

AGENDA

Lunar Surface Science Workshop Fundamental and Applied Lunar Surface Research in Physical Sciences August 18–19, 2021 Virtual

Times listed are Eastern Daylight Time (EDT).

Time Zone Converter

7:00 a.m. PDT
8:00 a.m. MDT
9:00 a.m. CDT
10:00 a.m. EDT
4:00 p.m. CEST

August 18, 2021

PLENARY TALKS DAY 1

Chair: Kevin Sato

Times (EDT)	Presenter	Title
10:00 a.m.	Craig Kundrot	Introduction and Welcome
10:05 a.m.	Lisa Carnell	Agenda, Goals, and Expectations for LSSW
10:10 a.m.	Fran Chiamonte	Physical Sciences Welcome
10:20 a.m.	Brad Carpenter	Fundamental Physics Welcome
10:30 a.m.	Krystyn J. Van Vliet	Biological and Physical Sciences Decadal Survey
10:50 a.m.	Julie Robinson	Artemis: Gateway, Lunar Surface, Orion
11:10 a.m.		BREAK
11:20 a.m.	Morgan Abney	Life Support and Thermal Management
11:40 a.m.	Gary Ruff	Materials Flammability and Habitat Fire Safety
12:00 p.m.	Corky Clinton	Lunar Research for Advanced Manufacturing
12:20 p.m.	Slava Turyshev	Fundamental Physics Research on the Lunar Surface
12:40 p.m.		BREAK

LIFE SUPPORT AND THERMAL MANAGEMENT

CONCURRENT SESSION 1

Chair: John McQuillen

Times (EDT)	Authors (*Denotes Presenter)	Title
12:50 p.m.	Broyan J. *	Lunar Life Support Overview (Invited)
1:00 p.m.	Morrison C. G. *	Commercial Radioisotope Solutions for Lunar Thermal Management, Watt Scale Electricity, and X-Ray Remote Sensing
1:10 p.m.	Henderson B. G. *	Thermal Gradients in the Near Surface of the Lunar Regolith
1:20 p.m.	Nastasi N. * Bope A. Horack J. Meyer M. E. Dannemiller K. C.	Interaction of Lunar Dust and International Space Station (ISS) Dust on Microbial Growth in Space Habitats
1:30 p.m.	McFarland A. J. * Elumalai A. Miller C. Mills D. K.	Next Generation Planetary Particulate Filter Systems

MATERIALS FLAMMABILITY AND HABITAT FIRE SAFETY**CONCURRENT SESSION 1****Chair: Dan Dietrich**

Times (EDT)	Authors (*Denotes Presenter)	Title
1:40 p.m.	Ferkul P. F. * Ya-Ting Liao Y. L. Gary Ruff G. R.	Fire on the Moon: Solid Fuel Combustion Experiments (Invited)
1:50 p.m.	Kingsley S. * Jones B. Xu Z. Saleh J. Orlando T. M.	Real Time Chemically Specific Monitoring and Predictive Analytics for On-Board Combustion Events
2:00 p.m.	T'ien J. S. *	Past Research on Material Flammability in Partial Gravity: A Review
2:10 p.m.		BREAK

LUNAR RESEARCH FOR ADVANCED MANUFACTURING**CONCURRENT SESSION 2****Chair: Mike Fiske**

Times (EDT)	Authors (*Denotes Presenter)	Title
12:50 p.m.	John Vickers *	In-Space Manufacturing (Invited)
1:00 p.m.	Jennifer Edmondson *	Construction Materials Development and Processing for ISRU (Invited)
1:10 p.m.	Mekalip L. M. Lynam J. G. *	Concentrating Urea from Simulated Urine for Use as a Plasticizer in Regolith-Based Cement
1:20 p.m.	McDuffie J. A. * Calvo R. B. Fuierer P. A.	Exploring the Mechanical Properties of Ceramic Coatings Made by Dry Aerosol Deposition of Lunar Regolith Simulant
1:30 p.m.	Easter P. * Long-Fox J. Peppin M. Landsman Z. Sipe C. Weber L. Metke A. Britt D.	Quantification and Comparison of Rheologic Properties of Simulated Agglutinates as a Component of Lunar Regolith Simulant
1:40 p.m.	Metke A. * Landsman Z. Long-Fox J. Perucci A. Easter P. Sipe C. Weber L. Britt D.	High-Fidelity Lunar Dust Simulants
1:50 p.m.		BREAK

