



*The Moon Beyond 2002:  
Next Steps in Lunar Science  
and Exploration*

Taos, New Mexico  
September 12–14, 2002

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**WORKSHOP PROGRAM**

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***THE MOON BEYOND 2002:  
NEXT STEPS IN LUNAR SCIENCE AND EXPLORATION***

**September 12–14, 2002  
Taos, New Mexico**

**SPONSORED BY**

Los Alamos National Laboratory  
The University of California Institute of Geophysics and Planetary Physics  
(IGPP)  
Los Alamos Center for Space Sciences and Exploration  
Lunar and Planetary Institute

**HOSTED BY**

Los Alamos National Laboratory

**MEETING ORGANIZER**

David J. Lawrence  
Los Alamos National Laboratory

**SCIENTIFIC ORGANIZING COMMITTEE**

Mike Duke, *Colorado School of Mines*  
Sarah Dunkin, *Rutherford Appleton Laboratory*  
Rick Elphic, *Los Alamos National Laboratory*  
B. Ray Hawke, *University of Hawai'i*  
Lon Hood, *University of Arizona*  
Brad Jolliff, *Washington University*  
David Lawrence, *Los Alamos National Laboratory*  
Harrison Schmitt, *University of Wisconsin*  
Chip Shearer, *University of New Mexico*



**WEDNESDAY, SEPTEMBER 11, 2002**

Registration and Reception  
6:00 p.m. Martini Tree Bar

**THURSDAY, SEPTEMBER 12, 2002**

Overview of Lunar Science and Exploration  
8:30 a.m. Tenderfoot Katie's  
*Chairs: D. Lawrence and M. Duke*

Lawrence D. J. \*

*WELCOME, INTRODUCTIONS, AND REVIEW OF WORKSHOP AGENDA*

Head J. W. \* [30 MINUTES]

*The Moon: Keystone to Understanding Planetary Geological Processes and History* [#3073]

Taylor G. J. \* Martel L. M. V.

*Lunar Prospecting* [#3052]

Criswell D. R. \*

*Lunar Solar Power System and Lunar Exploration* [#3004]

Duke M. B. \*

*Human Exploration of the Moon* [#3063]

Cooke D. R. \*

*New Approaches for Exploration Beyond Low Earth Orbit* [#3040]

Nozette S. \* Worden S. P.

*DoD Technologies and Capabilities of Relevance to Future Lunar Science and Exploration Objectives* [#3019]

**10:25 BREAK**

Pieters C. M. \* Bullock M. Greeley R. Jolliff B. Sprague A. Stofan E.

*Lunar Science Missions in Context of the Decadal Solar System Exploration Survey* [#3017]

**GENERAL DISCUSSION**

**11:45 LUNCH**

**THURSDAY, SEPTEMBER 12, 2002**

Lunar Polar Deposits

1:00 p.m. Tenderfoot Katie's

Chair: P. Lucey

Bussey D. B. J. \* Robinson M. S. Edwards K. Spudis P. D.

Lucey P. G. Steutel D.

*Permanent Shadow in Lunar Simple Craters* [#3053]

Crider D. H. Vondrak R. R. \*

*Modeling the Stability of Volatile Deposits in Lunar Cold Traps* [#3006]

Butler B. J. \*

*Volatiles at the Poles of the Moon* [#3044]

Smith D. E. \* Zuber M. T. Degnan J. J.

*An Imaging Laser Altimeter for Lunar Scientific Exploration* [#3062]

Blair B. R. \* Diaz J.

*Sensitivity of Lunar Resource Economic Model to Lunar Ice Concentration* [#3051]

**GENERAL DISCUSSION**

**2:30 BREAK**

**THURSDAY, SEPTEMBER 12, 2002**

Investigating the Lunar Surface and Regolith

2:45 p.m. Tenderfoot Katie's

Chair: C. Shearer

Wilcox B. B. \* Robinson M. S. Thomas P. C.

*Regolith Thickness, Distribution, and Processes Examined at Sub-Meter Resolution* [#3048]

Prettyman T. H. \* Lawrence D. J. Vaniman D. T. Elphic R. C.

Feldman W. C.

*Classification of Regolith Materials from Lunar Prospector Data Reveals a Magnesium-rich Highland Province* [#3069]

Vaniman D. T. \* Prettyman T. H. Lawrence D. J. Elphic R. C.

Feldman W. C.

*Contoured Data from Lunar Prospector Indicate a Major Role for Minor Samples* [#3050]

Elphic R. C. \* Lawrence D. J. Prettyman T. H. Feldman W. C.

Vaniman D. T. Gasnault O. Maurice S. Gillis J. J. Jolliff B. L.

Lucey P. G.

*Remote Sensing of Titanium in Mare Basalt Soils: Will the Real TiO<sub>2</sub> Please Stand Up?* [#3070]

Lawson S. L. \* Feldman W. C. Lawrence D. J. Moore K. R. Elphic R. C.  
Maurice S. Belian R. D. Binder A. B.

*Lunar Surface Outgassing and Alpha Particle Measurements* [#3039]

Taylor L. A. \*

*Origin of Nanophase Fe in Agglutinates: A Radical New Concept* [#3022]

Armstrong J. C. \* Wells L. E. Kress M. E. Gonzalez G.

*The Moon: A Repository for Ancient Planetary Samples* [#3021]

## GENERAL DISCUSSION

4:45 ADJOURN

THURSDAY, SEPTEMBER 12, 2002

Poster Session

6:30 p.m. Looking Glass Room

Araki H. Matsumoto K. Heki K. Hanada H. Kawano N.

*Lunar Geodetic Missions in SELENE (2005–2006) and SELENE2* [#3032]

Asmar S. W. Schubert G.

