Workshop on Space Weathering of Airless Bodies

November 2–4, 2015

Program

LPI Contribution No. 1878

LUNAR AND PLANETARY INSTITUTE

USRA

Workshop on Space Weathering of Airless Bodies

November 2–4, 2015 • Houston, Texas

Organizer

Universities Space Research Association

Conveners

Lindsay Keller
NASA Johnson Space Center

Ed Cloutis
University of Winnipeg

Paul Lucey
University of Hawaii

Tim Glotch
Stony Brook University

Scientific Organizing Committee

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University of Arizona

Abstracts for this workshop are available in electronic format via the workshop website at www.hou.usra.edu/meetings/airlessbodies2015/ and can be cited as Author A. B. and Author C. D. (2015) Title of abstract. In *Workshop on Space Weathering of Airless Bodies,* Abstract #XXXX. LPI Contribution No. 1878, Lunar and Planetary Institute, Houston.

Lunar and Planetary Institute 3600 Bay Area Boulevard Houston TX 77058-1113

Technical Guide to Sessions

Sunday, November 1, 2015

5:00 p.m. – 6:30 p.m.	Great Room	Registration and Reception

Monday, November 2, 2015

8:30 a.m.	Lecture Hall	Moon I
1:30 p.m.	Lecture Hall	Asteroids/Itokawa
5:00 p.m. – 6:30 p.m.	Great Room	Poster Session: Space Weathering of Airless Bodies

Tuesday, November 3, 2015

8:30 a.m.	Lecture Hall	Mercury/Carbonaceous Chondrites Experiments
1:30 p.m.	Lecture Hall	Moon II

Wednesday, November 4, 2015

8:30 a.m.	Lecture Hall	NpFe/Simulants/OuterSS

Program

Monday, November 2, 2015
MOON I
8:30 a.m. Lecture Hall

Chairs: **Lindsay Keller**
Joshua Cahill

8:30 a.m. Pieters C. M. *
The Many Forms of Space Weathering **[#2047]**
Space weathering takes many forms and its alteration products are a direct function of a) location in the solar system, b) composition and texture of the surface, c) mass and magmatic evolution of the body, and d) length of time exposed.

9:00 a.m. Hemingway D. J. * Garrick-Bethell I. Kreslavsky M. A.
Latitudinal Variation in Spectral Properties of the Lunar Maria and Implications for Space Weathering **[#2039]**
The spectral properties of the lunar surface vary systematically with latitude in a way that matches the signature found at lunar swirls. This result could help us to distinguish between the effects of solar wind and micrometeoroid weathering.

9:15 a.m. Jeong M. Kim S. S. Garrick-Bethell I. Park S. M. Sim C. K. * Jin H. Min K. W.
Latitude-Dependence of Median Grain Size in the Lunar Regolith **[#2030]**
We conducted polarimetric observations of the Moon and constructed a grain size map of the lunar regolith. The grain size is found to be larger at higher latitude. This is thought to be a result of reduced space weathering effects at high latitudes.

9:30 a.m. Greenhagen B. T. * Lucey P. G. Song E. Arnold J. A. Lemelin M. Donaldson Hanna K. L. Bowles N. E. Glotch T. D. Paige D. A.
Space Weathering Effects in the Thermal Infrared: Lessons from LRO Diviner **[#2021]**
We quantify the degree to which space weathering affects the thermal infrared Christiansen Feature measured by LRO Diviner, and presents techniques to normalize space weathering effects and enable examination of the underlying composition.

9:45 a.m. Donaldson Hanna K. L. * Bowles N. E. Pieters C. M. Greenhagen B. T. Glotch T. D. Lucey P. G.
Effects of Space Weathering on Thermal Infrared Emissivity Spectra of Bulk Lunar Soils Measured Under Simulated Lunar Conditions **[#2020]**
In this initial study, TIR emissivity spectral measurements are made under lunar-like conditions of two highland soil samples that are similar in composition, but differing maturities to understand the effects of space weathering on TIR spectra.

