging is not ubiquitous. In this study we use the distribution of SWE in lunar soils as a guide to understanding the fate of Fe(sup 0) in VDP.

Derived from text

Implantation; Lunar Soil; Solar Wind; Vapor Deposition; Grains

20040066014 University of South Australia, Queensland, Australia

Preliminary Findings of a Study of the Lunar Global Megaregolith

Jackson, Noel W.; Spudis, Paul D.; Carter, Brad D.; Lunar and Planetary Science XXXV: Moon and Mercury; 2004; 2 pp.; In English; See also 20040066002; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Hartmann first coined the word "mega-regolith" to describe that part of the lunar crust that has a variable thickness of up to several kilometers, sandwiched between the surface thin regolith layer of a few metres in thickness and the bedrock below. Hartmann, described megaregolith as a "product of cataclysm ... at least a few kilometers deep". This study presents new information on the lunar megaregolith, using iron and titanium concentrations in crater ejecta derived from Clementine mission data and the Lucey et al iron and titanium mapping methods with the US Geological Survey ISIS software. Croft, Grieve, and later workers showed that craters excavate about 10% of their diameters for craters between 5 - 50 km across. These craters thus sample the upper few kilometers of the Moon and allowing probing of the megaregolith on a global scale. Worn/degraded craters or craters where basalts flows had covered the ejecta were excluded. The ejecta from 2059 craters of diameters between 5 and 50 km were analysed. Twelve points were collected from each crater ejecta field. No point exceeded a distance of one crater radius from the crater rim. These data were collected from the 12.00 o'clock position just outside the crater rim in a counter-clockwise direction and equally spaced. The average concentration (by weight percent) for Fe and Ti values for each point were entered into a spreadsheet and averaged with the calculated standard deviation. The derived data of this study were used to produce maps of iron and titanium concentrations spanning a global region of 60 N to 60 S. The bedrock map of Tompkins and Pieters is used to compare the relationship, if any, between the megaregolith with the bedrock and the Lucey et al surface Fe and Ti maps.

Derived from text

Geological Surveys; Regolith; Moon; Craters; Radii

20040066015 Kharkov National Aerospace Univ., Ukraine

Maps Characterizing the Lunar Regolith Maturity

Kaydash, V.; Shkuratov, Y.; Stankevich, D.; Omelchenko, V.; Pieters, C.; Taylor, L.; Lunar and Planetary Science XXXV: Moon and Mercury; 2004; 2 pp.; In English; See also 20040066002; Original contains black and white illustrations

Contract(s)/Grant(s): NAG5-10469; INTAS-2000-0792; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

There are several parameters characterizing maturity of the lunar regolith. Most reliable of them are the ratio Is/FeO, characterizing relative concentration of nano-phase reduced iron, and the agglutinate content. The ratio Is/FeO is often called the degree of maturity of the lunar regolith. Studies of lunar samples show that the agglutinate content correlates with the maturity degree. Besides, the abundance of crystalline component, independently of its composition, anti-correlates with the maturity degree. In present paper we examine these correlations, mapping the parameter Is/FeO, the abundance of agglutinates

in the lunar regolith, and the abundance of the crystalline component presented with pyroxene, plagioclase, olivine, and ilmenite. We use measurements of lunar samples made by Lunar Soil Characterization Consortium (LSCC) and multispectral lunar data of high spatial resolution available after the Clementine mission to the Moon.
Author
Mapping; Lunar Geology; Lunar Rocks; Lunar Soil; Regolith; High Resolution; Iron Oxides

20040066016 Sternberg Astronomical Inst., Moscow, Russia
Probable Model of Anomalies in the Polar Regions of Mercury
Kozlova, E. A.; Lunar and Planetary Science XXXV: Moon and Mercury; 2004; 2 pp.; In English; See also 20040066002; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Surface of Mercury it was repeatedly investigated by methods of a ground radar-location. Researches lead in 1991-1992 on radio telescopes Goldstone and Arecibo have allowed finding out in polar areas Mercury features with anomaly reflective properties. These features correspond to craters in polar areas of Mercury.
Derived from text
Anomalies; Mercury Surface; Polar Regions

20040066017 Tennessee Univ., Knoxville, TN, USA
A Comparison of Textural and Chemical Features of Spinel Within Lunar Mare Basalts
Mulcahy, C. K.; Taylor, L. A.; Goodrich, C. A.; Lunar and Planetary Science XXXV: Moon and Mercury; 2004; 2 pp.; In English; See also 20040066002; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Lunar mare basalts contain abundant Ti- and Cr-rich oxide minerals. The spinels display a variety of textures including composite grains of chromite and ulvouspinel that have both optically sharp and gradational contacts. EMP profiles for Cr and Ti across these contacts show that they are both chemically sharp and exhibit a gap in both Cr and Ti. Compositional ranges reported in this study agree well with data presented by El Goresy, who reported a compositional gap in lunar basalt 12063 and none in 12018. However, we maintain that a compositional gap does exist in the 12018 spinel.
Author
Textures; Chemical Analysis; Spinel; Lunar Maria; Basalt

20040066018 Institute of Space Research, Moscow, Russia
Physical Backgrounds to Measure Instantaneous Spin Components of Terrestrial Planets from Earth with Arcsecond Accuracy
Holin, I. V.; Lunar and Planetary Science XXXV: Moon and Mercury; 2004; 2 pp.; In English; See also 20040066002; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Precise measurement of rotational dynamics of terrestrial planets may give a bulk of information about their interiors, histories of formation and evolution. E. g. an arcsecond or better accuracy is desirable in obliquity and especially in physical librations of Mercury to place significant constraints on size and state of its core. Earth-based techniques now in use have low accuracy and can not measure variations in rotational components. In this work a new for astronomy radiophysical effect is considered allowing precise measurement by Earth-based radar of instantaneous transverse spin vectors of terrestrial planets and their variations with time. I show that the effect is classical because it follows immediately from the Huygens-Fresnel principle.
Derived from text
Terrestrial Planets; Earth Surface; Astronomy; Planetary Rotation

20040066019 Kharkov National Aerospace Univ., Ukraine
The Reiner Gamma Formation as Characterized by Earth-based Photometry at Large Phase Angles
Opanasenko, N.; Shkuratov, Y.; Lunar and Planetary Science XXXV: Moon and Mercury; 2004; 2 pp.; In English; See also 20040066002; Original contains black and white illustrations
Contract(s)/Grant(s): INTAS-2000-0792; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Swirls are albedo structures, occurring on the Moon and Mercury, which are considered to be results of cometary or meteoroid swarm encounters. The Reiner Gamma Formation (RGF) is the best swirl example on the Moon located in the

western portion of the nearside. The RGF is the most studied swirl. Infrared data obtained during lunar eclipses show the formation to have somewhat lower thermal inertia, indicating presence of fine-grain regolith. Radar measurements reveal no significant enhancements for the RGF area. Hence, the RGF exhibits a near-surface population of stones and blocks resembling the average mare regolith layer.
Derived from text
Albedo; Regolith; Meteoroids; Maria; Lunar Eclipses; Infrared Radiation

20040066020 Sternberg Astronomical Inst., Moscow, USSR
Variations of the Mercurian Photometric Relief
Shevchenko, V. V.; Lunar and Planetary Science XXXV: Moon and Mercury; 2004; 2 pp.; In English; See also 20040066002; Original contains color illustrations
Contract(s)/Grant(s): INTAS-ESA-99-403; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Differential photometry of the surface of Mercury can be carried out with result of Mariner 10 imaging the planet. The spacecraft data contain valuable information on regional variations of upper layer photometric properties. Because of trajectory and pointing angle constraints the planet could be observed from Mariner 10 only over a small range of phase angles between about 75 deg. and 110 deg. Therefore the photometric investigations are restricted to measuring the distribution of brightness on the Mercurian disk. Nevertheless it s possible to obtain surface distribution of the photometric relief or roughness characteristics along visible disk of the planet.
Author
Photometry; Mercury Surface; Surface Roughness; Brightness

20040066021 Paris-Sud Univ., Orsay, France
CM2-type Micrometeoritic Lunar "Winds" During the Late Heavy Bombardment
Langevin, Y.; Maurette, M.; Lunar and Planetary Science XXXV: Moon and Mercury; 2004; 2 pp.; In English; See also 20040066002; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Both conjunctures are reported as variations of the relative lunar cratering rates with time - they are discussed , and both represented of Hartmann. For Hartmann, an exponentially decreasing flux of impactors was striking the Moon - this conjuncture is coined here after as the LHBomb. In the other alternative of the lunar terminal cataclysm (LTC), there is a spectacular burst of impacts, spreading over a narrow time interval of approx. 150 Myr centred around 3.9 Gyr ago.
Author
Impactors; Micrometeorites; Lunar Rocks

20040066022 Lunar and Planetary Inst., Houston, TX, USA
Lunar and Planetary Science XXXV: Venus
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040066023 - 20040066026
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The session"Venus" included the following reports:Venera-Vega Geochemical Analyses: What Geologic Units are the Source of the Analyzed Material?; Mapping of Rift Zones on Venus, Preliminary Results: Spatial Distribution, Relationship with Regional Plains, Morphology of Fracturing, Topography and Style of Volcanism; An Effect of Stimulated Radiation Processes on Radio Emission from Major Planets; and Venusian Craters and the Origin of Coronae.
Derived from text
Venus (Planet); Geochemistry

20040066023
An Effect of Stimulated Radiation Processes on Radio Emission from Major Planets
Prigara, F. V.; Lunar and Planetary Science XXXV: Venus; 2004; 2 pp.; In English; See also 20040066022; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The standard theory of thermal radio emission encounters some difficulties. The most crucial one is nonpossibility to explain the radio spectrum of Venus in the decimeter range. The radio spectra of planetary nebulae at high frequencies also

are not comfortably consistent with the standard theory. Here we show that the account for an induced character of radiation processes sufficiently improves the predictions of the standard theory.
Derived from text
Radiation Effects; Radio Emission; Standard Model (Particle Physics); Planetary Atmospheres

20040066024 Moscow State Univ., Russia
Mapping of Rift Zones on Venus, Preliminary Results: Spatial Distribution, Relationship with Regional Plains, Morphology of Fracturing, Topography and Style of Volcanism
Cherkashina, O. S.; Guseva, E. N.; Krassilnikov, A. S.; Lunar and Planetary Science XXXV: Venus; 2004; 2 pp.; In English; See also 20040066022; Original contains color illustrations
Contract(s)/Grant(s): RFBR-02-05-65068; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Rift valleys on Venus were identified on Pioneer Venus topography data. After Magellan was shown that rift systems are wide spread. Two types of rift structures were subdivided: 1) rifts (chasmata) and 2) fracture belts. Both of them are hundreds to thousands of kilometers long and are deformed by linear system of faults and graben. Rifts are represented by topographic troughs, fracture belts by linear raises more than a kilometer above the surroundings. Both of them were mapped without subdivision as fracture belts or rifts. It was determined that chasmata cut regional plains with wrinkle ridges (Pwr) and fracture belts are mostly embayed by them. Synoptic mapping showed the distribution in space and time of rifts and large volcanoes of Venus, and that post-Pwr rifts dominate over the pre-Pwr rifts both in number of mapped segments and in area. To study geological structure of rifts on Venus including: 1) Spatial distribution of linear fracturing on the surface of the planet that may be interpreted as rift zones; 2) Time relationship of rift zones with Pwr that may be used as stratigraphic marker for Venus; 3) Morphology of rift fracturing; 4) Topography of rift zones; 5) Style and rate of rift associated volcanism. We used C1-MIDR SAR Magellan images (225 m/px) for analysis and paid special attention on following objectives: 1) Global and regional photogeological mapping of rift systems, including detail geological mapping of typical examples. 2) Study of relationship of rifts zones with Pwr. Two types of relationship of rift zones with Pwr were observed: a) Rift zones predate Pwr they are embayed by Pwr that are not deformed by rift fracturing; b) Rift zones postdate Pwr - they cut Pwr. Some rifts zones started to evolve before Pwr emplacement and finished after that, they are partly embayed by Pwr and partly deform Pwr. Thus we mapped in detail: a) pre-Pwr rift zones; b) post-Pwr rift zones; c) rift zones that started their evolution before Pwr emplacement and finished after that. 3) Study of topography of rift zones on base of GTDR data (resolution approximately 4 km/px). 4) Study of morphology of rift fracturing. Inside rift zones 40 samples have been chosen (50x50 km); 20 inside pre-Pwr rifts and 20 inside post-Pwr rifts. In these samples morphology have been described and fracture to fracture spacing have been measured. 5) Study of style and rate of volcanism. We studied 40 samples described and sites of detail mapping drawing attention to following: a) Is volcanic activity connected with rift zone or not? b) If rift related volcanic activity were observed, we studied type of volcanism shield volcanoes, extensive lobate flows or both of them are connected with rift zone.
Derived from text
Fracturing; Photomapping; Planetary Mapping; Spatial Distribution; Topography; Volcanology; Valleys; Venus Surface

20040066025 Museum of Natural History, London, UK
Venusian Craters and the Origin of Coronae
Vita-Finzi, C.; Howarth, R. J.; Tapper, S.; Robinson, C.; Lunar and Planetary Science XXXV: Venus; 2004; 2 pp.; In English; See also 20040066022; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Discussion of the geological evolution of Venus generally assumes that the planet underwent widespread, if not complete, resurfacing by volcanism about 500 Myr ago. In the absence of active plate tectonics - so the argument runs - Venus is heating up, although some heat is being lost from the interior by conduction through the crust and, more importantly, through several hundred diapiric structures which are manifested at the surface by the circular-to-oval structures 100-2600 km in diameter, known as coronae. The present study suggests that many coronae are impact craters and argues that the wide range of morphologies displayed by the combined population of coronae and acknowledged craters is due to variations over time in the nature of the target material and of the venusian atmosphere. The key implication is that Venus did not undergo resurfacing approximately 500 Myr ago and, in the absence of plate tectonics, that it now loses heat primarily by conduction through the crust and along rifts. In short, the Venusian greenhouse has underfloor heating.
Derived from text
Coronas; Planetary Evolution; Venus (Planet); Venus Atmosphere; Planetary Craters; Planetary Geology

20040066026 Academy of Sciences (USSR), Moscow, USSR

Venera-Vega Geochemical Analyses: What Geologic Units are the Source of the Analyzed Material?

