



Tuesday 18 February 2014

- 08:30 Registration
09:30 Welcome Introduction and Scope of the Workshop
09:45 Opening Address

Session 1: Opening Session

- 09:55 Priorities for Lunar Sample Return and Implications for Future Missions
Carpenter, J.¹; Anand, M.²; Chaussidon, M.³; Cloutis, E.⁴; Crawford, I.⁵; de Vera, J.-P.⁶; Finzi, A.⁷; Jaumann, R.⁸; Kring, D.⁸; Mitrofanov, I.⁹; Tranfield, E.¹⁰
¹ESA ESTEC, NETHERLANDS; ²Planetary and Space Sciences, The Open University, UNITED KINGDOM; ³CNRS, FRANCE; ⁴University of Winnipeg, CANADA; ⁵Birkbeck College, University of London, UNITED KINGDOM; ⁶DLR, Institute for Planetary Science, GERMANY; ⁷Politecnico di Milano, ITALY; ⁸Lunar and Planetary Institute, UNITED STATES; ⁹Space Research Institute (IKI) of the Russian Academy of Science, RUSSIAN FEDERATION; ¹⁰Instituto Gulbenkian de Ciência, PORTUGAL
- 10:10 Lunar Sample Return: An Exploration Milestone for the European Space Agency
Patti, B.; Carpenter, J.; Fisackerly, R.; Houdou, B.
ESA, NETHERLANDS
- 10:25 Studies of Lunar South Pole by Russian Landing Missions "Luna-Glob", "Luna-Resurs" and "Luna-Grunt"
Mitrofanov, I.¹; Dolgoplov, V.²; Khartov, V.²; Lukjanchikov, A.²; Zelenyi, L.¹
¹Institute for Space Research of Russian Academy of Science, RUSSIAN FEDERATION; ²Lavochkin Science and Industry Association, RUSSIAN FEDERATION;
- 10:40 Enabling Solar System Exploration through Lunar Sample Return
Neal, C.R.¹; Shearer, C.K.²; Pleascia, J.³; Mackwell, S.⁴; Lawrence, S.⁵; Carpenter, J.⁶
¹University of Notre Dame, UNITED STATES; ²University of New Mexico, UNITED STATES; ³Johns Hopkins Univ. Applied Physics Laboratory, UNITED STATES; ⁴Lunar and Planetary Institute, Houston, UNITED STATES; ⁵Arizona State University, UNITED STATES; ⁶ESA-ESTEC, NETHERLANDS
- 10:55 "NASA's Solar System Exploration Research Virtual Institute"--International Partnerships in Lunar Science
Schmidt, G.; Daou, D.
NASA Solar System Exploration Research Virtual Institute, UNITED STATES
- 11:10 COSPAR/ILEWG Report: Science Cases and Technical Challenges for Lunar Sample Return Missions
Foing, B.H.
ESA/ESTEC, ILEWG & VU Amsterdam, NETHERLANDS
- 11:25 Coffee Break

Session 2: The Science of Lunar Samples

- 11:45 Lunar Sample Return: Essential Ingredient for Improved Moon Formation Models
van Westrenen, W.
VU University Amsterdam, NETHERLANDS
- 12:00 Isotopic Constraints on the Origin and Evolution of the Moon
Kleine, T.
Institut für Planetologie, Westfälische Wilhelms-Universität Münster, GERMANY
- 12:15 Bombardment History of Moon, Mars and Mercury in the Light of Modern Models
Werner, Stephanie C.
CEED / University of Oslo, NORWAY
- 12:30 Lunar Sample Return - Chances for Improving the Lunar Chronology
Hiesinger, H.; van der Bogert, C.
Institut für Planetologie, Westfälische Wilhelms-Universität Münster, GERMANY



