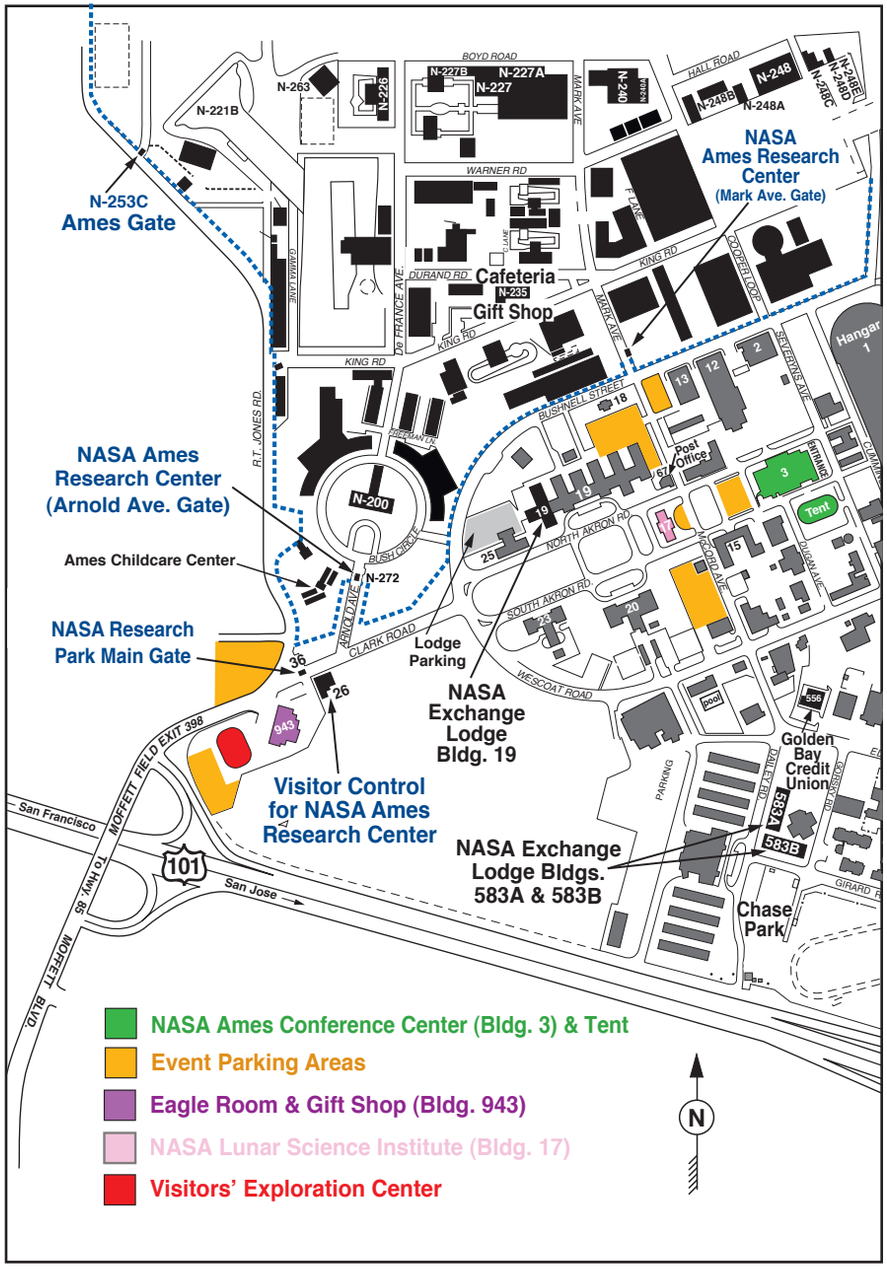
AMES RESEARCH CENTER



National Aeronautics and Space Administration

NASA LUNAR SCIENCE FORUM

NASA LUNAR SCIENCE INSTITUTE

JULY 19-21, 2011

LUNARSCIENCE.NASA.GOV/LSF2011

NASA AMES RESEARCH CENTER, MOFFETT FIELD, CA

www.nasa.gov

NASA LUNAR SCIENCE INSTITUTE

Dear Colleagues,

On behalf of the staff of the NASA Lunar Science Institute (NLSI) at NASA Ames Research Center, welcome to the fourth annual Lunar Science Forum! We proudly dedicate Lunar Science Forum 2011 to the memory of our dear friend, mentor, and scientist extraordinaire, Dr. Baruch Blumberg.