10:00 a.m. BREAK

10:15 a.m. Cahill J. T. S. * Lawrence D. J. Delen O. Stickle A. Raney R. K. Patterson G. W. Greenhagen B. T.
The Maturely, Immature Orientale Impact Basin **[#2016]**
Examining non-polar highlands regolith maturity from a variety of perspectives.

10:30 a.m. Wang Z. C. Wu Y. Z. Zheng Y. C. Blewett D. T. * Cloutis E. A.
Estimating the Degree of Space Weathering at the Chang'E-3 Landing Site: Radiative-Transfer Modeling of Nanophase Iron Abundance **[#2002]**
Estimating the degree of space weathering at the Chang'E-3 landing site: Radiative-transfer modeling of nanophase iron abundance.

10:45 a.m. Noble S. K. * Keller L. P. Christoffersen R. Rahman Z.
The Microstructure of a Micrometeorite Impact into Lunar Olivine **[#2034]**
Through TEM analysis of the cross-section of a ~20 μm diameter crater into an olivine single crystal we can see first-hand the effects of a single impact, including the creation of nanophase iron in the melt.

11:00 a.m. Thompson M. S. * Zega T. J.
Simulation of Micrometeorite Impacts Through In Situ Dynamic Heating of Lunar Soil **[#2018]**
We simulate micrometeorite impact events using slow and rapid-heating stages inside the TEM. We observe the development of Fe nanoparticles and possible vesiculated textures.

11:15 a.m. Christoffersen R. * Dukes C. A. Keller L. P. Rahman Z. Baragiola R. A.
Problems at the Leading Edge of Space Weathering as Revealed by TEM Combined with Surface Science Techniques **[#2065]**
Analytical field-emission TEM techniques cross-correlated with surface analyses by X-ray photoelectron spectroscopy (XPS) provides a unique two-prong approach for characterizing how solar wind ion processing contributes to space weathering.

11:30 a.m. Keller L. P. * Zhang S.
Rates of Space Weathering in Lunar Soils **[#2056]**
Space weathering effects (both vapor-deposited rims and solar wind amorphized rims) accumulate in 10^6–10^7 y in mature lunar soils based on observed solar flare track densities in individual space-weathered grains.

Monday, November 2, 2015
ASTEROIDS/ITOKAWA
1:30 p.m. Lecture Hall

Chairs: **Roy Christoffersen**
David Blewett

1:30 p.m. Sasaki S. * Okazaki M. Hiroi T. Tsuchiyama A. Miyake A. Matsumoto T.
Space Weathering: From Itokawa to Mercury via the Moon **[#2055]**
A small S-type asteroid Itokawa provided new aspects on space weathering, which are confirmed by experiments using pulse laser. Rocky surface could be weathered as regolith and sulfur would be another key element especially on Mercury.

1:45 p.m. Tsuchiyama A. * Matsumoto T. Uesugi M. Yada T. Shimada A.
Sakurama T. Kadokawa T.
Space Weathering on Itokawa Surface Deduced from Shape and Surface Features of Hayabusa Regolith Particles **[#2046]**
Examination of shape and surface features of Itokawa particles showed that space-weathered rims developed on individual particle surfaces promoted spectral change of Itokawa, while mechanical abrasion and fragmentation suppressed the spectral change.

2:00 p.m. Keller L. P. Berger E. L. * Christoffersen R.
Surface Exposure Ages of Space-Weathered Grains from Asteroid 25143 Itokawa **[#2044]**
The presence of track gradients in the three Hayabusa particles indicates that the regolith in the Muses-C region on Itokawa was relatively stable at mm to cm-depths for the last ~10^5 years, implying little overturn.