- 12:45 In-situ U-Pb Dating of Planetary Materials using the NanoSIMS 50 Ion Microprobe
Tartese, R.¹; Anand, M.¹; Delhaye, T.²
¹The Open University, UNITED KINGDOM; ²University de Rennes 1, FRANCE
- 13:00 Lunar Samples Returned by the Apollo Missions as Ground Truth for Thermal Emission Measurements made by the Diviner Radiometer.
Bowles, N.¹; Thomas, I.¹; Donaldson Hanna, K.¹; Greenhagen, B.²; Warren, T.¹; Zhang, W.¹
¹University of Oxford, UNITED KINGDOM; ²Jet Propulsion Laboratory/California Inst. Tech., UNITED STATES
- 13:15 Lunch Break
- 14:15 Formation of The Building Blocks of Life Via Icy Impacts
Martins, Z.¹; Price, M. C.²
¹Imperial College London, Department of Earth Science and Engineering, UNITED KINGDOM; ²School of Physical Sciences, University of Kent, UNITED KINGDOM
- 14:30 Lunar Soil as an Intermediate Agent in Photochemistry of Nucleic Acid and Protein Monomers in Bion10M Space Missions
Gontareva, N. B.; Kuzicheva, Evgenia
Institute of cytology, RUSSIAN FEDERATION
- 14:45 Lunar Dust Toxicity: Requirements for Lunar Dust Sample Return in Preparation for Future Human Exploration of the Moon
Tranfield, E.M.¹; Linnarsson, D.²; Carpenter, J.³; Fubini, B.⁴; Gerde, P.⁵; Loftus, D.⁶; Prisk, G.K.⁷; Staufer, U.⁸; Karlsson, L.⁵; van Westrenen, W.⁹
¹Instituto Gulbenkian de Ciência, PORTUGAL; ²Karolinska Institute, SWEDEN; ³ESA/ESTEC, NETHERLANDS; ⁴University of Torino, ITALY; ⁵Karolinska Institutet, SWEDEN; ⁶NASA-Ames Research Center, UNITED STATES; ⁷University of California, UNITED STATES; ⁸TU Delft, NETHERLANDS; ⁹VU University Amsterdam, NETHERLANDS
- 15:00 Lunar Volatiles - Analysing the Lunar Soil Grain by Grain.
Pillinger, C.T.; Greenwood, R.C.; Gibson, E.K.
Open University, UNITED KINGDOM
- 15:15 Mineral Surfaces in Lunar Soils: Archives of Lunar and Solar System History
Chaussidon, M
IPGP, FRANCE
- 15:30 An Assessment of Volatile Inventory of the Moon through Analyses of Returned Lunar Samples using a Multi-Proxy Approach
Anand, M.; Tartèse, R.; Barnes, J.; Mortimer, J.; Potts, N.
Open University, UNITED KINGDOM
- 15:45 The Moon as an Archive of Small Body Migration in the Solar System
Joy, K H.¹; Zolensky, M.²; Fagan, A.³; Crawford, I A.⁴; Kring, D A.³
¹University of Manchester, UNITED KINGDOM; ²ARES, NASA-JSC, UNITED STATES; ³LPI, UNITED STATES; ⁴Birkbeck, UNITED KINGDOM
- 16:00 The Lunar Geological Record as an Archive of the Galactic Environment of the Solar System
Crawford, I.¹; Fagents, S.²; Joy, K.³; Rumpf, M.²
¹Birkbeck College, UNITED KINGDOM; ²University of Hawaii, UNITED STATES; ³University of Manchester, UNITED KINGDOM
- 16:15 Coffee Break



Session 3: Life in Extreme Environments

- 16:30 Sample return and the implications for biological experiments on the Moon
de Vera, J.P.P.
German Aerospace Center (DLR) / Institute of Planetary Research, GERMANY
- 16:45 Astrobiological Interest and Considerations of a Lunar Sample Return Mission
Leuko, S.; Möller, R.; Panitz, C.; Rabbow, E.; Rettberg, P.
German Aerospace Centre (DLR e.V.), GERMANY
- 17:00 Limits of life - Deep space exposure of lichens and their bacterial communities as part of the Lunar Polar Sample Return Mission
Brandt, A.¹; Meessen, J.²
¹Heinrich-Heine-University, GERMANY; ²Heinrich-Heine-University, Institute of Botany, GERMANY
- 17:15 Cyanobacteria in Support of Human Lunar Bases. Why? How?
Verseux, C.^{1,3}; Baqué, M.¹; de Vera, J.-P.²; Rothschild³, L.; Billi, D.¹
¹University Tor Vergata, Rome, ITALY; ²German Aerospace Center, Institute of Planetary Research, Berlin, GERMANY; ³NASA Ames Research Center, Moffet Field, California, UNITED STATES
- 17:30 **Poster Session and Welcome Drink**
- 19:30 End of Day 1