FUNDAMENTAL PHYSICS RESEARCH ON THE LUNAR SURFACE**CONCURRENT SESSION 3****Chair: Slava Turyshev****Note: This session will continue without a breakout session.**

Times (EDT)	Authors (*Denotes Presenter)	Title
12:50 p.m.	Jan Harms *	Lunar Gravitational Wave Antenna (Invited)
1:05 p.m.	Collins C. J. * Metzler Z. Paik H. J.	Instrumenting the Moon as a Spherical Gravitational Wave Detector (Invited)
1:20 p.m.	Porcelli L. Dell'Agnello S. * Delle Monache G. Denni U. Filomena L. Mauro L. Mondaini C. Muccino M. Petrassi M. Rubino L. Salvatori L. Tibuzzi M. Bianco G. Vittori R.	MoonLIGHT + MPAC: Overview and Scientific Objectives
1:35 p.m.	Wilson J. T. * Lawrence D. J. Peplowski P. N.	Fundamental Physics with High-Heritage Neutron Sensors on the Lunar Surface

1:50 p.m.	Eubanks T. M. *	Time, Metrology, and Fundamental Physics on the Lunar Surface
2:05p.m.	Wurz P. * Riedo A. Grimaudo V. Keresztes Schmidt P. Lukmanov R. Tulej M.	Investigation of the Surface Composition by Laser Ablation/Ionization Mass Spectrometry
2:20 p.m.	Goel A. * Bandyopadhyay S. McGarey P. Rafizadeh R. Delapierre M. Arya M. Chahat N. E. Goldsmith P. F. Lazio J. Stoica A. Quadrelli M. Nesnas I. A. Hallinan G. W.	Ultra-Long Wavelength Radio Astronomy Using the Lunar Crater Radio Telescope (LCRT) on the Farside of the Moon
2:35 p.m.	van Belle G. T. * Hillsberry D.	A Uniquely Capable Yet Simple Optical Interferometer for Ultra-High-Resolution Astronomy from the Lunar Surface
2:50 p.m.		BREAK
3:00 p.m.	Ulf Israelsson	BPS Decadal Fundamental Physics White Paper Importance
		Discussion
4:00 p.m.		Wrap-Up and Adjourn

BREAKOUT SESSIONS DAY 1

Times (EDT)	Facilitators	Breakout Sessions
2:20 p.m.	John McQuillen Dan Dietrich Mike Fiske	Group A — Life Support and Thermal Management Group B — Materials Flammability and Habitat Fire Safety Group C — Lunar Research for Advanced Manufacturing
3:20 p.m.		BREAK
3:30 p.m.	John McQuillen Gary Ruff Mike Fiske	Group A — Life Support and Thermal Management Group B — Materials Flammability and Habitat Fire Safety Group C — Lunar Research for Advanced Manufacturing
4:30 p.m.		Adjourn

Lunar Surface Science Workshop
Fundamental and Applied Lunar Surface Research in Physical Sciences
August 19, 2021

PLENARY TALKS DAY 2

Chair: Lisa Carnell

Times (EDT)	Presenter	Title
10:00 a.m.	Lisa Carnell	Agenda, Goals, and Expectations for LSSW
10:05 a.m.	Harrison Schmitt	Keynote: Apollo Legacy
10:35 a.m.	David Carrier	Apollo Experience: Lunar Soil Properties
10:55 a.m.	Carle Pieters	Moon's Properties and Its Geology
11:15 a.m.	Kevin Cannon	Lunar Ice and Mapping
11:35 a.m.		BREAK
11:45 a.m.	Christine Hartzell	Lunar Dust and Plasma
12:05 p.m.	Jerry Sanders	In Situ Resource Utilization
12:25 p.m.	Zach Pirtle	Commercial Lunar Payload Services (CLPS)
12:45 p.m.	Tony Colaprete	VIPER
1:05 p.m.		BREAK