2:15 p.m. Matsumoto T. * Tsuchiyama A. Watanabe N. Yasuda K. Miyake A. Nakauchi Y. Okada T.
Abe M. Yada T. Uesugi M. Karouji Y. Nakato A.
Hashiguschi M. Kumagai K.
Systematic Ion Irradiation Experiments to Olivine: Comparison with Space Weathered Rims of Itokawa Regolith Particles **[#2045]**
We performed H and He ion irradiation experiments using olivine fragments, in order to reveal formation time-scales of space weathered rims and formation processes of blisters by solar wind irradiation.

2:30 p.m. Loeffler M. J. * Dukes C. A. Christoffersen R. Baragiola R. A.
Space Weathering of Silicates Simulated by Laser Irradiation **[#2023]**
We present our results from experiments where we have laser irradiated pressed pellets of SiO_2 and two different olivine compositions (Fo_{90} and Fo_{99+}), while monitoring our samples with reflectance and photoelectron spectroscopy.

2:45 p.m. Christoffersen R. * Loeffler M. J. Dukes C. A. Baragiola R. A.
Compositional and Microstructural Evolution of Olivine During Pulsed Laser Irradiation: Insights Based on a FIB/Field-Emission TEM Study **[#2051]**
Field-emission TEM shows multi-layer vapor and melt deposits produced on olivine by pulsed laser irradiation contain abundant nanophase metallic Fe and have some microstructural similarities to melt deposits in micrometeorite impact craters.

3:00 p.m. BREAK

3:15 p.m. Vilas F. * Hendrix A. R.
Seeking Evidence in UV/Blue Reflectance Spectra for Differences in Submicroscopic Iron Created by Space Weathering on Particles from S-Complex Asteroids and the Moon **[#2042]**
Does the UV/blue/Spectrum change with different/Nanophase iron?

3:30 p.m. Blewett D. T. * Denevi B. W. Le Corre L. Reddy V. Schroder S. E. Pieters C. M. Tosi F. Zambon F. De Sanctis M. C. Ammannito E. Roatsch T. Raymond C. A. Russell C. T.
Modeling and Observations of Optical Space Weathering on Vesta **[#2004]**
We use Hapke model spectra to predict the effects of lunar-style space weathering on Vesta, contrast with the effects of mixing with carbonaceous-chondrite material, and to guide interpretation of Dawn multispectral observations of Vesta.

3:45 p.m. Kohout T. * Malina O. Penttilä A. Kröger A. Britt D. Filip J. Muinonen K. Zboril R.
Space Weathering Induced Slope Changes in Pyroxene and Howardite Spectra **[#2022]**
Space weathering laboratory simulations with pyroxene and howardite show lack of reddening over 1 μm region similarly as observed on Vesta. Thus DAWN observations do not contradict space weathering mechanism driven by the presence of $npFe^0$.

4:00 p.m. Stojic A. N. * Pavlov S. G. Markus A. K. Weber I. Morlok A. Hiesinger H.
Experimental Space Weathering: A Coordinated LIBS, TEM, VIS, and NIR/MIR Study **[#2019]**
We pursue an experimental approach simulating space weathering by irradiating analog material and subsequently investigating the altered areas by means of Transmission Electron Microscopy, VIS/NIR, and MIR spectral measurements.

4:15 p.m. Yang Y. Z. * Yuan Y. Wang Z. W. Zhang H. Jin W. D. Hsu W. B.
Mid-Infrared Reflectance Spectra of Pulsed Laser Irradiated Olivine Grains **[#2013]**
To understand the effects of space weathering processes on VNIR and MIR reflectance spectra, we carried out pulsed laser irradiation simulations and reflectance spectroscopic measurements of olivine grains.

4:30 p.m. Libourel G. * Delbo M. Wilkerson J. Ganino C. Michel P.
Effects of Solar Heating on Asteroids **[#2005]**
We will describe laboratory experiments and numerical modelling devoted to study under which conditions solar heating may alter asteroid surfaces.