Wednesday 19 February 2014

08:30 Registration

Session 4: Missions and Sample Curation

- 09:00 Lunar Sample Return Mission to Polar Regions - Interferences Between Scientific Goals, Science Instruments and Technical Possibilities for Operational on Surface
Tretyakov, V.I.¹; Dolgoplov, V.P.²; Lukiyanichikov, A.V.²; Mitrofanov, I.G.¹
¹RAS, RUSSIAN FEDERATION; ²Lavochkin Space Association, RUSSIAN FEDERATION
- 09:15 MoonRise: A South Pole-Aitken Basin Sample Return Mission Concept
Jolliff, B.¹; Shearer, C.²; Papanastassiou, D.³; Alkalai, L.³; Swindle, T.⁴; Jaumann, R.⁵; Osinski, G.⁶
¹Washington University in St. Louis, UNITED STATES; ²University of New Mexico, UNITED STATES; ³Jet Propulsion Laboratory, UNITED STATES; ⁴University of Arizona, UNITED STATES; ⁵DLR, GERMANY; ⁶University of Western Ontario, CANADA
- 09:30 MoonRise: Advancing our Understanding of Planetary Differentiation through a South Pole-Aitken Basin Sample Return Mission.
Shearer, C.¹; Jolliff, B.²; Borg, L.³; Warren, P.⁴; Taylor, J.⁵; Cohen, B.⁶; Norman, M.⁷; Jacobsen, S.⁸
¹Institute of Meteoritics, UNITED STATES; ²Washington University, UNITED STATES; ³Lawrence Livermore National Laboratory, UNITED STATES; ⁴UCLA, UNITED STATES; ⁵University of Hawaii, UNITED STATES; ⁶NASA Marshall Space Flight Center, UNITED STATES; ⁷Australian National University, AUSTRALIA; ⁸Harvard University, UNITED STATES
- 09:45 Human-assisted Lunar Sample Return from the Schrödinger and South Pole-Aitken Basins using the Orion Spacecraft
Kring, D.¹; Hopkins, J.²
¹USRA - LPI, UNITED STATES; ²Lockheed Martin Space Systems, UNITED STATES
- 10:00 The Utilization of the Orion Exploration Vehicle as a Platform for a Lunar South Pole Sample Return Mission
Pratt, W.; Hopkins, J.
Lockheed Martin Space Systems Company, UNITED STATES
- 10:15 Amundsen Crater: A High-Priority Lunar Landing Site for In Situ and Sample Return Studies of Polar Volatiles
Blair, D.¹; Lemelin, M.²; Roberts, C.³; Runyon, K.⁴; Nowka, D.⁵; Paige, D.⁶; Kring, D.⁷
¹Purdue University, UNITED STATES; ²University of Hawaii at Manoa, UNITED STATES; ³State University of New York University at Buffalo, UNITED STATES; ⁴Johns Hopkins University, UNITED STATES; ⁵Museum für Naturkunde, GERMANY; ⁶University of California, Los Angeles, UNITED STATES; ⁷Lunar and Planetary Institute, UNITED STATES
- 10:30 Robotic Traverse and Sample Return Strategies for a Lunar Farside Mission to Schrödinger Basin
Potts, N.J.¹; Gullikson, A.²; Curran, N.³; Dhaliwal, J.K.⁴; Leader, M.K.⁵; Rege, R.N.⁶; Kring, D.A.⁷
¹The Open University, UNITED KINGDOM; ²School of Earth Sciences and Environmental Sustainability, Northern Arizona University, UNITED STATES; ³School of Earth, Atmospheric and Environmental Sciences, University of Manchester, UNITED KINGDOM; ⁴Scripps Institute of Oceanography, UC San Diego, UNITED STATES; ⁵Cockrell School of Engineering, The University of Texas, UNITED STATES; ⁶School of Engineering and Applied Sciences, Columbia University, UNITED STATES; ⁷Center for Science and Exploration, USRA-Lunar and Planetary Institute, UNITED STATES
- 10:45 Coffee Break
- 11:00 The Past, Present, and Future Curation of the Apollo Sample Suite
Zeigler, R.
NASA, UNITED STATES
- 11:15 Concept for a Lunar and Asteroid Receiving Facility (LaARF)
Vrublevskis, J.B.¹; Berthoud, L.¹; Schroeven-Deceuninck, Hilde²; Guest, M.¹; Baker, R.³; Bridges, J.⁴; Crook, B.⁵; Grady, M.⁶; Pope, A.⁷; Sephton, M.⁸; Sims, M.⁴; Smith, C.⁹
¹Systems Engineering & Assessment Ltd., UNITED KINGDOM; ²European Space Agency, UNITED KINGDOM; ³STC, UNITED KINGDOM; ⁴University of Leicester, UNITED KINGDOM; ⁵Health & Safety Laboratories, UNITED KINGDOM; ⁶Open University, UNITED KINGDOM; ⁷M+W Group, UNITED KINGDOM; ⁸Imperial College London, UNITED KINGDOM; ⁹Natural History Museum, UNITED KINGDOM