The past three years have witnessed a renaissance in lunar science, demonstrated by five major lunar missions, the establishment of NASA's Lunar Science Institute, and a growing and energized community of young scientists. Embracing the entire lunar science community, the Lunar Science Forum crosses discipline lines to unearth new knowledge of our Moon. Over the course of this forum you will hear presentations on topics ranging from geology & geochemistry, impacts, lunar formation & solar system dynamics, space plasma & surface interactions, volatile characterization and the unique astronomy enabled by the radio-quiet far side of the Moon. To underscore the importance of reaching out to the public and educating the next generation, Education and Public Outreach (EPO) endeavors and student participation are highlighted throughout our program.

Developed by an outstanding scientific organizing committee (SOC), under the expert guidance of NASA Ames planetary scientist, Jeff Moore, the oral and poster presentations reflect the breadth of scientific discovery lunar exploration efforts have enabled. Please join me in thanking the SOC and the local organizing committee members, listed on the back cover, for their dedicated efforts.

Welcome to NASA Ames Research Center, where innovation and creativity abound, and welcome to the Lunar Science Forum, where NASA science and exploration join hands to help forge NASA's future.

Yvonne Pendleton
Director, NASA Lunar Science Institute

FOCUS GROUPS Tuesday, July 19, 12:30

Lunar Bombardment ..... Northwing

Chair: William Bottke The Moon's surface has recorded and preserved the impact history of the inner Solar System since the Moon's formation. Studies of the impact record can give valuable insights into the ultimate evolution of the Solar System.

Lunar Dust and Plasma ..... NLSI Conference Room, Building 17

Chairs: Mihaly Horanyi and William Farrell Understanding the dust and plasma environment on and near the surface of the Moon will allow us to better define requirements for surface operations, dust mitigation and radiation protection.

FOCUS GROUPS Wednesday, July 20, 12:30

ALSEP Data Recovery ..... NLSI Conference Room, Building 17

Chairs: Lynn Lewis and Gregory Schmidt The ALSEP experiments on the Moon's surface returned a wide variety of scientific data that is essential to further exploration and characterization of the lunar surface. This focus group has found data that are being brought to light for the first time in 4 decades, and which will greatly enhance the scientific archives for all lunar scientists.

South Pole Aitken Basin ..... Northwing

Chair: Noah Petro The South Pole-Aitken (SPA) Basin is the largest known impact basin in the Solar System. With a diameter of 2500 km, SPA provides great scientific potential for extracting native lunar mantle material and determining bulk lunar composition.

Lunar Commerce ..... NASA Space Portal Building, 555

Chair: Bruce Pittman Continued exploration and scientific research produces emerging markets and new opportunities to expand human commerce to the Moon. Efforts spawned from the Google Lunar X-Prize offer significant new opportunities for the lunar science community.

Lunar Space Biology/Astrobiology ..... Mezzanine

Chairs: Cary Mitchell and Brad Bailey The Moon's surface allows us to examine the impact history of the inner Solar System and the solar radiation flux over time, both are important to the understanding of evolution on Earth. Additionally, studies of the biological interaction with the lunar surface is crucial to designing long-duration, sustainable habitats.