Abdrakhimov, A. M.; Basilevsky, A.T.; Lunar and Planetary Science XXXV: Venus; 2004; 2 pp.; In English; See also 20040066022; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Soviet landers Venera 8, 9, 10, 13, 14, and Vega 1 and 2 made geochemical analyses of Venus' surface materials and this is the only direct geochemical information about Venus surface. Geologic analysis of the Magellan images of the landing site showed that the landing ellipses cover predominantly the volcanic plains so it was concluded that the plain-forming lavas had most probably been analyzed although one can not exclude a possibility that at least one of the landers studied some other geologic unit outcropped within the landing ellipse. In recent work it was suggested that the fine-layered surface rocks seen on all Venera panoramas may be the partly lithified and partly eroded deposits of debris excavated at impact crater formation events, ejected into the atmosphere and then deposited as dark parabolas seen in the Magellan images around the youngest craters of Venus larger than 11 km in diameter. If so, the source of the layered deposit material could be not only the now observed plain-forming lavas but the rocks from some depth. This paper is devoted to consideration of this possibility.
Author

Geochemistry; Venus Surface; Volcanoes; Craters

20040066029 Westfaelische Wilhelms Univ., Muenster, Germany

Impacts in Two-layered Targets on Earth: Effects of Cover Thickness on Crater Morphostructure

Abels, A.; Lunar and Planetary Science XXXV: Impacts; 2004; 2 pp.; In English; See also 20040066027; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Typical crystalline and sedimentary rocks on Earth react differently on a hypervelocity impact. The best documented manifestation of this difference are the different onset diameters for central uplift, viz. approx. 2 and approx. 4 km in sedimentary and crystalline targets, respectively. Another phenomenon are different types of concentric craters, that is those with a shallow outer and a deep inner crater. They are related to layered targets typically consisting of a relatively high-strength (hs) crystalline basement and a low strength (ls) sedimentary cover. In the following, a phenomenological succession is proposed that includes a classification of terrestrial craters into nine general types. It is constrained by field data (compiled from published literature) and ascribes the variability primarily to a different cover thickness (tc) at impact, further influenced by the impact magnitude. Furthermore, it implies that some variations are initiated during the excavation stage.
Author

Craters; Crystallinity; Hypervelocity Impact; Sedimentary Rocks; Thickness; Layers

20040066030 Witwatersrand Univ., Johannesburg, South Africa

Field Studies in the Central Uplift of the Vredefort Impact Structure

Wieland, Frank; Gibson, Roger L.; Reimold, Wolf Uwe; Lunar and Planetary Science XXXV: Impacts; 2004; 2 pp.; In English; See also 20040066027; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This study presents results of a structural investigation of the inner parts of the central uplift of the Vredefort impact structure. The dome possesses a polygonal geometry, with the polygon segments separated by zones of asymmetric homoclinal folding and radial oblique-slip faulting related to tangential compression. Multiple joint sets developed in all rock types display predominantly normal-slip displacements related to late-stage central uplift collapse.
Author

Displacement; Rocks; Collapse

20040066033 Lunar and Planetary Inst., Houston, TX, USA

Lunar and Planetary Science XXXV: Meteorites

2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040066034 - 20040066049

Contract(s)/Grant(s): NCC5-679

Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The session "Meteorites" included the following reports:Description of a New Stony Meteorite Find from Bulloch County, Georgia; Meteorite Ablation Derived from Cosmic Ray Track Data Dhofar 732: A Mg-rich Orthopyroxenitic

Achondrite Halogens, Carbon and Sulfur in the Tagish Lake Meteorite: Implications for Classification and Terrestrial Alteration; Electromagnetic Scrape of Meteorites and Probably Columbia Tiles; Pre-Atmospheric Sizes and Orbits of Several Chondrites; Research of Shock-Thermal History of the Enstatite Chondrites by Track, Thermoluminescence and Neutron-Activation (NAA) Methods; Radiation and Shock-thermal History of the Kaidun CR2 Chondrite Glass Inclusions; On the Problem of Search for Super-Heavy Element Traces in the Meteorites: Probability of Their Discovery by Three-Prong Tracks due to Nuclear Spontaneous Fission Trace Element Abundances in Separated Phases of Pesyanoe, Enstatite Achondrite; Evaluation of Cooling Rate Calculated by Diffusional Modification of Chemical Zoning: Different Initial Profiles for Diffusion Calculation; Mineralogical Features and REE Distribution in Ortho- and Clinopyroxenes of the HaH 317 Enstatite Chondrite Dhofar 311, 730 and 731: New Lunar Meteorites from Oman; The Deuterium Content of Individual Murchison Amino Acids; Clues to the Formation of PV1, an Enigmatic Carbon-rich Chondritic Clast from the Plainview H-Chondrite Regolith Breccia ;Numerical Simulations of the Production of Extinct Radionuclides and ProtoCAIs by Magnetic Flaring.
Derived from text
Meteorites; Classifications

20040066034 Academy of Sciences (Russia), Moscow, Russia
Research of Shock-Thermal History of the Enstatite Chondrites by Track, Thermoluminescence and Neutron-Activation (NAA) Methods
Ivliev, A. I.; Kashkarov, L. L.; Kalinina, G. V.; Kuyunko, N. S.; Lavrentyeva, Z. A.; Lyul, A. Y.; Skripnik, A. Y.; Lunar and Planetary Science XXXV: Meteorites; 2004; 2 pp.; In English; See also 20040066033; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The results of complex search of the bulk samples and separate fractions selected from the enstatite chondrites Abee EH4 (a sample 15832), Adhi Kot EH4 (15059), Atlanta EL6 (2611) and Pillistfer EL6 (1864) are presented. The study of these samples was carried out with help of thermoluminescence (TL), track and neutron-activation (NAA) methods. The purposes of the given work consist in definition of sensitivity of various methods for an estimation of the quantitative characteristics of a thermal and/or shock-thermal influence on substance of these meteorites during formation and subsequent evolution of their parent bodies.
Author
Thermal Shock; Chondrites; Neutron Activation Analysis

20040066035 GEMINILUX, Budapest, Hungary
Electromagnetic Scrape of Meteorites and Probably Columbia Tiles
Foldi, T.; Berczi, S.; Lunar and Planetary Science XXXV: Meteorites; 2004; 2 pp.; In English; See also 20040066033; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Any moving outerspace surface affected by solar radiation or solar wind may behave as cathode-anode system if it interact with the thin plasma. On the basis of experiments and observations in: a) high vacuum transmitting (power) tubes, and in b) AC-DC tubes with Hg-vapour medium: we made two models about the transports in the thin plasma flowing around the outerspace surface. We concluded that material transports may cause various effects from the destructive cavity formations and material loss of the surface till the rebuilding (reshaping) the surface, depending on the pressure in the thin plasma. Both models conclude the material loss of the surface, but the mechanism of this process is slightly different in the two models.
Author
Electromagnetic Interactions; Meteorites; Tiles; Pressure; Destruction

20040066036 Academy of Sciences (Russia), Moscow, Russia
Radiation and Shock-thermal History of the Kaidun CR2 Chondrite Glass Inclusions
Kalinina, G. V.; Kashkarov, L. L.; Ivliev, A. I.; Skripnik, A. Y.; Lunar and Planetary Science XXXV: Meteorites; 2004; 2 pp.; In English; See also 20040066033; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Inclusions of glass in the Kaidun CR2 anomalous chondrite were studied to investigate of both: conditions of these glasses origin, and evolution history of the Kaidun meteorite as whole. In this report the results of track and thermoluminescence (TL) investigation of a Kaidun glass fragments are presented. On the received data the shock-thermal history of these glasses at an early stage of a meteorite parent body formation are considered.
Derived from text
Glass; Inclusions; Thermoluminescence; Radiation; Chondrites

20040066038 Max-Planck-Inst. fuer Chemie, Mainz, Germany

Halogens, Carbon and Sulfur in the Tagish Lake Meteorite: Implications for Classification and Terrestrial Alteration

Dreibus, G.; Friedrich, J. M.; Haubold, R.; Huisl, W.; Spettel, B.; Lunar and Planetary Science XXXV: Meteorites; 2004; 2 pp.; In English; See also 20040066033; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Two types of Tagish Lake samples exist: a pristine meteorite recovered within only days after landing on a frozen lake and disturbed samples that were located in the lake ice and collected 3 months later. We quantified halogens, C, and S in aliquots of one pristine and two disturbed samples of Tagish Lake analyzed previously. The abundances of the volatile halogens Cl, Br, and I in the pristine Tagish Lake sample confirmed the unique nature of this carbonaceous chondrite. The similarity of the observed depletion of Cl, Br, and I as found for Na in the disturbed samples relative to the pristine sample is in accordance with the postulated loss of sodium, possibly as a halogen salt, by weathering during residence in the lake ice. Author

Meteoritic Composition; Carbonaceous Chondrites; Abundance; Chlorine; Bromine; Iodine

20040066039 Academy of Sciences (Russia), Moscow, Russia

Dhofar 732: A Mg-rich Orthopyroxenitic Achondrite

Demidova, S. I.; Nazarov, M. A.; Kurat, G.; Brandstaetter, F.; Ntaflos, T.; Clayton, R. N.; Mayeda, T. K.; Lunar and Planetary Science XXXV: Meteorites; 2004; 2 pp.; In English; See also 20040066033; Original contains color and black and white illustrations

Contract(s)/Grant(s): RFBR-03-05-20008; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Dhofar 732 is an ungrouped achondrite found in Oman. We report here preliminary data on the petrography, mineralogy, chemistry and oxygen isotopic composition of this meteorite, which is completely different from any known achondrite. Author

Oxygen; Meteorites; Achondrites

20040066040 Academy of Sciences (Russia), Moscow, Russia

Meteorite Ablation Derived from Cosmic Ray Track Data

Alexeev, V. A.; Lunar and Planetary Science XXXV: Meteorites; 2004; 2 pp.; In English; See also 20040066033; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The long-term averaged production rates of cosmic ray nuclear tracks (p/t) versus the depth (d) in meteorites with pre-atmospheric radii of R = 3-1000 cm was presented graphically. On the basis of these data, we have found the generalized type of the equation describing the value of p/t depending on d: lg(p/t) = A + Bd(sup C). The values of coefficients for values of R used are given. The coefficients for intermediate values of radii are calculated by the method of linear interpolation. Derived from text

Ablation; Cosmic Rays; Meteorites; Particle Tracks

20040066041 Academy of Sciences (Russia), Moscow, Russia

On the Problem of Search for Super-Heavy Element Traces in the Meteorites: Probability of Their Discovery by Three-Prong Tracks due to Nuclear Spontaneous Fission

Kashkarov, L. L.; Kravets, L. I.; Kalinina, G. V.; Kniazeva, G. P.; Lunar and Planetary Science XXXV: Meteorites; 2004; 2 pp.; In English; See also 20040066033

Contract(s)/Grant(s): RFFI-01-02-16410; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Search and identification of super-heavy elements (SHE) of Z greater than or = 110 in a cosmic matter were carried out by observation in olivine crystals from meteorites pallasites of the anomalous-long chemically etchable tracks - traces of braking of high-energy transuranic SH-nuclei, contained in the galactic cosmic rays (GCR). Calibration of track lengths formed in olivine by the accelerated U-238 nuclei of approx. 30 and approx. 70 MeV/nucleon energy indicate, that the maximum in a length distribution of specially annealed and then etched tracks for them is L = 230 +/- 25 microns. On this base discovered in these investigations 11 very long (L greater than or = 340 microns) tracks can be attributed to SH-nuclei. Derived from text

Meteorites; Stony-Iron Meteorites; Heavy Elements; Extraterrestrial Matter

20040066042 Academy of Sciences (Russia), Moscow, Russia

Trace Element Abundances in Separated Phases of Pesyanoe, Enstatite Achondrite

Lavrentjeva, Z. A.; Lyul, A. Y.; Kolesov, G. M.; Lunar and Planetary Science XXXV: Meteorites; 2004; 2 pp.; In English; See also 20040066033; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Pesyanoe enstatite achondrite, or aubrite consists of nearly iron - free enstatite with minor forsterite, diopside, plagioclase, troilite, and metal and number of rare trace minerals that reflex the highly reducing conditions under which this meteorite formed. Pesyanoe is coarse-grained breccia with angular fragments set in a matrix with the same minerals as the larger fragments. The origin of the aubrites has been debated, with some authors proposing their formation as nebular condensates, while other favor igneous processing on an aubrite parent body. The latter hypothesis is presently proffered for the following reasons: enstatite crystals are large and relict igneous textures have been found despite the brecciation the aubrites experienced. Rare earth element (REE) patterns (in particular Eu anomalies) have been interpreted as suggestive of an igneous origin. Most aubrites have negative Eu anomalies. Whole-rock REE patterns, with negative Eu anomalies have been used as one of the major arguments in favor of on igneous origin for aubrites. In the present paper the results of elemental abundances in separated grain-sized fractions, "matrix" from Pesyanow aubrite are reported.