- 11:30 European Curation Facility for Space Returned Samples
Brucato, J. R.
INAF - OAA, ITALY
- 11:45 Enabling Technologies for Robotic Sampling in Lunar Environment
Finzi E.A.; Di Lizia, P.
Politecnico di Milano, ITALY
- 12:00 Technologies for Automated Sample Handling and Sample Distribution on Planetary Landing Missions
Richter, L.; Hofmann, P.; Haarmann, R.
Kayser-Threde GmbH, GERMANY
- 12:15 Lunar Soil Sampling at Near Polar Conditions and Simulants of Regolith with High Content of Volatiles
Magnani, P.; Fumagalli, A.
Selex ES, ITALY
- 12:30 MoonRise: Mission Concept, Sample Acquisition and Transfer System
Alkalai, L.
Jet Propulsion Laboratory (JPL), Caltech, UNITED STATES
- 12:45 Electromagnetic Penetrators for Newly-developed Sampling Device
Grygorczuk, J.¹; Kozlov, O.²; Wisniewski, L.¹; Kozlova, T.²; Dobrowolski, M.¹; Kedziora, B.¹; Tokarz, M.¹; Krasowski, J.¹; Seweryn, K.¹; Banaszekiewicz, M.¹
¹Space Research Centre PAS, POLAND; ²Space Research Institute of the Russian Academy of Sciences, RUSSIAN FEDERATION
- 13:00 Autonomous Regolith Sampling on the Planetary Bodies – Tests Results from the CHOMIK Penetrator and Manipulator Arm Operation
Seweryn, K.¹; Kozlova, T.²; Grygorczuk, J.³; Kozlov, O.²; Banaszekiewicz, M.³; Wawrzaszek, R.³
¹Space Research Centre of the Polish Academy of Sciences (CBK PAN), POLAND; ²Space Research Institute of the Russian Academy of Sciences (IKI RAN), RUSSIAN FEDERATION; ³Space Research Centre of the Polish Academy of Sciences, POLAND
- 13:15 Lunch Break
- 14:15 Panel Discussion
- 15:10 Coffee Break