Science Organizing Committee

Jeff Moore, Chair

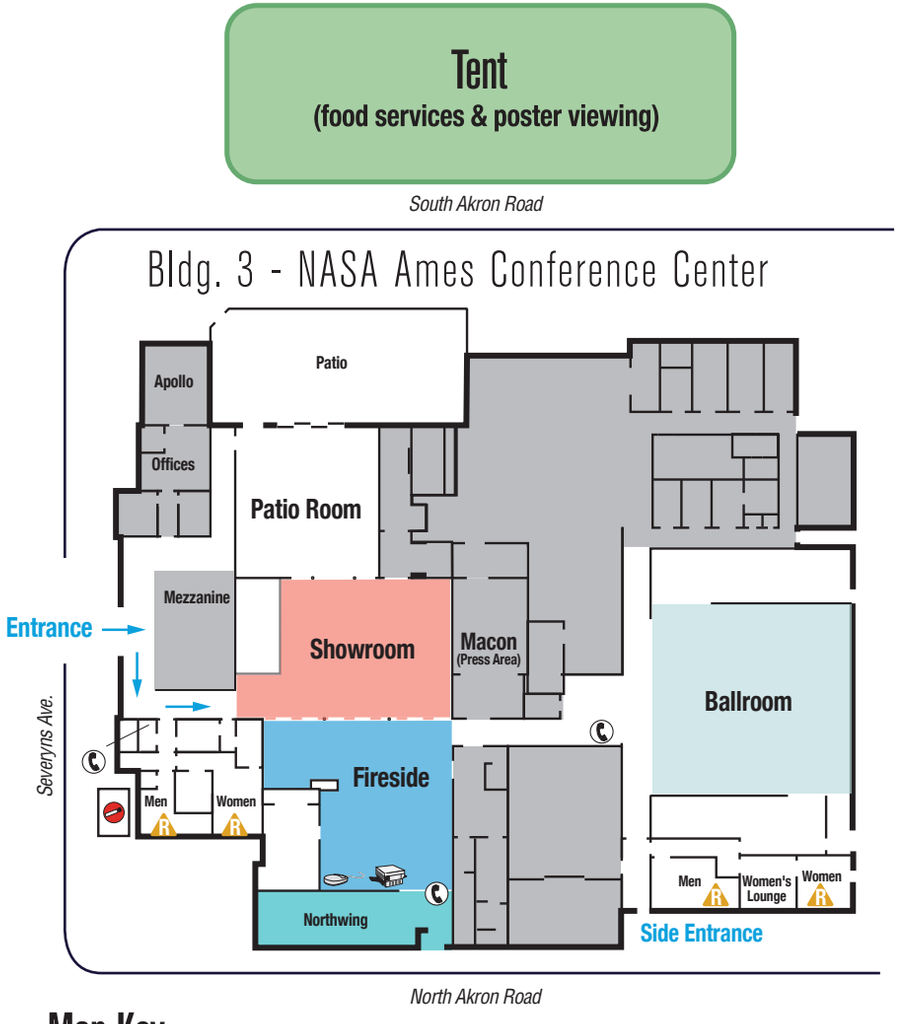
Gwen Barnes	Roy Christoffersen	Yvonne Pendleton
Ross Beyer	Barbara Cohen	Cass Runyon
William Bottke	Geraint Harker	Richard Vondrak
Adrian Brown	Jerome Johnson	Michael Wargo
Carrie Chavez	Francis Nimmo	Kevin Zahnle

Local Organizing Committee

Shirley Berthold, Chair

Dave Archibald	Brian Fallini	Teague Soderman
Jennifer Baer	Alicia Galliano	Greg Schmidt
Brad Bailey	Maria Leus	Ken Silverman
Greg Bennett	Joe Minafra	Mark Weldon
Jerry Clark	Deb Narasaki	Cathy Weselby
Doris Daou	Ashcon Nejad	Chris Wilson
Brian Day	Terry Reichert	Mary Williams

EVENT MAP



Map Key

Meeting Rooms

- Ballroom
- Fireside
- Showroom
- Northwing

- House Phone
- Computer Access
- Printer Access

- Restrooms
- Handicapped Restrooms (Ballroom only)
- Smoking Area

Monday, July 18, 2011 EARLY REGISTRATION

5-6:30pm	Early Registration	Conf. Center Entrance
6-7:30pm	Opening Reception and Lunar Braille Book Event, refreshments and no-host bar	Forum Tent