LUNAR DUST — PROPERTIES, BEHAVIOR, AND MITIGATION

CONCURRENT SESSION 1

Chair: Brad Carpenter

Times (EDT)	Authors (*Denotes Presenter)	Title
1:15 p.m.	Farr B. * Wang X. Goree J. Hahn I. Israelsson U. E. Horanyi M.	Electron Beam Dust Mitigation Method for Lunar Surface Exploration (Invited)
1:30 p.m.	Bellan P. *	Plasma Lunar Surface Probe (Invited)
1:45 p.m.	Mukhopadhyay K. * Brisset J. Beltran E. Crawford K. E.	Durable and Transparent Dust-Repellent Coatings for Space Applications
2:00 p.m.	Keaton T. D. * Dennison J. R.	Environmental Charging of Lunar Regolith: Electron Yield Measurements of Alumina Particulates
2:15 p.m.	Wang X. * Horanyi M. Hsu H.- W. Deca J. Sternovsky Z.	Investigation of Electrostatic Dust Charging and Lofting on the Lunar Surface
2:30 p.m.	Hirabayashi M. * Hyde T. W. Konopka U. Thomas H.	Dusty Physics on the Surface of the Moon
2:45 p.m.	Creel R. * Chang J. Hendrix D. Cadogan D. Cohen M. Rask J.	Apollo Dust Lessons Learned for Artemis
3:00 p.m.		BREAK

Chair: Christine Hartzell

Times (EDT)	Authors (*Denotes Presenter)	Title
3:10 p.m.	Horanyi M. * Benna M. Kempf S. Pokorny P. Sternovsky Z. Szalay J.	Lunar Meteoroid Monitor (LMM)
3:25 p.m.	Zakharov A. V. Kuznetsov I. A. * Bednyakov S. A. Bychkova A. S. Dolnikov G. G. Dubov A. E. Kartasheva A. A. Lyash A. N. Shashkova I. A. Shekhovtsova A. V.	Lunar Near-Surface Dusty Plasma Investigations with PmL Instrument of the "Luna-25" Mission
3:40 p.m.	Wohl C. J. Das L. *	Generation of Lunar Simulant Contaminated Surfaces to Evaluate Passive Dust Mitigation Materials
3:55 p.m.	Levine J. S. *	Lunar Dust: Some Knowledge Gaps
4:10 p.m.	Wood S. E. *	Non-Linear Depth-Dependence of Regolith Average Temperatures: Sensitivity to Regolith Properties and Implications for Buried Habitats and Volatile Resources
4:25 p.m.	Christine Hartzell	Previous Data and Plasma BPS Decadal White Paper Workshop
		Discussion
5:25 p.m.		Wrap-Up and Adjourn

LUNAR RESEARCH IN EXTRACTION, PROCESSING, AND HANDLING

CONCURRENT SESSION 2

Chair: Karen Daniels

Times (EDT)	Authors (*Denotes Presenter)	Title
1:15 p.m.	Karen Daniels *	Lunar Research in Extraction, Processing, and Handling (Invited)
1:25 p.m.	Walton O. R. *	Fine Particle Cohesion Affects Design and Performance of Lunar Regolith Processing and Handling Equipment
1:35 p.m.	Shulman H. S. * Howard C. Rickman D. L. Effinger M. R. LaPaglia J.	Exploration of Scalable Methods to Fabricate Synthetic Lunar Minerals for Engineered Regolith Simulants
1:45 p.m.	Liccardello G. * Jochum A. Zelon J.	High Temperature Vacuum Pyrolysis Approach for Processing Lunar Regolith

1:55 p.m.	Sperl M. * Kranz W. T. Coquand O.	Rheology for Dry Granular Media from First Principles
2:05 p.m.	Long-Fox J. M. * Easter P. B. Peppin M. Landsman Z. A. Britt D. T.	Statistical Examination of the Effects of Funnel Size on Mass Flow Rates of Lunar Regolith Simulants LHS-1 and LMS-1
2:15 p.m.	Purrington C. P. *	Volatile Extraction Through Rotatory Extraction Drums and Cold Trap Pressure Management on Excavated Regolith
2:25 p.m.	Just G. H. * Roy M. J. Joy K. H. Hutchings G. C. Smith K. L.	LES3 — Lunar Excavation and Size Separation System for the LUVMI-X Rover Platform
2:35 p.m.	Newbold T. N. II * Williams H. W. Grossman K. G. Petersen E. P. Bell E. B. Toro-Medina J. T.	Concentrated Solar Simulator for Molten Regolith Electrolysis
2:45 p.m.	Whittington A. G. * Parsapoor A.	Lower Cost Lunar Bricks: Energetics of Melting and Sintering Lunar Regolith Simulants
2:55 p.m.	Rahjoo M. * deMoraes R. Gaspari G. M.	Rock Engineering Appraisal on the Lunar Rocks
3:05 p.m.	Balasubramaniam R. * Kashani A. Grottenrath R. Johnson W.	Scaling of Liquefaction Systems and the Effects of Gravity
3:15 p.m.		BREAK