Session 5: Supporting Measurements

- 15:30 In-situ Analysis in Support of Lunar Sample Return
Barber, S. J.; Morse, A. D.; Wright, I. P.; TBD others, TBD others
The Open University, UNITED KINGDOM
- 15:45 Lunar Active Neutron Spectrometer (LANS) for on-board un-distractive Screening of Water-rich samples for Lunar Polar Sample Return Mission
Tretyakov, V.I.¹; Mitrofanov, I.G.²; Golovin, D.V.²; Barmakov, Yu.N.³; Bogolubov, E.P.³; Kozyrev, A.S.²; Kurdumov, I.G.³; Litvak, M.L.⁴; Malakhov, A.V.²; Mokrousov, M.I.²; Ryzhkov, V.I.³; Sanin, A.B.²; Schatzkij, G.V.³
¹IKI, RUSSIAN FEDERATION; ²Space Research Institute Russian Academy of Sciences, RUSSIAN FEDERATION; ³All-Russia Research Institute of Automatics, RUSSIAN FEDERATION; ⁴1) Space Research Institute Russian Academy of Sciences, RUSSIAN FEDERATION
- 16:00 Dust-Impact Analyzer PmL for Luna Sample Return mission
Dolnikov, G.¹; Zakharov, A.²; Lyash, A.²; Kuznetsov, I.²; Shashkova, I.²
¹RAS Space Research Institute, RUSSIAN FEDERATION; ²RAS, RUSSIAN FEDERATION
- 16:15 The Importance of in Situ Preanalysis of the Volatiles Composition in Lunar Soil Samples before their Delivery to the Earth
Gerasimov, M.V.¹; Szopa, C.²; Wurz, P.³; Cabane, M.²; Coll, P.⁴; Saggir, A.G.¹; Aseev, S.A.¹; Zaitsev, M.A.¹; Buch, A.⁵; Coscia, D.⁶ and the GAC team
¹IKI, RUSSIAN FEDERATION; ²LATMOS, Univ. Pierre et Marie Curie, Univ. Versailles Saint-Quentin & CNRS, FRANCE; Physikalisches Institut, University of Bern, SWITZERLAND; ⁴LISA, Univ. Paris-Est Créteil, Univ. Denis Diderot & CNRS, FRANCE; ⁵Ecole Centrale Paris; ⁶LATMOS, RUSSIAN FEDERATION



- 16:30 Laser Desorption Time-of-Flight Mass Spectrometers LASMA & ABIMAS
Managadze, G.¹; Wurz, P.²; Chumikov, A.¹; Luchnikov, K.¹
¹RAS Space Research Institute, RUSSIAN FEDERATION; ²University of Bern, SWITZERLAND
- 16:45 Low-Mass, Low-Energy Laser Induced Breakdown Spectroscopy for an In-Situ Mission to the Moon
Hübers, H.-W.¹; Pavlov, S. G.¹; Böttger, U.¹; Jessberger, E. K. J.²; Neumann, J.³; Henkel, H.⁴
¹German Aerospace Centre (DLR), GERMANY; ²Westfälische Wilhelms-Universität Münster, GERMANY; ³Laser Zentrum Hannover, GERMANY; ⁴von Hoerner & Sulger GmbH, GERMANY
- 17:00 Closing

Posters

In Situ PYRO-GC-MS Chemical Analysis of Lunar Soil : a Ground Truth to Interpret the Analysis the Samples Returned from the Moon

Szopa, C.¹; Gerasimov, M.²; Wurz, P.³; Hofer, L.³; Cabane, M.¹; Coll, P.⁴; Buch, A.⁵; Sapgir, A.G.²; Aseev, S.A.²; Zaitsev, M.A.²; Coscia, D.¹; and the GAC team,⁶

¹Université de Versailles Saint Quentin, FRANCE; ²IKI, RUSSIAN FEDERATION; ³University of Bern, SWITZERLAND; ⁴LISA, Univ. Paris-Est Créteil, Univ. Denis Diderot & CNRS, FRANCE; ⁵École Centrale Paris, FRANCE; ⁶

Developing a Special Photogrammetry Software, Simulating Illumination Techniques and GIS Analysis Methods for Lunar Landing Site

Kokhanov, A.¹; Zubarev, A.¹; Kozlova, N.¹; Patraty, V.¹; Karachevtseva, I.¹; Kreslavsky, M.²

¹Moscow State University of Geodesy and Cartography (MIIGAiK), MIIGAiK Extraterrestrial Laboratory, RUSSIAN FEDERATION; ²University of California - Santa Cruz, UNITED STATES

ISSI Team: Updating the Lunar Chronology and Stratigraphy

Assis Fernandes, V.^{1,2,3}; Alibert, Y.⁴; Artemieva, N.⁵; Fritz, J.¹; Jutzi, M.⁴; Werner, S. C.²

¹Museum für Naturkunde-Berlin, Leibniz-Institut für Evolutions- und Biodiversitätsforschung, Germany; ²Centre for Earth Evolution and Dynamics, University of Oslo, Norway; ³UNINOVA, Nova University, Lisbon, Portugal; ⁴Institute of Physics, Univ. of Bern, Switzerland; ⁵Institute for Dynamics of Geospheres RAS, Moscow Russia; Planetary Science Institute, Tucson, U.S.A.