Tuesday, July 19, 2011 AGENDA DAY 1

TIME	EVENT	LOCATION
7:00	Poster Setup Begins	Forum Tent
7:30	NLSI Director Breakfast with student lightning round presenters	Forum Tent
8-8:30	REGISTRATION: NASA Conference Center/COFFEE Served in Tent	Conf. Center Entrance
8:30-8:50	Welcome Speakers: **Pete Worden, Mike Wargo,** and **Yvonne Pendleton**	Conf. Center Ballroom
8:50-8:55	Dedication to Baruch Samuel Blumberg (1925-2011): **Greg Schmidt**	Conf. Center Ballroom
8:55-9:15	Keynote Address: Planetary Science from the Moon Outlined for the Decade 2013-20, **Clive Neal**	Conf. Center Ballroom
9:15	PLENARY SESSION I: Missions (Chairs: **Richard Vondrak** & **Mike Wargo**)	
9:15-9:30	**Mark Robinson**, Overview of LROC Observations of the Moon	Conf. Center Ballroom
9:30-9:45	**David Smith**, Two Years of Observations of Lunar Topography by the LOLA Instrument on LRO	Conf. Center Ballroom
9:45-10:00	**Benjamin Greenhagen**, Thermal Properties of the Moon observed by the Diviner Instrument on LRO	Conf. Center Ballroom
10:00-10:15	**Igor Mitrofanov**, Hydrogen Concentrations of the Lunar Poles as Measured by the LEND Instrument on LRO	Conf. Center Ballroom
10:15-10:45	BREAK	
10:45-11:00	**Jennifer Heldmann**, Lunar Science Advances: The LCROSS Revolution	Conf. Center Ballroom
11:00-11:15	**Richard Elphic**, Status of NASA's Lunar Atmosphere and Dust Environment Explorer (LADEE)	Conf. Center Ballroom
11:15-11:30	**Yvonne Pendleton**, NLSI EPO: Reaching Out to Everyone	Conf. Center Ballroom
11:30-11:45	**Emily CoBabe-Ammann**, The Lunar Science Education Vision: Bringing the Moon to All of Us!	Conf. Center Ballroom
11:45-12:00	**Maria Zuber**, Update on the Gravity Recovery and Interior Laboratory (GRAIL) Mission	Conf. Center Ballroom
12:00-12:15	**Vassilis Angelopoulos**, Acceleration, Reconnection, Turbulence and Electrodynamics of the Moon's Interaction with the Sun (ARTEMIS)	Conf. Center Ballroom
12:15-12:30	**Jack Burns**, The Dark Ages Radio Explorer (DARE) Proposed Mission	Conf. Center Ballroom
12:30-1:15	LUNCH/POSTER VIEWING	Forum Tent/Ballroom

AGENDA DAY 1 Tuesday, July 19, 2011

TIME	EVENT	LOCATION
1:15-2:00	SPECIAL EVENT: Preview of "Max Goes to the Moon" Children's Planetarium Show. Scientists' Input Wanted!	Conf. Center Ballroom
2:00	PLENARY SESSION II: Dust & Magnetic Properties (Chairs: **Richard Vondrak** & **Mike Wargo**)	
2:00-2:25	**William Farrell**, The Enigma of Lunar Dust Transport (Invited)	Conf. Center Ballroom
2:25-2:50	**Ian Garrick-Bethell**, Lunar Swirls: Present Knowledge and Future Opportunities (Invited)	Conf. Center Ballroom
2:50-3:05	Lightning Round #1: Student Poster Previews	Conf. Center Ballroom
3:05-3:15	BREAK	