Derived from text

Abundance; Achondrites; Enstatite; Trace Elements; Meteoritic Composition; Separation

20040066043 Fernbank Science Center, Atlanta, GA, USA

Description of a New Stony Meteorite Find from Bulloch County, Georgia (USA)

Albin, E. F.; Mauldin-Kinney, G.; Lunar and Planetary Science XXXV: Meteorites; 2004; 2 pp.; In English; See also 20040066033; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A very weathered 2.2 kilogram stony meteorite was found in June 2000 in Bulloch County, Georgia (USA). A butterbean farmer, Mr. Harold Cannon, found the meteorite while harvesting his crop. The unusual stone was picked up by a bean collecting machine and then set aside until December 2003 when it was finally identified as a new meteorite find. Based on the appearance of a several millimeter thick orange weathering rind, the stone is not a recent fall and must have been lying in the field for many years. Efforts are ongoing to locate companion meteorites within the find area. The name "Statesboro," taken from the nearest town, has been proposed for this new meteorite.

Derived from text

Farm Crops; Stony Meteorites; Guns (Ordnance)

20040066044 Academy of Sciences (Russia), Moscow, Russia

Pre-Atmospheric Sizes and Orbits of Several Chondrites

Gorin, V. D.; Alexeev, V. A.; Ustinova, G. K.; Lunar and Planetary Science XXXV: Meteorites; 2004; 2 pp.; In English; See also 20040066033; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The developed methods of modeling, based on the regularities of depth distributions of cosmogenic radionuclides in cosmic bodies of different sizes and compositions, are used to estimate the preatmospheric sizes and the extent of orbits of 12 chondrites fallen to Earth in 1967-2000. Previous experimental data on the contents of radionuclides ((54)Mn, (22)Na, (26)Al, (60)Co, etc.) in the chondrites are used. The density of tracks of heavy nuclei in the chondrites (where available) are also used to correct the shielding depth of the samples under the surface.

Derived from text

Chondrites; Orbits; Size (Dimensions); Asteroids

20040066045 Museum of Planetary Sciences, Prato, Italy

Mineralogical Features and REE Distribution in Ortho- and Clinopyroxenes of the HaH 317 Enstatite Chondrite

Moggi-Cecchi, V.; Pratesi, G.; Lunar and Planetary Science XXXV: Meteorites; 2004; 2 pp.; In English; See also 20040066033; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

HaH 317 is an EL4 enstatite chondrite found in 2001 during a scientific expedition by G.Pratesi and other Italian collectors. Two dark brown stones, a larger one of 103 g and a smaller one of 2 g were found in the Hammadah al Hamra region. Classification and mineralogy have been reported. This meteorite shows well defined chondrules and enstatite crystals

of 50 m size that suggest a petrologic type 4. Major phases are enstatite, kamacite and troilite; other minor phases are diopside and plagioclase in very small grains (less than 5 m). Niningerite and oldhamite have been found in very small grains, too. The main mineral assemblages shown by the meteorite are presented.
Derived from text
Mineralogy; Rare Earth Elements; Enstatite; Chondrites; Pyroxenes

20040066047 Academy of Sciences (Russia), Moscow, Russia
Dhofar 311, 730 and 731: New Lunar Meteorites from Oman
Nazarov, Mikhail A.; Demidova, Svetlana I.; Patchen, Allan; Taylor, Lawrence A.; Lunar and Planetary Science XXXV: Meteorites; 2004; 2 pp.; In English; See also 20040066033; Original contains color illustrations
Contract(s)/Grant(s): RFBR-02-05-64981; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Three new lunar meteorites, Dhofar 311, 730 and 731 were found recently in the Dhofar region of Oman. Here we report the first data on the petrography and mineralogy of these rocks. All of them are anorthositic impact-melt breccias and were recovered nearby Dhofar 081, 280, 302, 303, 305, 306, 307, 309 and 310. However, the new lunar finds are definitely not paired with Dhofar 081 and 280, but may be related to other lunar stones of the group.
Author
Lunar Rocks; Meteorites; Petrography; Mineralogy

20040066048 Arizona State Univ., Tempe, AZ, USA
The Deuterium Content of Individual Murchison Amino Acids
Pizzarello, S.; Huang, Y.; Lunar and Planetary Science XXXV: Meteorites; 2004; 2 pp.; In English; See also 20040066033; Original contains poor quality, truncated or crooked pages; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Murchison amino acids comprise a diverse suite of over seventy isomeric and homologous species of up to seven-carbon chain length that include: 2- amino mono- and dicarboxylic acids, 3-, 4-, and 5- amino acids, cyclo alkyl-, and N-substituted compounds. This complex distribution has required us to postulate diverse synthetic pathways for their numerous subgroups of molecular species. C-13 analyses have supported the proposal of diverse synthetic processes for these amino acids, by showing significant differences in their C-13 values. So, -metlyl amino acids exhibit a declining C-13 content with carbon chain length, while non - amino acids and dicarboxylic acids do not and have C-13 content that remains approximately unchanged for up to sevencarbon species. We have measured the deuterium content of individual Murchison amino acids by gas chromatography thermal conversion isotope ratio mass spectrometry (GCTC-IRMS).
Derived from text
Amino Acids; Deuterium; Murchison Meteorite; Atmospheric Chemistry

20040066050 Lunar and Planetary Inst., Houston, TX, USA
Lunar and Planetary Science XXXV: Mars
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040066051 - 20040066070
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The session "Mars" included the following reports:Tentative Theories for the Long-Term Geological and Hydrological Evolution of Mars; Stratigraphy of Special Layers Transient Ones on Permeable Ones: Examples from Earth and Mars; Spatial Analysis of Rootless Cone Groups on Iceland and Mars; Summer Season Variability of the North Residual Cap of Mars from MGS-TES; Spectral and Geochemical Characteristics of Lake Superior Type Banded Iron Formation: Analog to the Martian Hematite Outcrops; Martian Wave Structures and Their Relation to Mars; Shape, Highland-Lowland Chemical Dichotomy and Undulating Atmosphere Causing Serious Problems to Landing Spacecrafts; Shear Deformation in the Graben Systems of Sirenum Fosssae, Mars: Preliminary Results; Components of Martian Dust Finding on Terrestrial Sedimentary Deposits with Use of Infrared Spectra; Morphologic and Morphometric Analyses of Fluvial Systems in the Southern Highlands of Mars; Light Pattern and Intensity Analysis of Gray Spots Surrounding Polar Dunes on Mars; The Volume of Possible Ancient Oceanic Basins in the Northern Plains of Mars MARSES: Possibilities of Long-Term Monitoring Spatial and Temporal Variations and Changes of Subsurface Geoelectrical Section on the Base; Results of the Geophysical Survey Salt/Water Interface and Groundwater Mapping on the Marina Di Ragusa, Sicily and Shalter Island, USA ;A Miniature

UV-VIS Spectrometer for the Surface of Mars; Automatic Recognition of Aeolian Ripples on Mars; Absolute Dune Ages and Implications for the Time of Formation of Gullies in Nirgal Vallis, Mars; Diurnal Dust Devil Behaviour for the Viking 1 Landing Site: Sols 1 to 30; Topography Based Surface Age Computations for Mars: A Step Toward the Formal Proof of Martian Ocean Recession, Timing and Probability; Gravitational Effects of Flooding and Filling of Impact Basins on Mars; Viking 2 Landing Site in MGS/MOC Images South Polar Residual Cap of Mars: Features, Stratigraphy, and Changes.
Derived from text
Mars Surface; Topography; Landforms

20040066051 Open Univ., Milton Keynes, UK
Diurnal Dust Devil Behaviour for the Viking 1 Landing Site: Sols 1 to 30
Ringrose, T. J.; Towner, M. C.; Zarnecki, J. C.; Lunar and Planetary Science XXXV: Mars; 2004; 1 pp.; In English; See also 20040066050; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

On 20th July 1976 Viking Lander 1 touched down on Chryse Planitia, Mars. The Viking Landers provided the first detailed in situ analysis of the martian meteorological conditions. The meteorological package included pressure, temperature, and wind sensors, enabling the landers to perform the first detailed in situ investigation of martian weather. Around the same time it was becoming apparent that dust devils existed on Mars and were responsible for lofting considerable amounts of surface material. The detection of dust devils from surface meteorological data was first reported in summary by Ryan and Lucich, who gave an indication of annual occurrence statistics. Subsequent diurnal analysis of the Viking Lander 2 meteorological data has been reported by Ringrose et al and this work follows on from these findings.
Author
Wind (Meteorology); Meteorological Parameters; Mars Environment; Mars Atmosphere; Lofting; Dust

20040066054 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Morphologic and Morphometric Analyses of Fluvial Systems in the Southern Highlands of Mars
Mest, S. C.; Crown, D. A.; Lunar and Planetary Science XXXV: Mars; 2004; In English; See also 20040066050; Copyright; Avail: Other Sources; Paper was not available at the time of publication

Morphologic and Morphometric Analyses of Fluvial Systems in the Southern Highlands of Mars [#1844] Geologic and geomorphic mapping, image analysis, and hydrologic modeling are being used to characterize the morphology and morphometry of circum-Hellas and circum-Isidis valley networks in order to determine the process(es) of network formation.
CASI
Geological Surveys; Mapping; Morphology; Image Analysis; Hydrology

20040066055 University of Western Ontario, London, Ontario, Canada
Viking 2 Landing Site in MGS/MOC Images
Stooke, P. J.; Lunar and Planetary Science XXXV: Mars; 2004; 2 pp.; In English; See also 20040066050; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Viking Lander 2 (VL2) landed on Mars on 3 September 1976. Its location (47.67 degrees N, 225.59 degrees W from radio tracking) has not been identified unambiguously in orbital images. The Viking 1 and Pathfinder sites were located in orbital images by matching horizon topography in lander panoramas with features seen in orbital images. The difficulty with VL2 arises from the low relief of the site and the low resolution of Viking Orbiter images of the region. Stooke tried to locate VL2 just prior to the availability of Mars Global Surveyor MOC images of the site. Three possible locations were identified. Here, an attempt to match VL2 horizon features with MOC images of the area is reported. One of the three locations reported previously allows numerous surface features to be matched between Lander and MOC images. It also corresponds closely with locations proposed by Oberst et al. and Parker and Kirk.
Derived from text
Landing Sites; Mars Global Surveyor; Viking Lander 2; Mars Photographs; Topography

20040066056 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Gravitational Effects of Flooding and Filling of Impact Basins on Mars
Smith, David E.; Zuber, Maria T.; Lunar and Planetary Science XXXV: Mars; 2004; 2 pp.; In English; See also 20040066050; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The presence of large impact basins and the low northern plains that might have contained ice or liquid water at an earlier stage of Mars evolution suggests that the global gravity field could have been different in the distant past than it is today. In addition, any significant change in the distribution of mass affects the moments of inertia and consequently and could conceivably change the position of the pole and the length of day. Similar effects could have been produced by large erosional processes, such as the removal of crustal material from the Arabia Terra region and subsequent re-deposition in the Chryse region of the northern plains. We have endeavored to estimate the magnitudes of material that might have been involved in these processes and their possible effect on the gravity and dynamics of Mars. We have used present-day topography and gravity field as a starting point, recognizing that both the result of the processes that we are trying to study rather than the state at the times of interest.
Derived from text
Gravitational Effects; Structural Basins; Mars Surface; Floods; Topography