4:45 p.m. DISCUSSION

Monday, November 2, 2015
POSTER SESSION: SPACE WEATHERING OF AIRLESS BODIES
5:00 p.m. Great Room

Savin D. W. Domingue D. L. Miller K. A.
A Proposed Apparatus to Study the Impact of Solar Wind Ions on the Surfaces of Mercury, the Moon, and Asteroids **[#2007]**
We propose to construct a unique instrument to study the effects of solar wind ion irradiation on the regolith surfaces of Mercury, the Moon, and asteroids. Our approach will overcome many of the limitations of past work.

Yesiltas M. Thieme J. Simos N. Glotch T. D.
Simulation of Space Weathering: Instrumentational Development **[#2012]**
We are designing a series of experiments in order to simulate space weathering in the laboratory and measure its effects on astronomically relevant samples.

Cintala M. J. Keller L. P. Christoffersen R. Hörz F.
Space Weathering in Houston: A Role for the Experimental Impact Laboratory at JSC **[#2061]**
In the highly multidisciplinary field of space weathering, experimentation often is the only means of collecting hard information. The Experimental Impact Laboratory at JSC is capable of supporting a wide array of relevant impact investigations.

Vance A. M. Christoffersen R. Keller L. P.
Evolution of Shock Melt Compositions in Lunar Agglutinates **[#2064]**
A novel compositional spectrum imaging technique reveals the presence of an anomalous Fe-rich component in the shock melt glass matrix in lunar agglutinates.

Malina O. Kohout T. Tucek J. Filip J. Britt D. Zboril R.
Methodology of Space Weathering Simulation and Its Application on Olivine and Pyroxene Samples **[#2029]**
We reported here a new two-step thermal treatment method for the simulation of space weathering process in laboratory. The two-step synthesis method has been used for two different materials (olivine and pyroxene) and spectral changes were compared.

Corley L. M. Gillis-Davis J. J. Lucey P. G.
Comparison of the Temperature Effects on Reflectance Spectra of Fresh and Experimentally Space Weathered Olivine **[#2067]**
Reflectance spectra of fresh and laser irradiated olivine are measured at temperatures between 100–255 K to determine if an anticorrelation between temperature and reflectance in LOLA data is due to the influence of temperature on space weathering.

Esposito V. J. Farrell W. M. Zimmerman M. I.
Solar Wind Hydrogen Implantation and Diffusion in Defect-Rich Regolith on the Moon **[#2038]**
We examine the correlation of retained solar wind hydrogen with crystal defects in the top 100 nm of material.

Wilson J. K. Schwadron N. Jordan A. P. Spence H. E. Looper M. D. Townsend L. W.
Shallow Lunar Hydrogen and Forward-Scattered Albedo Protons **[#2015]**
The CRaTER instrument sees a ~40% higher flux of lunar albedo protons (>65 MeV) at grazing angles compared to the nadir direction. A shallow layer (<10 cm) of hydrated lunar regolith may enhance the yield of forward-scattered albedo protons.

Sim C. K. Kim S. S. Jeong M.
Maturity of the Crater Rim Walls as a Function of the Crater Size **[#2024]**
The median grain size <d> retrieved from ground-based polarimetry and optical maturity (OMAT) of the interior rim walls of ~140 craters of various size. We discuss the relationship between maturation rate and crater size.

Retherford K. D. Liu Y. Hendrix A. R. Greathouse T. K. Gladstone G. R. Mandt K. E. Patrick E. L. Egan A. F. Kaufmann D. E. Hurley D. M. Cahill J. T. S. Pryor W. R.
Lunar Reconnaissance Orbiter LAMP Investigations of Space Weathering **[#2070]**
LRO-LAMP far-UV lunar reflectance measurements are strongly diagnostic of space weathering effects within the top 50–100 nm of the surface.