	PARALLEL SESSION #1. Conf. Center BALLROOM	PARALLEL SESSION #2. Conf. Center SHOWROOM
3:15	**OF THE MOON:** Geology/Recent Mission Results (Chairs: **Carle Pieters** & **Lynn Carter**)	**ON THE MOON**: Dust/Magnetic Properties/Radiation/Space Weathering (Chairs: **Jennifer Meyer** & **Amanda Hendrix**)
3:15-3:30	**Harlan Spence**, Latest Results from the Lunar Reconnaissance Orbiter (LRO) Cosmic Ray Telescope for the Effects of Radiation (CRaTER) Science Investigation	**David Glenar**, Optical Scattering by Lunar Exospheric Dust: What Could be Learned from LRO LAMP and LADEE UVS?
3:30-3:45	**Lynn Carter**, Regolith Variation Across the Lunar South Pole: Comparing Mini-RF and Diviner Data	**Zoltan Sternovsky**, LDEX: The Dust Detector on LADEE (Lunar Atmosphere and Dust Environment Explorer)
3:45-4:00	**William Boynton**, Science Implications of Neutron Suppressed Regions (NSR) Determined with the Lunar Exploration Neutron Detector (LEND)	**Timothy Stubbs**, Inferring Exospheric Dust Dynamics from Apollo Observations of High-Altitude Lunar Horizon Glow
4:00-4:15	**Brian Day**, NASA Mission Applications of Citizen Science	**Jennifer Meyer**, Precession of the Lunar Core
4:15-4:30	**Carle Pieters**, Mineralogical Mysteries of the Moon Revealed by M3	**Clement Suavet**, Paleomagnetic Record of Mare Basalt 10017
4:30-4:45	LROC **Mark Robinson**, WAC Ultraviolet Reflectance of the Moon	**Dmitry Golovin**, Space Monitoring of Lunar Radiation Environment by LEND Onboard LRO
4:45-5:00	**James Head**, Volcanic Flooding of Impact Basins: New Insights from Lunar Reconnaissance Orbiter Lunar Orbiter Laser Altimeter Data	**Amanda Hendrix**, The Ultraviolet Reflectance of the Moon: Weathering and Compositional Effects

5:00-6:30	POSTER SESSION: Pizza, refreshments and no-host bar	Forum Tent
6:30-8:30	SPECIAL EVENT: NASA Night and Shoemaker Award	Forum Tent

Wednesday, July 20, 2011 AGENDA DAY 2

TIME	EVENT	LOCATION
8-8:30	REGISTRATION: NASA Conference Center/COFFEE Served in Tent	Conf. Center Entrance
8:30	PLENARY SESSION 111: Geology and Petrology (Chair: **Clive Neal**)	Conf. Center Ballroom
8:30-8:55	**James Head** Orientale Basin (Invited)	Conf. Center Ballroom
8:55-9:20	**Barbara Cohen**, Recent Improvements to Selenochronology by Samples and Missions (Invited)	Conf. Center Ballroom
9:20-9:35	Lightning Round #2: Student Poster Previews	Conf. Center Ballroom

	PARALLEL SESSION #3. Conf. Center BALLROOM	PARALLEL SESSION #4. Conf. Center SHOWROOM
9:35	**OF THE MOON:** Geology/Petrology (Chairs: **Clive Neal** & **Ben Bussey**)	**MISSIONS/COMMERCIAL** (Chairs: **Doris Daou** & **Cass Runyon**)
9:35-9:50	**Benjamin Greenhagen**, Diviner Observations of Lunar Farside Compositional Anomalies	**Frank Schowengerdt**, The International Lunar Research Park
9:50-10:05	**Clive Neal**, A Non-Destructive Technique to Distinguish Impact Melts from Pristine Basalts	**Seiichi Nagihara**, Recent Efforts for Searching, Recovering, and Reading the ALSEP Digital Raw Data Tapes
10:05-10:20	**Stephen Parman**, Formation of Mg-Spinel Anorthosite by Melt-Wallrock Reaction	**Paul Spudis**, Using the Resources of the Moon to Create a Permanent, Cislunar Space Faring System
10:20-10:35	**Carlton Allen**, Remote Analysis of FeO in Lunar Pyroclastic Glass Deposits by LRO Diviner	**Doris Daou**, Education and Public Outreach: More than Just Glamour!
10:35-10:45		BREAK
10:45-11:00	**James Ashley**, Geologic Mapping, Morphology, and Dating of the King Crater Region	**Alexandra Matiella Novak**, The Unknown Moon - Education and Public Outreach for Lunar Science
11:00-11:15	**Joshua Bandfield**, Lunar "Cold Spots": A Population of Thermophysically and Morphologically Distinct Craters	**David Gump**, Repeated and Affordable Access to the Lunar Surface Via Commercial Expeditions
11:15-11:30	**William Bottke**, The Great Archean Bombardment, or the Late Late Heavy Bombardment	**John Cooper**, Lunar Solar Origins Exploration (LunaSOX)
11:30-11:45	**Ben Bussey**, Lunar Processes and History from Global Mapping by MINI-RF RADAR	**Mihaly Horanyi**, iDUST: A Mission Concept for "Dust Tomography" of the Heliosphere
11:45-12:00	**Georgiana Kramer**, Integrated Spectral and Geomorphological Analysis of the Schrödinger Basin	**Tobin Munsat**, First Science Results of the CCLDAS Dust Accelerator Facility
12:00-12:15	**Brendan Hermalyn**, Ejecta Evolution and Thermal Signature from the LCROSS Impact: Insight from Experiments	**Brian O'Brien**, Updated Review of Apollo Dust Measurements on the Moon
12:15-12:30		**Dong-Wook Lee**, 3-D Simulations of the Lunar Sodium Exosphere and Its Tail