20040066057 Turkcell Iletisim Hizmetleri A.S., Istanbul, Turkey
The Volume of Possible Ancient Oceanic Basins in the Northern Plains of Mars
Oner, A. Tayfun; Ruiz, Javier; Fairen, Alberto G.; Tejero, Rosa; Dohm, James M.; Lunar and Planetary Science XXXV: Mars; 2004; 2 pp.; In English; See also 20040066050; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Based on geologic, geomorphologic, and topographic evidence, the past occurrence of great water bodies on the northern plains of Mars has been proposed and their peloshorelines mapped, including water bodies that range in extent from oceans to paleolakes. Topography in regions lower than the mean elevation of the main proposed paleoshorelines has been previously used to propose preliminary estimations of water volume in these putative oceanic basins. Tests of paleoshoreline hypothesis have been performed using both MOC imagery and MOLA data, but the results are not definitive. High-resolution MOC images indicate that there is not sufficient evidence to support the paleoshoreline hypothesis, although other workers present arguments that dispute these findings. From high-resolution MOLA topography it has been stated that the Deuteronilus shoreline is the only putative paleoshoreline which roughly correlates to an equipotential surface. However, by taking into account lithosphere rebound due to water unloading associated with the disappearance of an ocean or different thermal isostasy histories among regions, especially relevant for the Tharsis and Elysium region, it has been argued that it is not necessarily true that a paleoequipotential surface must match a present-day equipotential surface.
Derived from text
Oceans; Mars Surface; Geomorphology; Topography; Mapping; Surface Water; Planetary Geology

20040066058 Academy of Sciences (Russia), Moscow, Russia
MARSES: Possibilities of Long-Term Monitoring Spatial and Temporal Variations and Changes of Subsurface Geoelectrical Section on the Base Results of the Geophysical Survey Salt/Water Interface and Groundwater Mapping on the Marina Di Ragusa, Sicily and Shalter Island, USA
Ozorovich, Y. R.; Lukomsky, A. K.; Potemkin, S. A.; Lunar and Planetary Science XXXV: Mars; 2004; 2 pp.; In English; See also 20040066050; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

One of the more important challenges facing natural resource managers today is how to identify, measure and monitoring the cumulative impacts of land use decisions across space and time. The secondary task is to measure the soil properties of Martian subsurface, which includes porosity, electrical resistance of the liquid phase, thermal conductivity, temperature dependence. A main task of the MARSES monitoring system is to examine changes in the subsurface properties of local areas regolith on the Martian surface on the base of the database of various soil slices in terrestrial conditions.
Author
Soil Science; Mars Surface; Data Bases; Geophysics; Impact Damage

20040066059 Academy of Sciences (USSR), Moscow, USSR
Martian Wave Structures and Their Relation to Mars' Shape, Highland-Lowland Chemical Dichotomy and Undulating Atmosphere Causing Serious Problems to Landing Spacecrafts
Kochemasov, G. G.; Lunar and Planetary Science XXXV: Mars; 2004; 2 pp.; In English; See also 20040066050; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The new wave planetology firmly states that "orbits make structures". This three-word sentence (not yet adequately estimated by the majority of planetologists!) is based on cosmic observations of the last 40 years. Numerous

images of planets, satellites and asteroids allow to conclude that orbiting frequencies have a direct relation to the tectonic granulation of celestial bodies. Due to elliptical keplerian orbits causing standing inertia-gravity waves in celestial bodies spheres they (spheres) acquire wave-woven granular structures. The higher orbiting frequency the smaller tectonic granulation. This law was tested in sequences of planets, in sequences of Galilean satellites, and in cases of Titan, Proteus, the Moon, Phobos. Satellites present a special case because they have two orbits (two frequencies) in the Solar system. Thus, their granulation is determined by this two main frequencies and by the modulated frequencies (division or multiplication of the higher frequency by the lower one). The scale giving a relation between frequency and granula size is Earth occurring in the "golden-middle" of the Solar system. The Earth s granula is R/4 (R - a planet radius) corresponding to the frequency 1/1 year. A "necklace" of such 8 intermittent (+ or -) granulas is well studied at the equatorial zone where the most pronounced are Congolese (+), Indian (-), Indinesian (+) superstructures. Mars having orbiting frequency twice as lower as Earth must develop larger superstructures (R/2) and this is exactly that is observed at Mars. If 8 terrestrial granulas (4 standing waves in the great circle) more or less evenly deform the planetary body, 4 martian granulas (2 standing waves, wave 2) make its body squeeze in one direction and extend in the perpendicular one. This makes the martian body elliptical (it concerns also both its satellites) that is clearly observed in shape of its areoid. As the atmosphere is a subject to the same wave warping one observes two symmetric bulges separated by two hollows in all atmospheric layers.
Derived from text
Mars Surface; Atmospheric Stratification; Gravity Waves; Highlands; Dichotomies; Landing

20040066060 Universidad Rey Juan Carlos, Madrid, Spain
Shear Deformation in the Graben Systems of Sirenum Fosssae, Mars: Preliminary Results
Martin-Gonzalez, F.; dePablo, M. A.; Marquez, A.; Lunar and Planetary Science XXXV: Mars; 2004; 2 pp.; In English; See also 20040066050; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This abstract approaches the results of a preliminary study of a detailed mapping of the structures that form the Sirenum Fossae graben systems. The study has been focused on the segment crossing Gorgonum Chaos (centered at 37.5 deg.S, 170.9 deg.W). In this area, some of the grabens features and geometries have raised the importance of a detailed study of their shear deformation in order to measure the total extension, the strain ellipsoid, etc. The graben systems placed in the Martian Highlands (Memnonian, Sirenum, Icaria, Thaumasia and Claritas Fossae), due to the radial distribution around the Tharsis region, have been explained in a variety of ways: a) faulting due to regional strain associated with isostatic, dynamic, or thermal Tharsis uplift, b) near surface faulting due to radial dyke emplacement, and c) or the combination of these factors.
Derived from text
Deformation; Shear Properties; Mars Surface; Geological Faults

20040066061 Mogilev State Univ., Mogilev, Belarus
Components of Martian Dust Finding on Terrestrial Sedimentary Deposits with Use of Infrared Spectra
Maxe, Larissa P.; Lunar and Planetary Science XXXV: Mars; 2004; 2 pp.; In English; See also 20040066050; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Scientists suppose that seas and lakes on Mars existed during earlier geological periods. Accordingly it can be supposed that on Mars can be find rests of sedimentary deposits of seas and lakes or products of transformation of ones. Therefore the Earth sedimentary deposits of seas and lake's, especially ancient, can be used as analogue objects for the analysis of possible sedimentary deposits of ancient Martian seas and lakes. It was supposed the presence of similar minerals in chemical composition of terrestrial sedimentary deposits and Martian dust, as it can be the transformed sedimentary deposit. Accordingly it was supposed a probability of similar chemical and physical transformations of sediment substances occur during natural or organized artificially processes.
Author
Mars Surface; Dust; Sediments; Deposits

20040066062 Instituto Superior Tecnico, Lisbon, Portugal
Automatic Recognition of Aeolian Ripples on Mars
Pina, P.; Saraiva, J.; Barata, T.; Lunar and Planetary Science XXXV: Mars; 2004; 2 pp.; In English; See also 20040066050; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Over the years, the evolution in resolution power of the instruments aboard planetary probes scanning the surfaces of

planets and moons of the Solar System has allowed for the observation of ever smaller details, in narrower spectra regions with increased spectral responses and also in shorter time intervals. These higher resolutions (spatial, spectral, radiometric and temporal) are naturally leading to larger quantities of raw data. Although human analysis will always be fundamental for qualitative evaluation, there exists a vast field for automation of procedures through the application of digital image analysis methods, such as the following example. One of the first features on the martian surface to attract our attention were aeolian ripples. Several studies of these features have been published recently, seeking to distinguish them from dunes, to take account of the variety of forms that may occur and to compare these structures on Earth and Mars and extrapolate some of their characteristics. Some aeolian features have even been studied in the context of the selection of landing sites for the NASA MERs, thanks to spatial detail available from recent instruments.
Derived from text
Image Analysis; Spectra; Radiometers; Mars Surface; Planetary Surfaces

20040066063 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Berlin, Germany
Absolute Dune Ages and Implications for the Time of Formation of Gullies in Nirgal Vallis, Mars
Reiss, D.; vanGasselt, S.; Neukum, G.; Jaumann, R.; Lunar and Planetary Science XXXV: Mars; 2004; 2 pp.; In English; See also 20040066050; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The observation of gullies in high resolution images suggests that liquid water may have been present on Mars in the recent past. Some debris fans of gullies superpose dunes and patterned ground; this and the lack of impact craters and dust covers as well as the fresh-looking appearance indicate a relatively young age of the gullies, possibly less than 1 Ma. Age determinations by crater count methods are difficult due to the limited area of the small-scale gully features and the lack of impact craters on fresh appearing gullies. The estimated ages from superposition on relatively young surface features (dunes, patterned ground) and from proposed climatic conditions range rom less than 6 Ma to 1 Ma and within the last 10(exp 5) 10(exp 6) years up to formation under present day conditions. In this study we derived the absolute age of gully features superposing dunes from crater frequency measurements on high-resolution MOC-imagery in Nirgal Vallis. This gives us an upper limit age of the gullies in this mid-latitude region on Mars.
Author
Dunes; Chronology; Mars Surface; Craters

20040066064 Cornell Univ., Ithaca, NY, USA
South Polar Residual Cap of Mars: Features, Stratigraphy, and Changes
Thomas, P. C.; Malin, M. C.; Edgett, K. S.; James, P. B.; Cantor, B,. A.; Williams, R.; Lunar and Planetary Science XXXV: Mars; 2004; 2 pp.; In English; See also 20040066050; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Mars Orbiter Camera (MOC) images show that the south residual cap consists of at least two major layered units deposited at different times separated by a period of degradation. The older depositional unit is a series of 4-6 layers, each approx. 2 m thick, expressed in mesas and large areas with polygonal troughs in its upper surface. This deposit, here termed unit A, has been embayed, and in many areas largely removed, by expansion of quasi-circular depressions. Surrounding the remnants of unit A are thinner, smooth-surfaced deposits, here termed unit B, occurring in one to three layers, each 1-2 m thick. Many depressions within unit B display topographic moats, which have a bimodal size distribution, and there is a virtual absence of moats within depressions less than 40 m diameter. This bimodality, the occurrence of narrow moats within larger ones, and the observation that moated material inside depressions is always thinner than the surrounding materials is most easily explained by deposition of a layer after erosion of moats to an average width of about 50 m, followed by more backwasting of all layers.
Derived from text
Degradation; Polar Caps; Residues; Mars Surface; Stratigraphy

20040066066 Nevada Univ., Reno, NV, USA
Summer Season Variability of the North Residual Cap of Mars from MGS-TES
Calvin, W. M.; Titus, T. N.; Lunar and Planetary Science XXXV: Mars; 2004; 2 pp.; In English; See also 20040066050; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

There is a long history of telescopic and spacecraft observations of the polar regions of Mars. The finely laminated ice

deposits and surrounding layered terrains are commonly thought to contain a record of past climate conditions and change. Understanding the basic nature of the deposits and their mineral and ice constituents is a continued focus of current and future orbited missions. Recent work using Mars Global Surveyor (MGS) data sets have described evolution of the seasonal CO2 frost deposits. In addition, the north polar residual ice cap exhibits albedo variations between Mars years and within the summer season. The Thermal Emission Spectrometer (TES) data set can augment these observations providing calibrated albedo over the course of the summer season and additional constraints such as temperature evolution and spectral properties associated with ice and rocky materials.
Author
Summer; Annual Variations; Polar Caps; Northern Hemisphere; Mars (Planet)

20040066067 Arizona Univ., Tucson, AZ, USA
Tentative Theories for the Long-Term Geological and Hydrological Evolution of Mars
Baker, V. R.; Dohm, J. M.; Maruyama, S.; Lunar and Planetary Science XXXV: Mars; 2004; 2 pp.; In English; See also 20040066050; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The current successes of and immediate future prospects for spacecraft science instruments afford exceptional opportunities to assess our global view of the long-term geological and hydrological evolution of Mars. Is it possible to present a self-consistent, physically coherent conceptual model that integrates all new discoveries, particularly those most anomalous in regard to the currently prevailing paradigms? Our attempt to do this combines earlier concepts of episodic, short-term hydro-climatic changes (MEGAOUTFLO - Mars Episodic Glacial Atmospheric Oceanic Upwelling by Thermo-tectonic FLood Outbursts) with global geophysical and geological syntheses (GEOMARS - Geological Evolution Of Mars and Related Syntheses). An important purpose of this exercise is to stimulate discussion of key issues that will guide ongoing analyses of the new data. The latter will lead to the regenerative successors that will surely replace these less-than-perfect tentative theories.
Derived from text
Mars Atmosphere; Planetary Evolution; Planetary Geology; Hydrology; Tectonics