Penttilä A. Kohout T.
Online Spectral Fit Tool for Analyzing Reflectance Spectra **[#2054]**
The Online Spectral Fit Tool is developed for analyzing Vis-NIR spectral behavior of asteroids and meteorites. Implementation is done using JavaScript/HTML. Fitted spectra consist of spline continuum and gamma distributions for absorption bands.

Kim I. H. Jeong M. S. Sim C. K. Baek K. H. Kim S. S.
Multi-Band Polarimetry of Lunar Regolith Materials in Laboratory **[#2025]**
To understand the polarization characteristics of the lunar regolith, we have carried out multi-band (U, B, V, and R) polarimetric measurements. Powders of SiO_2, Fe_2O_3, Al_2O_3, CaO that are found in the lunar regolith and JSC-1A were considered.

MacLennan E. M. Emery J. P. Lucas M. P. Pinilla-Alonso N.
Assessment and Characterization of Space Weathering Styles on Asteroid Surfaces **[#2033]**
We present preliminary results of a new project aimed at searching for and characterizing differing styles of space weathering among S-complex asteroids and quantifying the dependence on solar wind exposure, grain size, mineralogy, and surface age.

Clark B. E. Barucci M. A. Merlin F. Lantz C. Campins H. Fornasier S. Dotto E. Lauretta D. S.
How to Map Space Weathering on an Asteroid Surface **[#2036]**
Our OSIRIS-REx space weathering map of asteroid 101955 Bennu will be an expression of the probability that each surface facet exhibits space weathering. To each surface facet, we will assign a ranking in: slope, band depth, albedo, and context.

Schriver D. Travnicek P. Domingue D. Helbert J.
Precipitation of Electrons at Mercury's Surface from the Magnetosphere **[#2040]**
Results from a global kinetic simulation of Mercury's magnetosphere will be presented to describe the properties of electron precipitation at Mercury's surface which can result in space weathering of the regolith.

Tuesday, November 3, 2015
MERCURY/CARBONACEOUS CHONDRITES EXPERIMENTS
8:30 a.m. Lecture Hall

Chairs: **Deborah Domingue**
Heather Kaluna

8:30 a.m. Domingue D. L. * Schirver D. Trávní?ek P. M. Helbert J.
Mercury's Weather-Beaten Surface: An Examination of the Relevant Processes Through Comparisons and Contrasts with the Moon and Asteroids **[#2028]**
We examine global color properties of Mercury and their correlations to the predicted trends due to particle bombardment and thermal processing. Color ratio and spectral slope analyzes are interpreted relative to lunar and asteroid studies.

9:00 a.m. Gillis-Davis J. J. * Kaluna H. M. Bradley J. P. Ishii H. A. Lucey P. G.
Darkening of Mercury's Surface by Sulfides and Carbon **[#2041]**
We report on sulfur/sulfide and carbon-bearing composition related spectral effects for materials that have experienced identical simulated space-weathering conditions.

9:15 a.m. Lucey P. G. * Trang D. Kaluna H. M. Lemelin M. T. Gillis-Davis J. Glotch T. Blewett D. T.
Quantitative Modeling of the Optical Effects of Space Weathering **[#2008]**
Models of the optical effects of space weathering are used to derive the abundance of space weathering products.

9:30 a.m. Trang D. * Lucey P. G. Izenberg N. R.
Radiative Transfer Modeling of MESSENGER VIRS Spectra of Mercury: Detection and Mapping of Submicroscopic Iron and Carbon **[#2043]**
We produced maps of the distribution of nanophase iron, nanophase carbon, and microphase iron on the surface of Mercury.

9:45 a.m. Stockstill-Cahill K. R. * Domingue D. L. Cahill J. T. S.
Radiative Transfer Modeling of Near-Infrared Reflectance Data of Airless Planetary Bodies **[#2048]**
We are adapting algorithms developed for the radiative transfer theory of Hapke for application to a broader scope of airless planetary bodies.