AGENDA DAY 2 Wednesday, July 20, 2011

TIME	EVENT	LOCATION
12:30-2:00	LUNCH Served in Tent / FOCUS GROUP SESSIONS	See last page
2:00	PLENARY SESSION IV: Geology & Regolith (Chair: **Jeff Moore**)	Conf. Center Ballroom
2:00-2:25	**Paul Warren**, Sample-Based Constraints on the Extent of Primordial Melting Bulk Composition of the Moon (Invited)	Conf. Center Ballroom
2:25-2:50	**Paul Spudis**, New Insights Into Lunar Multi-Ring Impact Basins (Invited)	Conf. Center Ballroom

	PARALLEL SESSION #5. Conf. Center BALLROOM	**PARALLEL SESSION #6.** Conf. Center SHOWROOM
2:50	**OF THE MOON:** Geology/Regolith (Chairs: **Jeff Plescia** & **Jerome Johnson**)	**ON THE MOON:** Human Exploration/Robotics (Chairs: **Barb Cohen** & **Allen Wilkinson**)
2:50-3:05	**Teemu Öhman**, Impact Melt-Rich Lithologies in Lunar Crater Kepler	**Douglas Currie**, Robotic Anchored Lunar Deployment of the Lunar Laser Ranging Retroreflector for the 21st Century
3:05-3:20	**Jeff Plescia**, Artificial Lunar Impacts: Constraints on Cratering Mechanics	**Noah Petro**, The Next Generation Lunar Scientists and Engineers (NGLSE)
3:20-3:35	**Jennifer Whitten**, Volcanic Resurfacing of Heavily Cratered Terrain: Flooding Experiments on the Moon using Lunar Orbiter Laser Altimeter (LOLA) Data	**Kevin Hussey**, "Eyes On The Solar System" A Real-time, 3D-Interactive Explorer for the MoonKAM and Beyond
3:35-3:50	**Raphael Garcia**, Very Preliminary Reference Moon Model	**Frank Giovane**, Test of the Habitat Particle Impact Monitoring System (HIMS) for Detecting Impact Damage on Habitats
3:50-4:15	BREAK	
4:15-4:30	**Jerome Johnson**, Lunar Regolith Mobility and Excavation Experiment and Modeling Progress	**Emerson Speyerer**, Small Illuminated Peaks Near the Lunar Poles
4:30-4:45	**Michael Poston**, Thermal Stability of Water and Hydroxyl on Lunar Regolith Surrogates as Explored by Temperature Program Desorption Experiments	**Babak Cohanim**, New Platforms for Science on the Lunar Surface
4:45-5:00	**Noah Petro**, South Pole-Aitken Basin Regolith: Contributions from Small, Interior Craters and Positive Implications for Sampling SPA Impact Melt	**Barbara Cohen**, NASA's Robotic Lunar Lander Develpoment Project: An Update
5:00-5:15	**Jean-Pierre Williams**, Lunar Surface Temperatures: Modeling Results and LRO Diviner Observations	**Allen Wilkinson**, Lunar Excavation and Penetration Experiments in a Simulant Soil Test Bed
5:15-5:30	Lightning Round #3: Late Breaking Results/Poster Preview	Lightning Round #4: Late Breaking Results/ Poster Preview
5:30-7:00	POSTER SESSION: Hors D'oeuvres and no-host bar	Forum Tent