LUNAR ENVIRONMENT AND ITS EFFECTS ON MATERIALS

CONCURRENT SESSION 3

Chair: Miria Finckenor

Times (EDT)	Authors (*Denotes Presenter)	Title
1:15 p.m.	Sheila Thibeault *	Lunar Environment and Its Effects on Materials (Invited)
1:25 p.m.	Petro N. E. * Schmitt H. H. Horz F. Killen R. M. Saxena P. Morrisey L.	Understanding the Lunar Environment and Its Effects on Materials: Insights from Apollo 17's Long-Term Lunar Surface Exposure Experiment and Surveyor VII
1:35 p.m.	Tosi F. * Pettinelli E. Carli C. Massironi M. Pozzobon R. Rinaldi G. Fonte S. Orosei R. Mattei E. Cosciotti B. Franceschi M. Avanzinelli R. Casalini M. Pratesi G. Giacomini L. Zambon F.	MELODY: Moon multisensor and Laboratory Data analysis
1:45 p.m.	Seibers Z. D. * Ryan E. A. Schabile M. S. Shofner M. L. Reynolds J. R.	Design and Performance Considerations of Graphene-Laminated Thermoplastics for Electrically Conductive Applications on the Lunar Surface
1:55 p.m.	Wagner E. B. * Seyffert E. Shah S.	New Shepard as a Suborbital Lunar-g Testbed

EXTRACTION OF WATER-ICE FROM REGOLITH RESEARCH, INCLUDING SEPARATION, PURIFICATION, ELECTROLYSIS, AND LIQUEFACTION

CONCURRENT SESSION 3

Chair: Chris Henry

Times (EDT)	Authors (*Denotes Presenter)	Title
2:05 p.m.	Leslie Gertsch *	Extraction of Water-Ice from Regolith Research, Including Separation, Purification, Electrolysis, and Liquefaction (Invited)
2:15 p.m.	Zacny K. *	Planetary Volatiles Extractor (PVEx) for Science and ISRU Missions
2:25 p.m.	Vijapur S. H. * Hall T. D. Garich H. Inman M.	Ionic Liquid-Assisted Electrochemical Extraction of Oxygen from Lunar Regolith

	Nulwala H.	
2:35 p.m.	Danilovic N. * Weber A. Shepard S. P. Pandey A. Li Y.	High Efficiency, Self-Contained Vapor-Fed Unitized Regenerative Fuel Cells for Lunar Water ISRU
2:45 p.m.	Wisser M. D. Wette M. R. * Bedworth P. V. Shepard S. P.	Perforene®: A Robust, Highly Efficient Membrane Solution for Lunar Water Purification
2:55 p.m.		BREAK

BREAKOUT SESSIONS DAY 2

Times (EDT)	Facilitators	Breakout Sessions
3:25 p.m.	Suman Sinha Ray Miria Finckenor Eric Fox	Group A — Extraction of Water-Ice from Regolith Research, Including Separation, Purification, Electrolysis, and Liquefaction Group B — Lunar Environment and its Effects on Materials Group C — Lunar Research in Extraction, Processing, and Handling
4:25 p.m.		BREAK
4:35 p.m.	Suman Sinha Ray Miria Finckenor Eric Fox	Group A — Extraction of Water-Ice from Regolith Research, Including Separation, Purification, Electrolysis, and Liquefaction Group B — Lunar Environment and its Effects on Materials Group C — Lunar Research in Extraction, Processing, and Handling
5:35 p.m.		Adjourn