20040066068 Eotvos Lorand Univ., Budapest, Hungary
Stratigraphy of Special Layers: Transient Ones on Permeable Ones: Examples from Earth and Mars
Berczi, Sz.; Kereszturi, A.; Horvath, A.; Lunar and Planetary Science XXXV: Mars; 2004; 2 pp.; In English; See also 20040066050; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Although stratigraphy has been developed for strata of geological ages, its principles can be used for layers formed by short timescale events too. Aeolian transports and moreover, climatic seasons produce transient layers on the planetary surface with various time scale. We studied the stratigraphic behaviour of the dark dune material strata and the precipitated frost layers from the point of view of their interaction during defrosting. The dark layer was formed by winds and its surface pattern is dependent of its thickness. The frosted layer is interacting with the permanent (longer scale stable) but permeable lower dark dune layer. The transient frost cover may be a source of components to be invaded in the permanent layer. Contrary, evaporation may liberate some solid or liquid component residing in the soil. This way stratigraphy of the dark dune layer and its defrosting cover is a complex process.
Derived from text
Stratigraphy; Mars Surface; Permeability; Earth Surface; Planetary Geology

20040066069 Nevada Univ., Reno, NV, USA
Spectral and Geochemical Characteristics of Lake Superior Type Banded Iron Formation: Analog to the Martian Hematite Outcrops
Fallacaro, Alicia; Calvin, Wendy M.; Lunar and Planetary Science XXXV: Mars; 2004; 2 pp.; In English; See also 20040066050; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Thermal Emission Spectrometer (TES) onboard Mars Global Surveyor discovered grey, crystalline hematite based on its fundamental oxide vibrational features at 300, 450, and 525/cm at Sinus Meridiani (SM), Aram Chaos (AC), and various small outcrops within the Valles Marineris (VM). One of the proposed formation mechanisms for the grey, crystalline hematite is through precipitation of ferric oxides in iron rich waters as in terrestrial banded iron formation (BIF). Subsequent burial

metamorphism would crystallize the deposit. Archean earth banded iron formation was first suggested as a possible terrestrial analog for early Mars based on the hypothesis that dark regions on Mars could be chemically altered, containing ferrous clay alteration minerals similar to those in BIF. A recent study of the Mariner 6 and 7 spectra shows increased hydration signatures in the SM and AC hematite regions further supporting an aqueous formation mechanism. Due to the lack of a volcanic source and subsequent volcanic features surrounding the Martian hematite regions, and the increased hydration signatures, a sedimentary, aqueous depositional environment is the preferred interpretation for this research, and thus terrestrial BIF is chosen as an appropriate analog.
Author
Spectra; Geochemistry; Strata; Iron; Planetary Geology

20040066070 AVL-AST doo, Zagreb, Croatia
Topography Based Surface Age Computations for Mars: A Step Toward the Formal Proof of Martian Ocean Recession, Timing and Probability
Salamuniccar, G.; Nezic, Z.; Lunar and Planetary Science XXXV: Mars; 2004; 2 pp.; In English; See also 20040066050; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Large body of work on the impact crater statistics was already done, as e.g. described by Neukum, where Hatmann's model from 1981 and Neukum s model from 1981 and 1983 were compared, and where Cratering Chronology Diagrams were shown in log/log scale, showing Cumulative Crater Frequency (N km-2) as a function of Age (years) for some particular crater diameter. However, recently it was presented that this, according to the Mathematical Theory of Stochastic Processes (MTSP), is only one possible representation of bombardment of lunar/planetary surface modeled as stochastic process in the Mathematical Statistics Theory (MST) domain. Basic idea is that there is more than one representation in the MST domain of the same stochastic process modeled according to MTSP, where each one can provide us with new information about some lunar/ planetary body. First work in this new field resulted in representation of crater statistics in the form of the Topography Profile Diagrams (TPDs). They show correlation hardly explainable by anything other than an ancient ocean, offering an opportunity to prove existence of Martian ocean, if it will be possible to prove that nothing else could cause such correlation. This is particularly interesting because after the initial proposal of Contact 1 and 2, many other indications of oceanic phases on Mars were also proposed, for example episodic water inundations in the northern plains caused by Tharsis and Elysium-triggered catastrophic outflows that ponded in the northern plains to form large water bodies, aptly explained by the MEGAOUTFLO hypothesis, possible hydroisostatic influences on the collective geometry of strandline features, cracking of the cryosphere by dike injection and subsequent release of water from a confined aquifer that can take place fast enough to form an ocean, etc.
Derived from text
Topography; Mars Surface; Geochronology; Extraterrestrial Oceans; Probability Theory

20040066075 Lunar and Planetary Inst., Houston, TX, USA
Lunar and Planetary Science XXXV: Asteroids, Meteors, Comets
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040066076 - 20040066080
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The session Asteroids, Meteors, Comets includes the following topics: 1) Where Some Asteroid Parent Bodies; 2) The Collisional Evolution of the Main Belt Population; 3) On Origin of Ecliptic Families of Periodic Comets; 4) Mineralogy and Petrology of Laser Irradiated Carbonaceous Chondrite Mighei; and 5) Interaction of the Gould Belt and the Earth.
Derived from text
Asteroids; Comets; Meteoroids; Planetary Geology

20040066076
Interaction of the Gould Belt and the Earth
Smirnova, L. V.; Lunar and Planetary Science XXXV: Asteroids, Meteors, Comets; 2004; 2 pp.; In English; See also 20040066075; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Now one of the problems in astronomy is asteroid and comet hazard. The great and small catastrophes after falling

celestial bodies on the Earth occurred in the history many times. Asteroids and comets within Solar systems are main sources of danger. But meteors of the galactic origin also possible fall on the Earth. The chances of such falling are less than the possibility of falling of Solar system s minor planets on the Earth. The Gould belt is possible source of galactic meteors. OB-association of Sco-Cen from the OB- association of Sco-Cen from the Gould belt is situated from us on distance 130 parsecs now. It may be give 20 explosions supernova stars on the distance before 40 pc for 11 million years. Postponing on geological scale of time episodes mass extinction of species (x-axes is million years calculated from our epoch, vertical scale is a per cent survived of species) paleontologists have found between them regular intervals in 26 million years. We shall determine of epochs of extreme cometary s hazard, considering motion of the belt and Sun in gravitation field of the Galaxy. Initial data are initial positions of bodies and vectors of theirs velocities.
Author
Asteroids; Comets; Meteoroids; Hazards; Geochronology

20040066077 Sternberg Astronomical Inst., Moscow, USSR
Where Some Asteroid Parent Bodies
Busarev, V. V.; Lunar and Planetary Science XXXV: Asteroids, Meteors, Comets; 2004; 2 pp.; In English; See also 20040066075; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

From analysis of observational data and results of contemporary cosmogonic models a hypothesis is propounded on intensive production of dust in the asteroid belt during a postaccretionary period. A consequence of this may be a settling of the dust on asteroid parent bodies in the form of a layer with atypical content. It could make them inaccessible in some cases for remote investigations.
Author
Dust; Asteroids; Asteroid Belts

20040066078 Yaroslavl State Pedagogical Univ., Yaroslavl, Russia
On Origin of Ecliptic Families of Periodic Comets
Perov, N. I.; Lunar and Planetary Science XXXV: Asteroids, Meteors, Comets; 2004; 2 pp.; In English; See also 20040066075; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

There are two popular models of origin of comets. In accordance with the first hypothesis of origin of comets a source of long period comets (P greater than 200 years) is spherically symmetric Oort s cloud, spaced 2 x 10(exp 4) - 3 x 10(exp 5) AU apart the Sun. It is assumed there are 10(exp 12) - 10(exp 13) comets, moved along elliptical orbits, in this cloud. Stars and gigantic molecular clouds, passing by near the Sun, set some comets of Oort s cloud move into the internal part of the Solar system and these comets turn into long-periodic comets. The fundamental mass of Oort s cloud is formed by planetesimals, thrown aside from the zone of the giant planets.
Derived from text
Comets; Elliptical Orbits; Oort Cloud; Stellar Evolution

20040066079 Academy of Sciences (USSR), Moscow, USSR
The Collisional Evolution of the Main Belt Population
Kuzmitcheva, M. Yu.; Ivanov, B. A.; Lunar and Planetary Science XXXV: Asteroids, Meteors, Comets; 2004; 2 pp.; In English; See also 20040066075
Contract(s)/Grant(s): RFBR-01-05-64564-a; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Numerical modeling of a disruptive-cascade of minor body populations leads to a new interpretation of the lunar impact crater size-frequency distribution (SFD) and the observed size distribution of the main-belt asteroids. Within our model of a collisional evolution we adjust the best fit to the observed main-belt distribution size-strength scaling relations for asteroidal strength. To compare with the lunar SFD we then average obtained distributions with a sliding time window of 2 Ma. Our numerical model of a collisional evolution:
Author
Collisions; Mathematical Models; Lunar Craters; Frequency Distribution

20040066080 Academy of Sciences (Russia), Moscow, Russia
Mineralogy and Petrology of Laser Irradiated Carbonaceous Chondrite Mighei
Shingareva, T. V.; Basilevsky, A. T.; Fisenko, A. V.; Semjonova, L. F.; Korotaeva, N. N.; Lunar and Planetary Science XXXV: Asteroids, Meteors, Comets; 2004; 2 pp.; In English; See also 20040066075; Original contains color and black and white illustrations
Contract(s)/Grant(s): RFBR-02-05-65156; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

For the last several years a number of laser irradiation experiments have been performed to simulate space weathering on the surface of the Moon and asteroids. Some researchers used nanosecond-pulse laser simulating effects of micrometeorite bombardment by particles of 1-10 microns in diameter. Such treatment leads to formation of SMFe on the surface of irradiated samples. We used a microsecond-pulsed laser irradiation which simulates micrometeorite bombardment by 30-50 microns particles if their density is 2-3 g/qu cm and velocity approx. 1-3 km/s. Such treatment leads to the melting of the treated material and consequent quenching of the melt. The goal of this study is simulation of the mineralogical and petrological changes in the products of micrometeorite bombardment of carbonaceous chondrite material, the case when micrometeorites are relatively large. Carbonaceous chondrites are considered as representing materials of the C- and D-type asteroids and maybe Phobos. In this study we irradiated the CM chondrite Mighei.
Derived from text
Mineralogy; Simulation; Petrology; Carbonaceous Chondrites

20040066108 NASA Ames Research Center, Moffett Field, CA, USA
Overview and Status of the Kepler Mission
Koch, D.; Borucki, W.; Dunham, E.; Geary, J.; Gilliland, R.; Jenkins, J.; Latham, D.; Mayer, D.; Sobeck, C.; Duren, R., et al.; November 24, 2003; 1 pp.; In English; SPIE Symposium on Astronomical Telescopes and Instrumentation, 21-25 Jun. 2004, Glasgow, Scotland, UK
Contract(s)/Grant(s): UPN 853-15-01; No Copyright; Avail: Other Sources; Abstract Only

The Kepler Mission is a search for terrestrial planets with the design optimized for detecting Earth-size planets in the habitable zone (HZ) of solar-like stars. In addition, the mission has a broad detection capability for a wide range of planetary sizes, planetary orbits and spectral types of stars. The mission is in the midst of the development phase with good progress leading to the preliminary design review later this year. Long lead procurements are well under way. An overview in all areas is presented including both the flight system (photometer and spacecraft) and the ground system. Launch is on target for 2007 on a Delta II.
Author
General Overviews; Terrestrial Planets; Space Missions; Detection

20040067849 Lawrence Livermore National Lab., Livermore, CA
Adaptive Optics at Lawrence Livermore National Laboratory
Gavel, D.; Mar. 10, 2003; 14 pp.; In English
Report No.(s): DE2004-15006844; UCRL-JC-151636; No Copyright; Avail: Department of Energy Information Bridge

Adaptive optics enables high resolution imaging through the atmospheric by correcting for the turbulent air's aberrations to the light waves passing through it. The Lawrence Livermore National Laboratory for a number of years has been at the forefront of applying adaptive optics technology to astronomy on the world's largest astronomical telescopes, in particular at the Keck 10-meter telescope on Mauna Kea, Hawaii. The technology includes the development of high-speed electrically driven deformable mirrors, high-speed low-noise CCD sensors, and real-time wavefront reconstruction and control hardware. Adaptive optics finds applications in many other areas where light beams pass through aberrating media and must be corrected to maintain diffraction-limited performance. We describe systems and results in astronomy, medicine (vision science), and horizontal path imaging, all active programs in our group.
NTIS
Adaptive Optics; Astronomy; Telescopes