Thursday, July 21, 2011 AGENDA DAY 3

TIME	EVENT	LOCATION
8-8:30	COFFEE	Forum Tent
8:30	PLENARY SESSION V: Volatiles/Atmosphere & Astrophysics/ Heliophysics (Chair: **Bill Bottke**)	Conf. Center Ballroom
8:30-8:55	**Alan Stern**, The Lunar Atmosphere: Recent Observations and Prospects for Future Missions (Invited)	Conf. Center Ballroom
8:55-9:20	**Georgiana Kramer**, The New Lunar Water Debate: Surface Phenomenon Versus Internal Processing (Invited)	Conf. Center Ballroom
9:20-9:45	**Jack Burns**, The Astro2010 Decadal Survey: New Horizons for Astrophysics from the Moon (Invited)	Conf. Center Ballroom

	PARALLEL SESSION #7. Conf. Center BALLROOM	**PARALLEL SESSION #8.** Conf. Center SHOWROOM
9:45	**OF THE MOON:** Volatiles/Atmosphere (Chairs: **Ross Beyer** & **Diane Wooden**)	**FROM THE MOON:** Astrophysics/Heliophysics (Chairs: **Jack Burns** & **Joe Lazio**)
9:45-10:00	**Anthony Colaprete**, A Model for the Distribution of Volatiles at the LCROSS Impact Site	**Peter Chi**, Ultra-Low-Frequency Waves at the Moon: Apollo Observations and Inferences About the Plasma and Subsurface Environments
10:00-10:15	**Ross Beyer**, Feasibility and Definition of a Limited-Scale Lunar Polar Volatiles Prospecting Mission	**Steve Durst**, ILO-X Technology Demonstrator: Astrophysics and Communications from the Moon
10:15-10:30	**Alberto Saal**, High Pre-Eruptive Water Contents Preserved In Lunar Melt Inclusions	**Steven Furlanetto**, The Dark Ages Radio Explorer: Theoretical Motivation
10:30-10:45	BREAK	
10:45-11:00	**Dana Hurley**, Toward Understanding the Distribution and Abundance of Volatiles at the Lunar Poles	**Joseph Lazio**, The Science Instrument for the Dark Ages Radio Explorer (DARE)
11:00-11:15	**David Loftus**, Organic Molecules on the Moon	**Jasper Halekas**, First Remote Measurements of Lunar Surface Charging from ARTEMIS: Evidence for Non-Monotonic Sheath Potentials Above the Dayside Surface
11:15-11:30	**Roald Sagdeev**, Use of Apollo 17 Epoch Neutron Spectrum as a Benchmark in testing LEND Collimated Sensor	**Janice Harvey**, Journey Through the Universe, NLSI Joins the Journey Team
11:30-11:45	**Matthew Siegler**, Lunar Polar Ice and the Obliquity History of the Moon	**Robert MacDowall**, A Pathfinder Mission for the ROLSS Lunar Radio Observatory
11:45-12:00	**Menelaos Sarantos**, Lunar Pickup Ions: Exospheric or Surface Origin?	**Simone Dell'Agnello**, Constraining Spacetime torsion with Apollo/Lunokhod Laser Ranging, Mercury Radar Ranging, LAGEOS, Gravity Probe B and BepiColombo
12:00-12:15	**Diane Wooden**, Heavy Atoms in Exosphere Above Cabeus PSR	**Richard Miller**, The Lunar Occultation Observer (LOCO) - A New Paradigm in Nuclear Astrophysics
12:15-12:30	Student Poster Awards/Closing Remarks	Conf. Center Ballroom
12:30-1:30	LUNCH	
1:30-5:00	LEAG/SBAG/MEPAG & Apollo Historic Sites Meeting	Conf. Center Ballroom