Lunar Surface Science Workshop
Fundamental and Applied Lunar Surface Research in Physical Sciences
Posters

Authors	Title
Life Support and Thermal Management	
Masoud A. Alakija F. Elumalai A. Mills DK.	Radiation Shielding Using Cerametal — Ceramic/Metal Nanoparticle Composites
Johnson P. A. Johnson J. C. Mardon A. A.	In-Situ Applications of Lunar Lava Tubes
Ektate S. E.	Moon Underground Human Astronaut Base for Safe Moon Exploration and Exploitation
Lunar Research for Advanced Manufacturing	
Voecks G. Barmatz M. Batres J.	Understanding Pretreatment Processes of Lunar Simulant to Assist in Defining Material Characterization
Own C. S. Thomas-Keprta K. T. Rahman Z. R. Clemett S. Martinez J. Morales Z. Koene R. A. Own L. S. Pettit D. R.	Applications of the Portable MOCHII Scanning Electron Microscope with Combination Energy Dispersive X-Ray and Raman Spectrometers to Applied Lunar Surface Research
Fundamental Physics Research on the Lunar Surface	
Zarkevich N. A.	Diversity of Energy Generation and Storage Methods on the Lunar Surface
Holma M. Kuusiniemi P. Joutsenvaara J. Tanaka H. K. M. Leone G.	Density Characterization of the Lunar Lava Tube Surroundings with Cosmic-Ray Based Muography Method
Mesa J. L. Díaz Michelena M. Maicas Ramos M. Sanz Lluch M. M. Pérez Jimenez M. Lavin García C. Aroca Hernández-Ros C.	Susceptometer for the In-Situ Determination of the Complex Magnetic Susceptibility of Lunar Rocks and Soil
Adhikari S. Marholm S. Eklund A. J. Bekkeng T. A. Clausen L. Miloch W. J. Almaeeni S. Els S.	Understanding Photo-Electron Sheath in Light of Langmuir Probe Data
Sengia T. Nagpal S. Yu N. Chaffin N. Binkley D. Mladenetz A. McTernan J. K. Bilén S. G.	Oasis: A Laser-Induced Breakdown Spectrometer Instrument for Finding Water in Permanently Shaded Regions on the Moon
Materials Flammability and Habitat Fire Safety	
Takahashi S. Kobayashi Y. Matsukawa N. Matsumoto K. Torikai H. Fujita O. Kikuchi M.	Flammability of Flat Solid Materials in Reduced Gravity Environment — FLARE/FLARE2, the ISS Orbital Experiment Projects
Fujita O. Hashimoto N. Konno Y. Guo F. Kawaguchi S. Kikuchi M.	Contribution of FLARE Project to Fire Safety in Reduced Gravity — Research on Flammability of Electric Wire
Hashimoto N. Konno Y. Pelletier B. Kikuchi M. Fujita O.	Development of Experimental Apparatus for Fire Safety of Solid Materials Under Partial Gravity Condition-FLARE-3, the ISS Orbital Experiment Project
Lunar Dust and Its Properties, Behavior, and Mitigation	
Metzger P. T. Fontes D. H. Sapkota D.	Extreme Soil Erosion Physics: What We Need to Learn About Supersonic Rarefied Gas Interacting with Granular Materials for Landing on the Moon, Mars, and Beyond
Wilkerson R. P. Voecks G. Shulman H. S. Rickman D. L. Effinger M. R.	Characterizing the Effects of Thermal Profile and Gas Environment on the Heat Treatment of JSC-1A Lunar Simulant Using Combined Thermogravimetry and Mass Spectroscopy
Merrill C. C. Pett C. T. Hartzell C. M.	Experimental Results of Gecko-Skin Inspired Dust Removal Technology