10:00 a.m. BREAK

10:15 a.m. Kaluna H. M. * Gillis-Davis J. J. Lucey P. G. Masiero J. R. Meech K. J.
Space Weathering Trends Among Carbonaceous Asteroids and Materials **[#2009]**
We combine observations and experiments to gain a comprehensive view of space weathering trends among carbonaceous asteroids and materials. Our data suggest space weathering trends may allow us to probe the aqueous histories of C-complex asteroids.

10:30 a.m. Lantz C. * Brunetto R. Barucci M. A.
Space Weathering on Primitive Asteroids: Ion Irradiation of Carbonaceous Chondrites **[#2003]**
We simulate space weathering processes on primitive bodies using ion implantation as a simulation of solar wind irradiation. The laboratory analogs we irradiate and analyze with visible to mid-infrared spectroscopy are carbonaceous chondrites.

10:45 a.m. Dukes C. A. * Fulvio D. Baragiola R. A.
Ion-Irradiation Induced Changes in the Surface Composition of Carbonaceous Meteorites **[#2063]**
The effect of weathering on carbonaceous materials remains ambiguous. In this work, we examine in detail the alterations in surface chemistry that result from ion impact on carbonaceous meteorites which accompany the changes in optical reflectance.

11:00 a.m. Keller L. P. * Christoffersen R. Dukes C. A. Baragiola R. A. Rahman Z.
Experimental Space Weathering of Carbonaceous Chondrite Matrix **[#2010]**
Helium ion irradiation of Murchison matrix resulted in amorphization of the matrix phyllosilicates, loss of OH, surface vesiculation, and a significant reduction of the Fe^{3+}/Fe^{2+} ratio in fine-grained phyllosilicates.

11:15 a.m. Helbert J. * Maturilli A. Ferrari S.
Laboratory Studies of Thermal Space Weathering on Airless Bodies **[#2001]**
Thermal space weathering can produce reversible as well as irreversible changes and acts on much shorter timescales than "traditional space weathering." We are going to present a number of examples of thermal space weathering measured at PEL.

11:30 a.m. Orlando T. M. * Fiege K. Bennett C. J. Trieloff M. Srama R.
Space Weathering of Asteroids, Mercury, and the Moon **[#2069]**
We summarize recent laboratory studies on photon, ion, and micrometeorite "weathering" of Mercury and asteroid surface analogs as well as actual lunar regolith samples and present results from linking micrometeorite impacts to energetic irradiation.

Tuesday, November 3, 2015
MOON II
1:30 p.m. Lecture Hall

Chairs: **William Farrell**
Daniel Britt

1:30 p.m. Glotch T. D. * Lucey P. G. Hayne P. O. Bandfield J. L. Greenhagen B. T. Shirley K. A.
Observations of Lunar Swirls by the Diviner Lunar Radiometer **[#2058]**
Diviner observations of lunar swirls show a CF anomaly consistent with abnormal space weathering. Night time cooling and surface roughness models indicate that the finely structured lunar regolith has not been disturbed at swirls.

1:45 p.m. Kramer G. Y. *
Space Weathering Effects in the Visible-IR Dominated by Solar Wind at Earth-Moon Distance **[#2068]**
Which of you changes/Airless body surfaces?/"Aye, it is I", said the Sun.

2:00 p.m. Farrell W. M. * Hurley D. M. Esposito V. J. Loeffler M. J. McLain J. L. Orlando T. M. Hudson R. L. Killen R. M. Zimmerman M. I.
The Role of Crystal Defects in the Retention of Volatiles at Airless Bodies **[#2037]**
The nature of defects in the crystal determines the retention properties of volatiles, like solar wind-implanted hydrogen.

2:15 p.m. McLain J. L. * Sarantos M. Johnson N. M. Keller J. W. Nuth J. A. Farrell W. M.
Thermal Desorption Kinetics of Volatiles on Silicate "Smokes:" Analog to Micrometeoric Impact Vapor Condensates **[#2053]**
Laboratory measurements of the thermal desorption kinetics of Ar, H_2O and other common lunar volatiles on silicate smokes will be presented, with a focus on comparing the desorption energies and surface chemistry with other regolith analogs.