20040067858 Lunar and Planetary Inst., Houston, TX, USA
Lunar and Planetary Science XXXV: Astrobiology
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040067859 - 20040067861
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The session "Astrobiology" included the following reports:The Role of Cometary and Meteoritic Delivery in the Origin and Evolution of Life: Biogeological Evidences Revisited; Hopane Biomarkers Traced from Bedrock to Recent Sediments and Ice at the Haughton Impact Structure, Devon Island: Implications for the Search for Biomarkers on Mars; and Survival of Organic Matter After High Temperature Events (Meteorite Impacts, Igneous Intrusions).
Derived from text
Exobiology; Biomarkers; Mars (Planet)

20040067859 Aberdeen Univ., UK
Hopane Biomarkers Traced from Bedrock to Recent Sediments and Ice at the Haughton Impact Structure, Devon Island: Implications for the Search for Biomarkers on Mars
Parnell, J.; Osinski, G. R.; Lee, P.; Cockell, C. C.; Taylor, C. W.; Lunar and Planetary Science XXXV: Astrobiology; 2004; 2 pp.; In English; See also 20040067858; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Hopanoid biomarkers have been successsfully traced from Palaeozoic target bedrock to Miocene impact-processed rocks, post-impact sediments, and Qu aternary ice at the Haughton impact Structure, Devon Island, High Arctic, suggesting that similar biomarkers and techniques to detect them might provide a promising strategy in the search for biomarkers in rocks, sediments and ice on Mars.
Author
Bedrock; Biomarkers; Ice; Mars Surface

20040067865 Lunar and Planetary Inst., Houston, TX, USA
Lunar and Planetary Science XXXV: Exploration and Observations
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040067866 - 20040067869
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The session, "Exploration and Observations" includes the following topics: 1) Charged Particle dose Measurements by the Odyssey/MARIE Instrument in Mars Orbit and Model Calculations; 2) Earth Thermal Field Variations in Dependence from Lunisolar Tides (by Vorotilovo Deep Well Observations); 3) ASTROHAB: A Modular Construction System for Lunar Bases; and 4) Solar Power Satellites for Orbital and Non-Terrestrial Applications.
Derived from text
Planetary Geology; Lunar Exploration; Satellite Observation

20040067866 NASA Johnson Space Center, Houston, TX, USA
Charged Particle Dose Measurements by the Odyssey/MARIE Instrument in Mars Orbit and Model Calculations
Cleghorn, T. F.; Saganti, P. B.; Zeitlin, C.; Cucinotta, F. A.; Lunar and Planetary Science XXXV: Exploration and Observations; 2004; 2 pp.; In English; See also 20040067865; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Knowledge of the space radiation environment is crucial both for human space exploration, and robotic space missions. It is likely that human explorers will return to the moon, and then go to Mars within the next thirty years. The radiation environment that they will encounter is a significant obstacle to future exploration, and must be dealt with successfully before longterm human missions outside of the magnetosphere can take place. Shielding technologies and materials must be developed to lower the dose and dose equivalent that human beings will receive on such missions. To begin this development, a fairly complete and accurate understanding of the space environment must be obtained. The major components of the space particle radiation environment that are most hazardous to humans are: galactic cosmic rays (GCR), the particles contained in solar particle events, (SPE), and secondary particles generated in material in the spacecraft itself. The intensity of the GCR varies by roughly a factor of two over the eleven-year solar cycle, inversely with the level of solar activity. These GCR particles are fully stripped nuclei, predominantly protons and helium, but also significant numbers of heavier ions, including carbon, oxygen, and iron. Since the ionization caused by nuclei passing through matter is proportional to the square of its charge (Z=10). The MARIE instrument has been described elsewhere.
Derived from text
Charged Particles; Dosage; Extraterrestrial Radiation; Spacecraft Instruments; Planetary Orbits; Mars (Planet); Astronomical Models

20040067867 FGUP NPC NEDRA, Yaroslavl, Russia

Earth Thermal Field Variations in Dependence from Lunisolar Tides (by Vorotilovo Deep Well Observations)

Esipko, O. A.; Rosaev, A. E.; Lunar and Planetary Science XXXV: Exploration and Observations; 2004; 1 pp.; In English; See also 20040067865; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A number of deep and superdeep wells have been drilled in Russia. The wells where all drilling activities have been finished, but the research activities still continue, are of a great scientific and practical interest for studying the present-day geological processes taking place in the Earth's interior. Vorotilovo deep well (VDW), drilled in a central part of Russian platform, is one of those wells-geolaboratories. The depth of the well is 5374 m, the temperature at the bottom is 95 C, open borehole in range 689-5374 m. As a result of geophysical fields monitoring, the complex nature of spatial-temporal variations that depend on the influence of various natural factors was determined in the VDW. Lunar tides are one of the important factors that define the geophysical fields variations in the VDW. The relation between temperature variations in the VDW and the tide (monthly) phase is detected. The dependence of such influence on the depth of measurement agrees with the model of layered Earth where every layer has a particular response on tidal force (in dependence from it s physical properties). The shift between phases of monthly tides and temperature variations is observed. This shift is different at different depth and by our estimations. In according with our results, most important to study temperature tide dependence at depth range 600 - 2500 m. At the top of the well, the surface effects (and processes) significant, at the bottom of well the temperature variations are too small. In addition to temperature, variations of another geophysical parameters (seismic-acoustic for example) show the dependence from tidal gravity variations. It may be significant at earthquake prediction problem. In the result of phase-amplitude modulation of a seis-moacoustic wave under the effect on a lunisolar tide studying, is shown that curves of seismoacoustic signal amplitude and tide are similar. However, the lagging about one hour is observed. The origin of this shift has two sources. First, it is the obvious inertia of the heat phenomena. Second, it is the lagging due to dissipation of the tidal energy inside, more correctly, in different Earth's shells. It means, that the main dissipation in Earth's upper core takes place in the depth interval 1800-2000 meters. The continuation of the measurements, improvement of data analyses methods and extension of collaboration of specialists from different brunches of science, are required in order to obtain more exact results and improve their interpretation. A joint experiment with registration temperature variation with seismic-acoustic emission recording, is planned at VDW at 2004.

Derived from text

Lunar Tides; Wells; Temperature Distribution; Earth Surface; Geophysics; Seismology

20040067868 Gaviraghi (Giorgio), Milan, Italy

ASTROHAB: A Modular Construction System for Lunar Bases

Gaviraghi, Giorgio; Lunar and Planetary Science XXXV: Exploration and Observations; 2004; 1 pp.; In English; See also 20040067865; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This high cost of space accessibility and the need to maximize the utilization of local resources has been the basic design requirement for this habitation construction system which could be used for stations and bases on the Moon. Other particular design parameters were: 1) minimum load from Earth; 2) maximum utilization of local resources; 3) minimum number of components; 4) simplicity of assembly; 5) minimum transportation space; and 6) flexibility of use and expansion possibility. The system is composed of two basic forms in carbon fibers, stackable for transportation purposes, with a minimum weight, that properly assembled allow any type of flexibility. The functional module form allow the construction of habitats and any other function such as office, medical facilities, laboratories, rover shelter etc. while the connector module form, assure the connection between the functional units. The single functional unit is composed of 24 forms that joined together allow a closed space, self supporting of a diameter of about 8 meters and a height ranging from 230 to 3.50 meters. Each module is composed by two form a U-shaped that are joined together and filled with lunar regolith to assure stability, radiation protection and insulation. The floor part of the modules could be filled with water, substituting the need for external water tanks. These units, connected between them by Connectors, O-shaped forms, allow the construction of stations or bases of any dimension and for any functional requirement. Their extremely light weight allow the erection of the station by the astronauts without the need of heavy construction equipment and their size the possibility to move them manually to their utilization location. This system is actually being developed as prototypes by our organization and we expect to assemble a simulated lunar or martian base in Italy utilizing the AstroHab system in the next months.

Derived from text

Lunar Bases; Systems Engineering; Moon; Spacecraft Modules

20040067869 StarGate Research Lab., Denver, CO USA

Solar Power Satellites for Orbital and Non-Terrestrial Applications

Greenspon, J. A.; Mardon, A. A.; Lunar and Planetary Science XXXV: Exploration and Observations; 2004; 1 pp.; In English; See also 20040067865; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In preparation for mankind's return to the lunar surface with a long-term presence, we need to greatly expand our ability to provide the most crucial elements for human survival; a constant, stable, but safe source of energy for our colonial inhabitants. In this paper we present an analysis of Space Power Satellite (SPS) systems that are intrinsically useful to complex operational power demands (including life support), which comprises the largest portion of any new space endeavour. Consumption of power is a technological driving factor, as well as a key element in driving resource development in near-Earth or deep space. We can also make use of SPS power from several orbital components to enable spacecraft operations from remote power complexes, removing a large portion of the mass of energy generation from future spacecraft designs. SPS for manned lunar operations energy consumption could be a model for the use in other parts of the inner solar system. SPS is a technology that could be used to ameliorate the near term energy crisis and as a technology is definitely cleaner then carbon, hydrocarbon or nuclear energy production. SPS could be developed from off the self technologies combined with theoretical studies for both governmental and commercial SPS programs, evolutionary tracks and third body orbital studies, these satellites can be developed and operating within twenty years, producing clean energy to Earth and our local neighbourhood.

Author

Solar Power Satellites; Satellite Orbits; Lunar Surface; Spacecraft Power Supplies

20040067870 Lunar and Planetary Inst., Houston, TX, USA

Lunar and Planetary Science XXXV: Education

2004; In English; Linar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040067871 - 20040067875

Contract(s)/Grant(s): NCC5-679

Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The session "Education" includes the following topics: 1) Convection, Magnetism, Orbital Resonances, Impacts, and Volcanism: Energies and Processes in the Solar System: Didactic Activities; 2) Knowledge Management in Aerospace-Education and Training Issues; 3) Creating Easy-to-Understand Planetary Maps; 4) Planetary Environment comparison in the Education of Astrobiology; and 5) Design and Construction of a Mechanism for the Orbital Resonances Simulation.

Derived from text

Education; Planetary Geology; Lunar Surface

20040067871 Eotvos Lorand Univ., Budapest, Hungary

Creating Easy-to-Understand Planetary Maps

Hargitai, H. I.; Lunar and Planetary Science XXXV: Education; 2004; 2 pp.; In English; See also 20040067870; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Maps are to answer a very simple question of its reader: "what's there?" For planetary maps, the answer is more difficult, because (1) in some cases even map makers don't know what's there, since the main original source data are images of the surface (2) its readers are not familiar with the surface forms (3) the official Latin IAU names appearing on the map provide little guidance. "Planetary nomenclature, like terrestrial nomenclature, is used to uniquely identify a feature on the surface of a planet or satellite so that the feature can be easily located, described, and discussed." While this goal is achieved in scientific discussions, for public education or popular science the present day international form of planetary names is not suitable. The IAU nomenclature is in Latin language which is not understandable for large part of the map readers. Most editors and popular writers do use a national language variant of these names (in books, articles, Atlases). Since there is no standardized national transformation rule for guiding this effort, they try their best, and this way produce multiple translated/transcribed/transliterated variants for the same feature name. In the case of maps for non-professional or young audience, I propose-to some extent in contrast to the UNGEN (United Nations Group of Experts on Geographical Names) efforts on a single standardization of geographical names-to use standardized national language variants of the Latin terminology, with which it would be much easier (or, this makes possible) to get answer to the general map readers' question

"What's there"-this way achieving the aims of IAU mentioned above, but extending the target audience to non professionals.
Derived from text
Planetary Mapping; Planetary Geology; Education; Topography

20040067872 Eotvos Lorand Univ., Budapest, Hungary
Planetary Environment Comparison in the Education of Astrobiology
Kereszturi, A.; Lunar and Planetary Science XXXV: Education; 2004; 1 pp.; In English; See also 20040067870; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We present examples used in the education of astrobiology at Polaris Observatory and Department of Physical Geography Eotvos Lorand University for the comparison of different planetary environments in the point of view of astrobiology. Here we compare locations where heat source and substantial volume of liquid water is present in the order of 10(exp 3)-10(exp 6) years. These are: 1. black smokers on Earth and probable Europa, 2. ice chimney as special fumaroles on Earth and probable on Mars. 3. young impact craters on Earth, Mars, Europa and Titan.
Derived from text
Education; Exobiology; Planetary Environments; Planetary Geology

20040067873 Universidad Complutense, Madrid, Spain
Convection, Magnetism, Orbital Resonances, Impacts, and Volcanism: Energies and Processes in the Solar System: Didactic Activities
Castilla, G.; Zambrano, Maria; dePalo, M. A.; Martin, L.; Lunar and Planetary Science XXXV: Education; 2004; 2 pp.; In English; See also 20040067870; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In many occasions the study of other planetary bodies in the classrooms is made only in terms of the external geological processes: volcanoes, cannons, impact craters, channels, dunes, and all those forms of the surface that permit us to compare the forms of the relief of the Earth with that of other planetary bodies. However, they are many more links between our planet and the other planetary bodies of rocky and icy type (planets and satellites). The internal energy or the relationship between several planetary bodies is also commons forms of energy or processes too many bodies of our solar system. In this work we show some didactic experiences, developed in the secondary education classrooms as well as with the general public, directed to make known some of the processes and sources of energy more common between the planets and satellites of the Solar System.
Derived from text
Convection; Magnetic Properties; Solar System; Planetary Geology; Orbital Resonances (Celestial Mechanics); Hypervelocity Impact; Volcanic Eruptions