Harpoon-based Lunar Sample Return System

Laine, P.

University of Jyväskylä, FINLAND

Planetary X-Ray Fluorescence Spectrometer Package for In-Situ Analysis

Köhler, Eberhard; Fabel, Oliver; Dreißigacker, Anne; van Gasselt, Stephan
Freie Universität Berlin, GERMANY

Unravelling the History of the Lunar Regolith with Small Samples

Curran, N. M; Joy, K. H; Burgess, R.

University of Manchester, UNITED KINGDOM

Analysis, Test and Simulation of Landing System Touchdown Dynamics

Witte, L.; Buchwald, R.; Schroeder, S.; van Zoest, T.

German Aerospace Center (DLR), GERMANY

Dust Electrostatic Charging, Transport and Contamination for Lunar Lander and Human Exploration Missions

Cipriani, F.

Telespazio Vega UK Ltd for ESA, NETHERLANDS



Investigation of Planetary Processes using Noble Gases in Lunar Samples

Katherine, H.¹; Burgess, R.²; Clay, P.²; Gilmour, J.²; Curran, N.²; McDonald, F.²; Crowther, S.²; Ruzie, L.²; Busemann, H.²; Turner, G.²
¹University of Manchester, UNITED KINGDOM; ²SEAES, University of Manchester, UNITED KINGDOM

Calibration of the Raman Technique to Determine Water Contents in Lunar Silicate Glasses

Colin, A.P.¹; Nichols, A.R.L.²; Rai, N.¹; Hooijschuur, J.H.¹; Davies, G.R.¹; van Westrenen, W.¹
¹VU University Amsterdam, NETHERLANDS; ²IFREE, JAMSTEC, Yokosuka, JAPAN

Shocked Anorthosite: Puzzling over its Whereabouts

Donaldson Hanna, K.¹; Cheek, L.²; Bowles, N.¹; Pieters, C.³
¹University of Oxford, UNITED KINGDOM; ²University of Maryland, UNITED STATES; ³Brown University, UNITED STATES

Viable Cells in Iron-containing Bacterial Biofilms - Consequences for the use in a Lunar Exposure Experiment

Feyh, N.¹; de Vera, J.-P.²; Szewzyk, U.¹
¹Environmental Microbiology, Institute of Environmental Technology, TU Berlin, GERMANY; ²Institute of Planetary Research, DLR, German Aerospace Centre Berlin, GERMANY

Destinations for Sampling Impact Melt Produced During the Impact at the South Pole - Aitken Basin

Hurwitz, D.M.; Kring, D.A.
Lunar and Planetary Institute, UNITED STATES

Separation of Asteroid Material From Lunar Regolith

Faber, D.; Covey, S.
Deep Space Industries, UNITED STATES

Powering a Solar Lunar Lander via an Orbiting Satellite

Stenzel, Ch.; Kossagk, M.; Diedrich, Th.
Astrium GmbH, GERMANY

Superorbital Re-entry Analysis in the X2 Expansion Tunnel

Fahy, E.¹; Morgan, R.¹; Buttsworth, D.²
¹The University of Queensland, AUSTRALIA; ²The University of Southern Queensland, AUSTRALIA

Landing Dispersion Analysis for Hazard Avoidance Capable Flight Systems

Witte, L.
German Aerospace Center (DLR), GERMANY

Systematic Reutilization of Components from Descent Stage Subsystems in Lunar Landers

Afonso Ribeiro, D.¹; McKenna-Lawlor, S.²; Bouchpan-Lerust-Juéry, L.³
¹Aedel Aerospace, PORTUGAL; ²Space Technology Ireland, Ltd., IRELAND; ³Aedel Aerospace, SWITZERLAND

Remote Grain Size Determination of the Lunar Regolith

Gundlach, B.
Institut für Geophysik und extraterrestrischer Physik; TU Braunschweig, GERMANY