2:30 p.m. Kuhlman K. R. * Kvit A. V. Baba K. Poplawsky J. D. Hiroi T. Isheim D.
Correlative Microscopy and Visible/Near-Infrared Spectral Analysis of Simulated Solar Wind Implanted Olivine **[#2060]**
Here we present the results of the first atom probe tomography (APT) and scanning transmission electron microscopy study (STEM) of San Carlos olivine (Fo90.1) exposed to simulated solar wind-based space weathering due to hydrogen (~1keV/amu).

2:45 p.m. Jordan A. P. * Wilson J. K. Stubbs T. J. Izenberg N. R. Schwadron N. A. Spence H. E.
The Space Weathering Implications of Dielectric Breakdown in Lunar Polar Regolith **[#2014]**
Solar energetic particles may cause dielectric breakdown in the lunar polar regolith. This breakdown weathering may significantly affect the regolith and may occur on other airless bodies in the solar system.

3:00 p.m. BREAK

3:15 p.m. Spence H. E. * Schwadron N. A. Wilson J. K. Jordan A. P. Winslow R. Joyce C. Looper M. D. Case A. W. Stubbs T. J. Zeitlin C. Blake J. B. Kasper J. C. Mazur J. E. Smith S. S. Townsend L. W.
Particle Radiation Environments and Their Effects at Planetary Surfaces of Airless Bodies: Remote Sensing Lessons Learned at the Moon by LRO/CRaTER and Extension to Other Planetary Objects **[#2006]**
We summarize the physics of GCR and SEP interactions with the Moon's surface and quantify how these same processes operate at similar airless objects throughout the solar system, including at Mercury, Mars' moons, asteroids, and the Pluto system.

3:30 p.m. Wetteland C. J. * Sickafus K. E. McSween H. Y. Jr. Taylor L. A.
The Earliest Solar System Weathering: Mega-Solar-Wind Effects in Early Solar System Silicates **[#2027]**
Early solar materials may be exposed to large fluxes of high-energy protons during stellar evolution. Experimental results indicate that small fragments of minerals may be melted, and low Z atoms can be transmuted to exotic isotopes.

3:45 p.m. Wang X. * Schwan J. Hsu H. W. Horanyi M.
Laboratory Investigations of Electrostatic Dust Transport on Airless Bodies and Its Effects on Space Weathering **[#2031]**
We present new laboratory experimental results of electrostatic dust transport and its mechanisms, and discuss its possible effects on the space weathering on the surface of airless bodies.

4:00 p.m. Britt D. T. * Schelling P. K. Blair R.
The Chemistry and Physics of Space Weathering **[#2057]**
Local chemistry and the nature of the energy input drive space weathering. Weathering products are not random, but the predictable outcome of reactions that depend on chemical feedstock, mineral kinetics, catalytic components, and energetic inputs.

4:15 p.m. Blair R. G. * Schelling P. K. Britt D. T.
Aspects of Space Weathering via Mechanically Initiated Chemistry **[#2059]**
The high energies or transient pressures developed during an impact event can open up reaction pathways that are not accessible at standard conditions. Reactive intermediates bind and transform surfaces producing weathering and redox chemistry.

4:30 p.m. DISCUSSION

Wednesday, November 4, 2015
NPFE/SIMULANTS/OUTERSS
8:30 a.m. Lecture Hall

Chairs: **Michelle Thompson**
Charles Hibbitts

8:30 a.m. Cahill J. T. S. * Blewett D. T. Nguyen N. V. Lawrence S. J. Denevi B. W.
Optical Constants of Iron and Nickel Metal from the Far-Ultraviolet to the Near-Infrared **[#2050]**
New iron and nickel far-ultraviolet to near-infrared optical constants are reported as well as models demonstrating their utility for modeling of airless bodies.