Wells I. Swets N. Butikofer C. Reising L. Bussey J. Kulsa S. Wallace G. Leachman J.	Preliminary Results of Liquid Nitrogen Removal of Lunar Regolith Simulant from Spacesuit Simulants
Jarmak S. G. Teolis B. D. Whizin A. D. Stern A. S. Retherford K. D. Durda D. D. Protopappa S. Green S. T. Phillips J. R.	Modeling Lunar Dust Hazards to Human Lunar Landers and Gateway
Bussey J. Weber M. Karcher S. Smith-Gray N. Bollinger D. McCloy J.	Characterization of Mount Saint Helens Ash for Use as a Lunar Regolith Simulant
Mezilis J. A. Ridenoure R. Hovik W. Jacobs D. C. McCormick C. Adkins M. Zacny K. Bergman D.	In Situ Measurement of Lunar Dust Plume Migration
Miller S. K. R. Banks B. A. Wohl C. J. Das L. Gordon K. L. Wiesner V. L. King G. C. Hasegawa M. M. Calle C. I. Orndoff E. S.	Passive Dust Mitigation Technologies Being Developed for Demonstration Under Patch Plate Materials Compatibility Analysis Task
Lunar Research in Extraction, Processing, and Handling	
Schmidt E. K. Patel K. M.	Small Transportable Cryogenic Containment Systems
Choi S. H. Bushnell D. M. Moses R. W.	A Portable High-Density Power Technology for Space, Lunar, and Planetary Applications
Choi S. H. Moses R. W.	Micro-Spectrometer for Resource Mapping in Extreme Environments
Lunar Environment and its Effects on Materials	
Goswami V. K.	Development of Lunar Mass-Energy Equation to Study Dynamics of Lunar Environment to Explore Life on Moon Through the Detoxification of Lunar Toxins
Zakharov A. V. Kuznetsov I. A. Bednyakov S. A. Bychkova A. S. Dolnikov G. G. Dubov A. E. Kartasheva A. A. Lyash A. N. Shashkova I. A. Shekhovtsova A. V.	Investigation of the Lunar Near-Surface Dusty Plasma Exosphere with PiC Method Simulation
Kring D. A. Fagan A. L. Paz A. Lemelin M.	Planning for an Initial Assessment of Volatile-Bearing Polar Regolith During Artemis Missions
Parsapoor A. Whittington A.	Thermal Properties of Lunar Regolith Simulants
Extraction of Ice Water from Regolith	
Holma M. Joutsenvaara J. Kuusiniemi P. Leone G. Tanaka H. K. M.	A Novel Concept for Exploration and Characterization of Subsurface Water-Ice on the Moon
Brisset J. Metzger P. Miletich T.	Thermal Extraction of Water Ice from the Lunar Surface — A 3D Numerical Model
Voecks G. Barmatz M. Steinfeld D. Batres J.	Preliminary Results from Application of RF to Extract Water Vapor from Icy Lunar Regolith Simulant
Kuhns M. Metzger P. Kuhns R. Meyen F. Zacny K.	RocketM: A Game Changing Approach for Lunar Resource Extraction
Truong Q. Lee K. Tarau C. Rokkam S. Zacny K. Williams H. Bergman D.	Waste Heat-Based Lunar Ice Extraction Process
Romero-Calvo A. Akay O. Brinkert K. Schaub H.	Magnetic Enhancement of Water Electrolysis in Reduced Gravity Environments
Paz A. J.	Observations on Fluidization, Particle Entrainment, Sublimation, and Evaporation During Tests Using Hydrated Regolith Simulants
Orlando T. M. Jones B. M. Loutzenhiser P. G. Ho K. Lively R.	An Integrated Lunar Volatile Extraction and Purification Pod
Ayllon Unzueta M. A. U. Gicquel F. G. Lawrence D. J. L. Parsons A. P. Schweitzer J. S. Starr R. S.	Bulk Elemental Composition Analyzer (BECA) for Lunar Resources Prospecting

Pandey A. Shepard S. Wisser M. Wette M. Li Y. Neal C. Gertsch L. Renno N. Weber A. Danilovic N.	Lunar Water ISRU Study (LuWIS) — Opportunities and Challenges
Free J. Cannard S. Sciortino J. Rhatigan J. Haberbusch M. Moran M. Barnett N. Bennett N. Adams N. Pelech T. Deng B.	Down Under Excavation and Transport (DUET) Lunar Mining System (LuMiS)
Schieber Garrett L. Jones B. M. Orlando T. M. Loutzenhiser P. G.	Characterization of H ₂ O Transport Through a Packed Bed of JSC-1A at Conditions Relevant to In-Situ Resource Utilization Technology