Lunar Dust-Plasma Environment in Kinetic Models

Kallio, E.¹; Alho, M.²; Alvarez, F.³; Barabash, S.⁴; Dyadechkin, S.⁵; Fernandes, V. A.⁶; Futaana, Y.⁴; Harri, A-M.²; Haunila, T.²; Heilimo, J.²; Holmström, M.⁴; Jarvinen, R.²; Lue, C.⁴; Makela, J.⁷; Porjo, N.⁸; Schmidt, W.²; Fatemi, S.⁴; Siili, T.²; Wurz, P.⁹
¹Finnish Meteorological Institute and Aalto University, FINLAND; ²Finnish Meteorological Institute, FINLAND; ³Arquimea Ingeniería, SPAIN; ⁴Swedish Institute of Space Physics, SWEDEN; ⁵Aalto University, FINLAND; ⁶University of Bern, SWITZERLAND, and Museum für Naturkunde, GERMANY; ⁷University of Jyväskylä, FINLAND; ⁸University of Turku, FINLAND; ⁹University of Bern, SWITZERLAND



Lunar Energetic Particle Monitor and Dosimeter

McKenna-Lawlor, S.¹; Kecskemeti, K.²; Hirn, A.²; Kudela, B.³

¹Space Technology Ireland, Ltd., IRELAND; ²Wigner Institute for Particle and Nuclear Physics, HUNGARY; ³Institute of Experimental Physics, SLOVAKIA

Are we ready for Lunar Magnetometry?

Diaz Michelena, M.

INTA, SPAIN

Electromagnetic Waves Diagnostics as a Tool for Monitoring Moon and Near Earth's Space Environment

Rothkaehl, H.¹; Mogilevsky, M.²; Skalsky, A.²; Atamaniuk, B.³; Morawski, M.³

¹Space Research Center PAS, POLAND; ²Space Research Institute RAS, RUSSIAN FEDERATION; ³SRC PAS, POLAND

The Radiation Environment on Moon and Implications for Human Missions

Berger, T.; Matthiä, D.; Reitz, G.

German Aerospace Center, GERMANY

A Lunar Laser Ranging Retroreflector Array for the 21st Century: History, Science, Status, Apollo Simulation and Future

Currie, D.; Dell'Agnello, S.; Delle Monache, G.O.; Behr, B.; Zacny, K.

University of Maryland, UNITED STATES

Orion/MoonRise: A Human/Robotic Approach to the return of samples from the South Pole-Aitken Basin

Alkalaj, L.

Jet Propulsion Laboratory (JPL), Caltech, UNITED STATES

CubeSats as Innovative Science Platforms for Lunar and Deep Space Exploration

Elsaesser, A.¹; Ricco, A. J.²; Quinn, R.²; Ehrenfreund, P.¹

¹Leiden Institute of Chemistry, NETHERLANDS; ²NASA Ames Research Center, UNITED STATES

In-situ Viscometry of Lunar Magmas at High Pressure and High Temperature

Raj, N.¹; Perrillat, J-P.²; Mezouar, M.³; Petitgirard, S.⁴; Colin, A.¹; van Westrenen, W.¹

¹VU University, Amsterdam, NETHERLANDS; ²Université Claude Bernard Lyon 1, Lyon, FRANCE; ³European Synchrotron Radiation Facility, Grenoble, FRANCE; ⁴Bayerisches Geoinstitut, Bayreuth, GERMANY

Scientific Benefits, Including Enhanced Sample Acquisition, Facilitated by Renewed Human Operations on the Lunar Surface

Crawford, I

Birkbeck College, UNITED KINGDOM

Enabling Science Objectives and Goals in the LEAG Lunar Exploration Roadmap through Sample Return.

Shearer, C.¹; Neal, C.²; Plescia, J.³; Mackwell, S.⁴; Lawrence, S.⁵; Carpenter, J.⁶

¹Institute of Meteoritics, UNITED STATES; ²University of Notre Dame, UNITED STATES; ³Applied Physics Laboratory, UNITED STATES; ⁴Lunar Planetary Institute, UNITED STATES; ⁵Arizona State University, UNITED STATES; ⁶ESA ESTEC, NETHERLANDS

Global Diversity of the Lunar Crust

Joy, K H.¹; Gross, J.²; Arai, T.³; Russell, S S.⁴

¹University of Manchester, UNITED KINGDOM; ²The American Museum of Natural History, Dept. of Earth and Planetary Sciences, UNITED STATES; ³Planetary Exploration Research Centre, Chiba Institute of Technology, JAPAN; ⁴The Natural History Museum, UNITED KINGDOM