20040067875 Instituto de Educacion Secundaria, Madrid, Spain
Design and Construction of a Mechanism for the Orbital Resonances Simulation
Martin, L.; Lopez, C.; Castilla, G.; dePablo, M. A.; Lunar and Planetary Science XXXV: Education; 2004; 2 pp.; In English; See also 20040067870; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In most of the occasions the study of the planets and satellites of our solar system is made in an isolated way. Rarely are they shown the planetary bodies as a system in continuous interaction. An exception to this affirmation is the relationship between the Earth and its satellite the Moon, whose system and interaction justifies the tides existence in the seas and oceans of the Earth. This system is not the only one whose consequences explain some of the most outstanding characteristics of some planetary bodies. In order to illustrate the importance of the relationships between several planetary bodies (planets and satellites), in this work is shown a didactic resource designed to show the orbital resonances between Jupiter and three of its satellites.
Derived from text
Simulation; Orbital Resonances (Celestial Mechanics); Natural Satellites; Solar System

20040067886 Lunar and Planetary Inst., Houston, TX, USA
Lunar and Planetary Science XXXV: Origin of Planetary Systems
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040067887 - 20040067892
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The session "Origin of Planetary Systems" included the following reports: (12753) Povenmire - Standard Comparison Small Main Belt Asteroid?; Gravitational Frequencies of Extra-Solar Planets; 'Jumping Jupiters' in Binary Star Systems; Hermes, Asteroid 2002 SY50 and the Northern Cetids - No Link Found!; What Kind of Accretion Model is Required for the Solar System; and Use of an Orbital Phase Curve of Extrasolar Planet for Specification of its Mass.
Derived from text
Planetary Systems; Solar System

20040067888 Academy of Sciences (Russia), Moscow, Russia
What Kind of Accretion Model is Required for the Solar System?
Ustinova, G. K.; Lunar and Planetary Science XXXV: Origin of Planetary Systems; 2004; 2 pp.; In English; See also 20040067886; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The main goal of the accretion model of the Solar system must be the precise conception of sources and mechanisms of formation of the observable mineralogical, chemical and isotopic composition of its matter. The starting point of the model is the isotopic and elemental composition of the primordial matter, i.e., of the protosolar and protoplanetary nebulae, and its transformation during such global processes as collapse, emergence of the protosun and its further evolution. As supposed in the early condensation models, the energy of the gravitation collapse was sufficient for evaporation of all the protosolar dust which then recondensed under the equilibrium conditions in the accretion disk and led to the isotopic and chemical homogeneity of the protoplanetary nebula. The numerous isotopic anomalies in meteorites forced everyone to refuse such a hypothesis. The gas-dust protoplanetary cloud is the main initial conception of all the contemporary models of origin of the Solar system. The thermodynamic accretion models at the T-Tauri stage of the solar evolution have turned out to be the most elaborated ones. They presented wide comprehension of the thermodynamic processes in the accretion disk and inferred many important factors of differentiation of matter in the early Solar system.
Author
Astronomical Models; Accretion Disks; Solar System Evolution; Thermodynamics

20040067889 Florida Inst. of Tech., Indian Harbour Beach, FL, USA
Hermes, Asteroid 2002 SY50 and the Northern Cetids: No Link Found!
Povenmire, Hal; Lunar and Planetary Science XXXV: Origin of Planetary Systems; 2004; 1 pp.; In English; See also 20040067886; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Before the photographic fireball patrols gave extremely accurate photographic orbital elements, visual reports were the only method of determining fireball and asteroidal links. Charles P. Olivier of the American Meteor Society and others realized that there were October fireballs that had similar orbital elements to the lost asteroid 1937 UB Hermes. Since Hermes was lost for 66 years, its orbital elements could only be speculated. Gary Kronk, Alexandra Terentjeva and others believed that Hermes was the parent body of the October Cetid fireballs. A number of Cetid fireballs were photographed by the Prairie, MORP and the European Network and showed that there were a northern and southern branch to these fireballs along with visual meteor showers. On September 30, 2002, a new near earth asteroid (NEA) was found which was thought to be Hermes. No link could be found and it was designated 2002 SY50. It was found to not be related to either branch of the Cetids. On October 15, 2003, Hermes was recovered and linked to the 1937 discovery images giving extremely accurate orbital elements. Hermes could not be linked to either the northern or southern branch of the Cetids or 2002 SY50. The D Criterion developed by Southworth and Hawkins shows a similarity but no link. It may be that all of these sets of orbital elements having low orbital inclinations have been subjected to intense pertubations by all the inner planets. We know that there is at least one torus of material which is producing the Cetid fireballs. There is probably another small asteroidal or burnt out comet nucleus which is responsible for one or both branches of the Cetids.
Author
Asteroids; Near Earth Objects; Meteoroid Showers; Orbital Elements

20040067890 Gary (Bruce), Hereford, AZ, USA

(12753)Povenmire: Standard Comparison Small Main Belt Asteroid?

Gary, Bruce; Povenmire, Hal; Lunar and Planetary Science XXXV: Origin of Planetary Systems; 2004; 1 pp.; In English; See also 20040067886; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In astronomy we need standard comparison objects. For quasars we use 3C-273. For galaxies, we compare to Andromeda or the Milky Way. For supernova we use the Crab. For stars we often use the Sun or Vega. For Planets we use Jupiter or Earth. For comets we compare to Halley. For the large asteroids, we compare to (1) Ceres. For the smaller main belt asteroids (SMBA) we do not have a standard comparison object. This abstract proposes (12753) Povenmire as it is close to the average or mean in all characteristics. The small main belt asteroids (SMBA) have similar characteristics. Asteroid (12753) POVENMIRE has nearly all the average characteristics of an 18 km diameter main belt asteroid. Essentially all SMBA have irregular shapes and surfaces. The amplitude of this SMBA has a magnitude fluctuation of .2 magnitude. This would indicate a potato shape but not a binary object. A ratio of 1:1.6 in length to width would account for this variation which would be about average. Probably about 20% of SMBA are binary. The mean specific gravity of SMBA are approximately 2.8. This would indicate that the total mass of (12753) would likely be similar to the combined masses of Phobos and Deimos, the moons of Mars. With all the new discoveries being made of minor planets, exceptions to the norm will be common. By having a standard comparison object, as a benchmark, the degree of strangeness can immediately be put into perspective. This will be invaluable for statistical studies.

Author

Asteroids; Standards; Orbital Elements

20040067905 Lunar and Planetary Inst., Houston, TX, USA

Lunar and Planetary Science XXXV: Outer Solar System

2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040067906 - 20040067911

Contract(s)/Grant(s): NCC5-679

Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM

The session "Outer Solar System" included the following reports:New Data About Seasonal Variations of the North-South Asymmetry of Polarized Light of Jupiter; Appearance of Second Harmonic in the Jupiter Spectrum; Dynamics of Confined Liquid Mass, Spreading on Planet Surface; "Cassini" will Discover 116 New Satellites of Saturn!; Jupiter's Light Reflection Law;and Internal Structure Modelling of Europa.

Derived from text

Jupiter (Planet); Saturn Satellites

20040067906 Kharkov National Aerospace Univ., Ukraine

New Data About Seasonal Variations of the North-South Asymmetry of Polarized Light of Jupiter

Goryunova, O. S.; Korokhin, V. V.; Akimov, L. A.; Starodubtseva, O. M.; Shalygin, E. V.; Velikodsky, Yu. I.; Lunar and Planetary Science XXXV: Outer Solar System; 2004; 2 pp.; In English; See also 20040067905; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

New data about the seasonal variations of the north-south asymmetry of linear polarization degree of the light reflected by Jupiter are presented.

Author

Linear Polarization; Annual Variations; Jupiter (Planet); Data Acquisition

20040067907 Academy of Sciences (Russia), Moscow, Russia

Dynamics of Confined Liquid Mass, Spreading on Planet Surface

Kostrikov, A. A.; Lunar and Planetary Science XXXV: Outer Solar System; 2004; 2 pp.; In English; See also 20040067905; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Ice or permafrost covers (completely or partially) appreciable number of planets and satellites of Solar system. By several ways subsurface water can spring away. What are the basic features of the confined water mass spreading? Generally speaking behavior of liquid mass (spot) poured out on the surface of planet depends on many parameters. This investigation had been

carried out to solve a simple problem of non-viscous liquid spreading on smooth surface of rotating planet.
Author
Confinement; Ice; Liquid Surfaces; Permafrost; Spreading

20040067908
"Cassini" will Discover 116 New Satellites of Saturn!
Nahodeneva, A. A.; Perov, N. I.; Lunar and Planetary Science XXXV: Outer Solar System; 2004; 2 pp.; In English; See also 20040067905; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We determine of regular, irregular, coorbital satellites of planets as natural celestial bodies, diameters of which are no less 1 km, and which are revolving around the planets (distance between the planet and the satellite is smaller by a factor of several orders in comparison with the distance between the planet and the Sun). In this case the planet centric force predominates over forces, are due the influence of the Sun, others planets and secondary satellites, oblateness of the planet, though the letters may set up significant perturbations of satellites orbits. It should be noted for the solar planets satellites the perturbations from the others planets are small, in comparison with perturbations of the Sun, and so others planets perturbations do not determine the motion of the satellites.
Derived from text
Celestial Bodies; Natural Satellites; Saturn Satellites

20040067909 Kharkov National Aerospace Univ., Ukraine
Jupiter's Light Reflection Law
Shalygin, E. V.; Velikodsky, Yu. I.; Korokhin, V. V.; Lunar and Planetary Science XXXV: Outer Solar System; 2004; 2 pp.; In English; See also 20040067905; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A reflection law for Jupiter in form of linear combination of Lambert and Lommel-Seeliger is proposed. It is shown that proposed law quite well describes brightness distribution over Jovian disk at phase angle 2.7 degrees. It is usually considered that Jupiter reflects light by Lambert's law. Indeed, Jovian atmosphere is optically thick and albedo is high enough for this approximation. However, single scattering can make significant contribution in the brightness, which can be described by Lommel-Seeliger's law multiplied by indicatrix of a particle. So, we approximately write a reflection law as a linear combination of Lambert's and Lommel-Seeliger's functions. We will try to find Jupiter's reflection law in this function.
Derived from text
Jupiter (Planet); Reflection; Functions (Mathematics); Light (Visible Radiation); Bouguer Law; Approximation

20040067910 Institute of Ocean Sciences, Sidney, British Columbia, Canada
Internal Structure Modelling of Europa
Thomas, C.; Lunar and Planetary Science XXXV: Outer Solar System; 2004; 2 pp.; In English; See also 20040067905; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The gravity data gathered by the Galileo Orbiter from close satellite flybys of Europa provide several important constraints to the possible internal structures of this satellite. Anderson et al. derived three-layer models by calculating analytical solutions to Clairaut s equation. Here, I present four-layer (ice, saltwater, silicate mantle, Fe-FeS core) models of Europa determined by empirical modelling of the satellite's interior.
Author
Europa; Planetary Structure; Mathematical Models; Computer Programs

20040067911 Taras Shevchenko Univ. of Kyiv, Kyiv, Ukraine
Appearance of Second Harmonic in the Jupiter Spectrum
Kostogryz, N. M.; Vidmachenko, A. P.; Lunar and Planetary Science XXXV: Outer Solar System; 2004; 1 pp.; In English; See also 20040067905; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The main task of our job was finding the second harmonic in the strong absorption line of methane in the spectrum of Jupiter. The theoretical basic of appearance the second harmonic is in . We can see the deviation from average for Jupiter on the basic and double frequencies on the fig .1. There you can see some place with appearance second harmonic. We find

existence double harmonic in the strong absorption lines of methane in the Jupiter s spectrum, when we worked up observation data with our program. This effect account must be taken of determine optical parameters of gas-aerosol and chemical composition of planet's atmosphere.
Derived from text
Jupiter Atmosphere; Line Spectra; Atmospheric Composition

20040067912 Lunar and Planetary Inst., Houston, TX, USA
Lunar and Planetary Science XXXV: Presolar Grains
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040067913 - 20040067913
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM
The session Presolar Grains includes the topic: On the Variations of the Elemental Composition of the P3 Component in Presolar Diamonds.
Derived from text
Planetary Geology; Granular Materials; Chemical Composition