8:45 a.m. Legett C. IV * Glotch T. D. Lucey P. G.
VNIR Effects of Space Weathering: Modeling Strong Absorbers in a Scattering Matrix **[#2071]**
We use the Multiple Sphere T-Matrix Model to examine a shift from darkening and reddening to just darkening of VNIR spectra of space weathered material. We will also present laboratory work using aerogel in combination with iron and carbon powders.

9:00 a.m. Hendrix A. R. * Vilas F. Retherford K. D. Mandt K. E. Greathouse T. K. Cahill J. T. S.
Lunar Space Weathering Effects in the Ultraviolet **[#2049]**
Ultraviolet/Observations of the Moon/Weathering effects!

9:15 a.m. Thompson M. S. * Zega T. J. Keane J. T. Becerra P. Byrne S.
The Oxidation State of Nanophase Fe Particles in Lunar Soil: Implications for Space Weathering **[#2017]**
The oxidation state of individual Fe nanoparticles is measured using electron energy-loss spectroscopy. The results indicate increasing oxidation state with increasing soil maturity.

9:30 a.m. Burgess K. D. * Stroud R. M. Dyar M. D. McCanta M. C.
Understanding Space Weathered Material Using STEM-EELS: Fe Oxidation State Measurements **[#2011]**
Measurements of Fe oxidation state using EELS in an aberration-corrected STEM show that experimental silicate glasses are heterogeneous at sub-micron spatial scales. Similar measurements on lunar soils will analyze oxidation states of npFe grains.

9:45 a.m. Penttilä A. * Väisänen T. Kohout T. Muinonen K.
Explaining Space-Weathering Effects on Spectra with Light-Scattering Simulations **[#2035]**
Space-weathering introduces changes to spectra of asteroid surfaces. We study these changes with controlled samples and laboratory measurements of the spectra. Measurements are modeled and explained using light-scattering theory and simulations.

10:00 a.m. BREAK

10:15 a.m. Taylor L. A. * Pieters C. M.
Lunar Soil Simulants Cannot Reproduce Apollo Lunar Soils with Many Space Weathering Products **[#2032]**
Apollo lunar samples are not available for most In-Situ Resource Utilization (ISRU) studies. Therefore, there have been many lunar soil simulants produced that are inadequate, but not appreciated as such. We will address this issue.

10:30 a.m. Schelling P. K. * Britt D. T. Quadery A. H. Tucker W. C. Blair R.
Atomic-Scale Modeling and Theory of Space Weathering Processes: Mechanisms and Surface Properties **[#2052]**
We apply atomic-scale simulation to describe space weathering, including point-defect migration and surface properties. Distinct differences are reported between olivine and orthopyroxene. Surface properties including adhesion are described.

10:45 a.m. Poston M. J. * Blacksberg J. Brown M. Carey E. Carlson R. Ehlmann B. L. Eiler J. Hand K. Hodyss R. Mahjoub A. Wong I.
Visible and Infrared Spectra of Weathered Solar System Ices **[#2066]**
Laboratory simulation of the weathering experienced by an icy object starting in the Kuiper Belt and migrating to the Trojan cloud.

11:00 a.m. Hibbitts C. A. * Paranicas C.
Space Weathering of the Non-Ice Material on Europa **[#2062]**
The Jovian magnetosphere will alter the non-ice material on the surface of Europa in many ways. Although the drivers of that alteration are known, the nature of that alteration is not well understood and should be characterized in the laboratory.

11:15 a.m. Scipioni F. * Schenk P. Tosi F.
Space Weather in the Saturn System **[#2026]**
We analyze the effect of space weather acting on the Saturn satellites Mimas, Enceladus, Tethys, Dione, and Rhea from the spectroscopic point of view. We will show results from the analysis of spectra returned by VIMS instrument onboard Cassini.