20040067913 Academy of Sciences (Russia), Moscow, Russia
On the Variations of the Elemental Composition of the P3 Component in Presolar Diamonds
Fisenko, A. V.; Verchovsky, A. B.; Semjonova, L. F.; Wright, I. P.; Pillinger, C. T.; Lunar and Planetary Science XXXV: Presolar Grains; 2004; 2 pp.; In English; See also 20040067912; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document
In the present study we focus mostly on the effects of parent body thermal metamorphism on variations of the elemental composition of P3 noble gases and the corresponding variations in release characteristics of the noble gases. In particular we analyse element variations in the low (less than 800 C) and high (greater than 800 C) temperature parts of the P3 gases (labeled below as P3-L and P3-H respectively), released during stepped pyrolysis. This aspect of P3 noble gases behavior in presolar diamonds has not been analysed in detail so far.
Derived from text
Chemical Composition; Diamonds; Rare Gases; Metamorphism (Geology); Meteorites

20040068004 Lunar and Planetary Inst., Houston, TX, USA
Lunar and Planetary Science XXXV: Planetary Formation and Early Evolution
2004; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; See also 20040068005 - 20040068006
Contract(s)/Grant(s): NCC5-679
Report No.(s): LPI-Contrib-1197; Copyright; Avail: CASI; C01, CD-ROM
The titles in this section include: 1) Thorium Anomalies in the NW Quadrant of the South Pole-Aitken Basin; 2) A Thermodynamic Regularities of Evaporation Processes of CMAS Compounds.
Author
Planetary Evolution; Lunar Composition; Thermodynamics

20040068005 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Thorium Anomalies in the NW Quadrant of the South Pole-Aitken Basin
Haskin, Larry A.; McKinnon, William B.; Benner, Lance A. M.; Jolliff, Bradley L.; Lunar and Planetary Science XXXV: Planetary Formation and Early Evolution; 2004; 2 pp.; In English; See also 20040068004; Original contains color illustrations
Contract(s)/Grant(s): NAG5-10485; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document
The relatively high concentrations of Th near the Imbrium antipode in the South Pole-Aitken (SPA) basin might represent Imbrium ejecta, a consequence of convergence of Th-rich material ejected by the Imbrium impact that occurred in the Th-rich Procellarum KREEP Terrane. Here, we present landing positions for 7500 fragments ejected from Imbrium obtained by three-body (Earth-Moon-fragment) numerical integration for uniformly selected azimuthal launch positions, ejection angles of 45 deg, and velocities from 0.95 to 0.99 lunar escape. This provides an estimate of the density of infalling ejecta fragments

to be expected in the vicinity of the Imbrium antipode. Similar calculations for 35 and 50 deg leave large empty regions surrounding the antipode.
Derived from text
Lunar Composition; Structural Basins; Thorium; Abundance; Ejecta; Lunar Craters

20040068094 California Inst. of Tech., Pasadena, CA, USA
Implications of Martian North/South Polar Differences
Murray, Bruce C.; [2003]; 3 pp.; In English
Contract(s)/Grant(s): NAG5-9606
Report No.(s): CIT-BCM.00004-1-NASA.000037; No Copyright; Avail: CASI; A01, Hardcopy

Our first requirement was to create the specialized tools necessary to precisely co-locate at highest spatial resolution the rapidly growing MOC/NA and MOLA data sets in the polar regions. This meant promptly creating a very accurate Mars Polar GIs system (based on the commercial ArcView product) along with various other supporting routines. Later we extended its use to the THEMIS/VIS data. That customized GIS and integrated data system has enabled all of our polar research to date. We focused initially on a preliminary geological reconnaissance in the Ultimi Lobe region of the South Polar Layered Deposits, which also included the intended MPL landing site about which much remote sensing data and interpretations had been accumulated before the failed landing attempt on December 3, 1999. The most interesting findings from that effort were discoveries about the layering, faulting and contact relationships exposed along the bounding scarp. Those results were published in Icarus. We have had a priority interest in the cratering record of the polar layered deposits, starting with the first post-Viking survey based on MOLA shaded relief maps and crossing profiles. Those results, based primarily on craters < 1 km diameter, were published in JGR and showed that a portion of the SPLD exhibited a large crater population consistent with an exposure age of 30 million years or more. Those craters also exhibited remarkably low Depth to Diameter ratios, which Asmin Pathare, then at UCLA, subsequently interpreted as due to slow viscous flow in the ice-rich material composing the PLD. Our cratering study also recognized that the craters of less than 1 km diameter were many order of magnitudes too few compared to what the crater production function of the larger craters requires.
Derived from text
Mars (Planet); Polar Caps; Geographic Information Systems

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SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots. For related information see *93 Space Radiation*.

20040065812 Centre de Spectrometrie Nucleaire et de Spectrometrie de Masse, Orsay, France
AMS Measurement of Mg-24(He-3,p)Al-26 Cross Section, Implications for the Al-26 Production in the Early Solar System
Fitoussi, C.; Duprat, J.; Kiener, J.; Tatischeff, V.; Gounelle, M.; Raisbeck, G.; Engrand, C.; Assuncao, M.; Coc, A.; Lefebvre, A., et al.; Lunar and Planetary Science XXXV: Early Solar System Chronology; 2004; 2 pp.; In English; See also 20040065806; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Numerous studies indicate that nuclei with half-life of about 1 Ma (26Al, 41Ca, 53Mn,..) were present in abundances well above the galactic mean values in the early solar system. The nucleosynthesis of such short life radioactivities (SLR) is a matter of debate between a "last minute" stellar source and an "in situ" irradiation scenarios. Witin the framework of the xwind model, it was calculated SLR production at short distance from the protosun by irradiation of p, and 3He on rocks of solar composition. Within this approach, a large porportion of 3He (2He/p=1.4) is necessary to explain the observed canonical ratio of 26Al,/27Al = 5x10-5 and these authors pointed out that such a high 3He flux would overproduce 41CA by a factor of 100. Gounelle calculated a core-mantle model for the irradiated rocks where the main target for 41Ca production (40Ca) is trapped in a refratory core and shielded from the irradiation by a Fe-Mg mantle. With such an hypothesis andusing a 3He/p=0.3 ratio, the canonical values of the SLR mentioned above and of the more recently discovered 10Be can be reproduced. In these two approaches, the 3He channels are playing a crucial role but many of the related cross sections have to be deduced from theoretical calculations since little experimental data exist on such reactions. In more thatn 90 percent of the 26Al is made via 3He reactions, the main channel being 24Mg (3He,p)26Al. Because it is endothermic, this reaction is expected to have a large contribution at low energy (~2MeV/A). We performed a two fold experiment in order to measure the

excitation function of 24Mg (3He, p)26Al(5+,1/2=0.716 Myrs) over the full energy range of interest.
Author
Aluminum Isotopes; Solar System; Endothermic Reactions; Irradiation; Radioactivity; Cross Sections

20040065853 NASA Marshall Space Flight Center, Huntsville, AL, USA
Evidence for Gradual External Reconnection Before Explosive Eruption of a Solar Filament
Sterling, Alphonse C.; Moore, Ronald L.; The Astrophysical Journal; January 1, 2004; Volume 602, pp. 1024-1036; In English; Copyright; Avail: Other Sources

We observe a slowly evolving quiet-region solar eruption of 1999 April 18, using extreme-ultraviolet (EUV) images from the EUV Imaging Telescope (EIT) on the Solar and Heliospheric Observatory (SOHO) and soft X-ray images from the Soft X-ray Telescope (SXT) on Yohkoh. Using difference images, in which an early image is subtracted from later images, we examine dimmings and brightenings in the region for evidence of the eruption mechanism. A filament rose slowly at about 1 km/s for 6 hours before being rapidly ejected at about 16 km/s leaving flare brightenings and postflare loops in its wake. Magnetograms from the Michelson Doppler Imager (MDI) on SOHO show that the eruption occurred in a large quadrupolar magnetic region with the filament located on the neutral line of the quadrupole s central inner lobe between the inner two of the four polarity domains. In step with the slow rise, subtle EIT dimmings commence and gradually increase over the two polarity domains on one side of the filament, i.e., in some of the loops of one of the two sidelobes of the quadrupole. Concurrently, soft X-ray brightenings gradually increase in both sidelobes. Both of these effects suggest heating in the sidelobe magnetic arcades. which gradually increase over several hours before the fast eruption. Also, during the slow pre- eruption phase, SXT dimmings gradually increase in the feet and legs of the central lobe, indicating expansion of the central-lobe magnetic arcade enveloping the filament. During the rapid ejection. these dimmings rapidly grow in darkness and in area, especially in the ends of the sigmoid field that erupts with the filament. and flare brightenings begin underneath the fast-moving but still low-altitude filament. We consider two models for explaining the eruption: "breakout. which says that reconnection occurs high above the filament prior to eruption, and tether cutting, which says that the eruption is unleashed by reconnection beneath the filament. The pre-eruption evolution is consistent with gradual breakout that led to (and perhaps caused) the fast eruption. Tether-cutting reconnection below the filament begins early in the rapid ejection. but our data are not complete enough to determine whether this reconnection began early enough to be the cause of the fast-phase onset. Thus, our observations are consistent with gradual breakout reconnection causing the long slow rise of the filament, but allow the cause of the sudden onset of the explosive fast phase to be either a jump in the breakout reconnection rate or the onset of runaway tether-cutting reconnection. or both.
Author
Sun; Solar Corona; Solar Flares; Solar Storms; Solar Prominences

20040066053 Moen (Alan), Angelbachtal, Germany
Light Pattern and Intensity Analysis of Gray Spots Surrounding Polar Dunes on Mars
Moen, Alan; Lunar and Planetary Science XXXV: Mars; 2004; 2 pp.; In English; See also 20040066050; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The NASA Mars Global Surveyor (MGS) Mars Orbital Camera (MOC) has captured many images of polar dunes with spots visible around the base. This study uses properties of light and shadow to analyze spot pattern and intensity in order to show that the spots are shadows cast by mound-like features on the planet's surface. Fourteen MGS MOC images were used in this study. They comprise a surface area of 698 square kilometers and contain an estimated 11,100 spots. Although the mounds are not directly observable in most images, various aspects of the mounds can be determined indirectly through the use of five methods of analysis: 1) Orientation of spots to sun azimuth, 2) Shadow Length versus sun inclination, 3) Shadow shape versus surface geometry, 4) Spot intensity comparison with known dune shadows, and 5) Shadow phase versus MOC view angle. Though difficult to imagine a process, whether chemical, geological, or biological, that can create mound-like features large enough to cause shadows visible from space, the measured data from seven MOC images indicate heights reaching 24.5 meters.
Derived from text
Dunes; Luminous Intensity; Polar Regions; Mars Global Surveyor; Surface Geometry; Mars Photographs

20040068075 NASA Marshall Space Flight Center, Huntsville, AL, USA

Accelerated Electrons in the LLBL as Observed by Interball on February 15, 1996

Vaisberg, O. L.; Avanov, L. A.; Smirnov, V. N.; Sauvaud, J-A.; Borodkova, N. L.; [2004]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

We analyze electron observations in the low latitude boundary layer (LLBL) with the Interball Tail satellite under a southward-duskward magnetosheath magnetic field. It is well known that the LLBL is characterized by bi-directional electron velocity distributions, which leads to an enhancement of the electron temperature. It is also well known that the electron temperature within the LLBL increases with a decrease of the LLBL number density. We found that the parallel electron velocity distribution changes self-consistently with varying number density. Namely, the shape of the parallel velocity distribution does not change in a log-log scale indicating that electron parallel velocities increase proportionately as the number density decreases. This suggests a possible role for the Fermi acceleration mechanism. We also discuss the LLBL topology that is provided by electron velocity distributions.

Author

Boundary Layers; Latitude; Electrons; Topology; Satellite Observation

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Includes aeronautical, astronautical, and space science related histories, biographies, and pertinent reports too broad for categorization; histories or broad overviews of NASA programs such as Apollo, Gemini, and Mercury spacecraft, Earth Resources Technology Satellite (ERTS), and Skylab; NASA appropriations hearings.

20040062465 General Accounting Office, Washington, DC

Nuclear Security: DOE Needs to Resolve Significant Issues Before It Fully Meets the New Design Basis Threat

Apr. 2004; 40 pp.; In English

Report No.(s): PB2004-104781; GAO-04-623; No Copyright; Avail: CASI; A03, Hardcopy

A successful terrorist attack on Department of Energy (DOE) sites containing nuclear weapons or the material used in nuclear weapons could have devastating consequences for the site and its surrounding communities. Because of these risks, DOE needs an effective safeguards and security program. A key component of an effective program is the design basis threat (DBT), a classified document that identifies the potential size and capabilities of terrorist forces. The terrorist attacks of September 11, 2001, rendered the then-current DBT obsolete. GAO examined DOE's response to the September 11, 2001, terrorist attacks, identified why DOE took almost 2 years to develop a new DBT, analyzed the higher threat in the new DBT, and identified the remaining issues that need to be resolved in order for DOE to meet the threat contained in the new DBT.

NTIS

Nuclear Weapons; Effectiveness

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