*Admittance Computations from Lunar Gravity and  
Topography Data* [#3064]

Byrne C. J.

*A New Moon: Improved Lunar Orbiter Mosaics* [#3016]

Chabot N. L. Agee C. B.

*Constraining the Material that Formed the Moon: The Origin  
of Lunar V, Cr, and Mn Depletions* [#3020]

Dukes C. A. Baragiola R. A.

*Contribution of Ion Sputtering to the Production of Na and K  
in the Lunar Atmosphere* [#3037]

Frassanito J. R. Cooke D. R.

*Applying Strategic Visualization® to Lunar and Planetary  
Mission Design* [#3047]

Hagerty J. J. Shearer C. K. Papike J. J.

*Using Small Basaltic Lunar Clasts to Reconstruct the Early  
Magmatic History of the Moon* [#3041]

Holin I. V.

*Radar Speckle Displacement Interferometry to Study Moon's  
Polar Axis Behaviour in the Sky* [#3030]

Hooper D. M.

*Modeling the Degradation of Small Lunar Impact Craters:  
An Example Using a DEM* [#3026]

Iwata T. Hanada H. Kawano N. Takano T. Namiki N.

*Global Lunar Gravity Mapping Using SELENE Sub-Satellites* [#3013]

Karner J. M. Papike J. J. Shearer C. K.

*Systematics of Chromium and Titanium in Olivine from Lunar Mare  
Basalts Compared to Basalts from the Earth and Mars* [#3046]

Lepper K.

*Anomalous Fading of Stimulated Luminescence (TL/OSL): Comparisons  
Between Lunar Materials and the JSC Mars-1 Simulant* [#3042]

Mitchell D. L. Halekas J. S. Lin R. P. Frey S. Hood L. L.

*Search for Correlations Between Crustal Magnetic Fields  
and Other Lunar Properties* [#3060]

Norman M. D. Bennett V. C.

*Siderophile Elements in Lunar Impact Melts: Implications for the  
Cataclysm, Impactor Sources, and Early Earth Environments* [#3031]

Perelygin V. P. Abdullaev I. G. Bondar Yu. V. Chuburkov Yu. T.

Fleischer R. L. Kravets L. I. Kashkarov L. L.

*On Search and Identification of Super Heavy ( $Z=110-114$ ) and Super  
Super Heavy ( $Z\geq 160$ ) Cosmic Ray Nuclei Tracks in the Moon Olivine  
Crystals* [#3036]

Petro N. E. Pieters C. M.

*Reconstructing the Stratigraphy of the Ancient South Pole-Aitken  
Basin Interior* [#3018]

Rodriguez P. Kennedy E. J. Kossey P. McCarrick M. Kaiser M. L.

Bougeret J.-L. Tokarev Yu. V.

*Lunar Radar Cross Section at Low Frequency* [#3008]

Sarrazin P. Blake D. Vaniman D. Bish D. Chipera S. Collins S. A.

*A Miniature Mineralogical Instrument for In-Situ Characterization  
of Ices and Hydrous Minerals at the Lunar Poles* [#3054]

Stegman D. R. Jellinek A. M. Zatman S. A. Baumgardner J. R.

Richards M. A.

*Lunar Core Dynamo Driven by Thermochemical  
Mantle Convection* [#3074]

Takahashi Y. D.

*Call for Cooperation Between Lunar Scientists and Astronomers:  
Proposing Lunar Science Missions to Enable Astronomy from  
the Moon* [#3059]

van Susante P. J.

*Study Towards Human Aided Construction of Large  
Lunar Telescopes* [#3009]

Young E. W.

*Grand Observatory* [#3005]

**FRIDAY, SEPTEMBER 13, 2002**

Lunar Composition and Remote Sensing

8:30 a.m. Tenderfoot Katie's

*Chairs: B. Jolliff and R. Elphic*

Taylor G. J. \* Hawke B. R. Spudis P. D.

*Bulk Composition of the Moon: Importance, Uncertainties,  
and What We Need to Know* [#3049]

Jolliff B. L. \* Gillis J. J.

*Lunar Crustal and Bulk Composition: Th and Al Mass Balance* [#3056]

Gillis J. J. \* Jolliff B. L.

*An Analysis of Remotely Sensed Data of Mare Australe* [#3025]

Hawke B. R. \* Lawrence D. J. Blewett D. T. Lucey P. G. Smith G. A.

Taylor G. J. Spudis P. D.

*Lunar Highlands Volcanism: The View from a New Millennium* [#3035]

Hiesinger H. \* Head J. W. III Wolf U. Jaumann R. Neukum G.

*Ages, Thicknesses and Mineralogy of Lunar Mare Basalts* [#3038]

Lawrence D. J. \* Elphic R. C. Feldman W. C. Gasnault O.

Prettyman T. H. Vaniman D. T.

*Identifying Locations for Future Lunar Sample Missions* [#3068]

**GENERAL DISCUSSION**

**10:15 BREAK**

Ohtake M. \* Demura H.

*Capability and Data Analyses of the Multiband Imager for the  
SELENE Mission* [#3061]

Haruyama J. \* Ohtake M. Matsunaga T. Hirata N. Demura H.

Nakamura R. LISM Working Group

*Expected Data by Lunar Imager/SpectroMeter (LISM)* [#3065]

Stutel D. \* Lucey P. G. Winter M. E. LeMouelic S.

*Efficient Material Mapping Using Clementine Multispectral Data* [#3058]



Robinson M. S. \* Jolliff B. L.

*Topographic-Photometric Corrections Applied to Clementine Spectral Reflectance Data of the Apollo 17 Region* [#3055]

Lucey P. G. \* Steutel D.

*A Complete First Order Model of the Near-Infrared Spectral Reflectance of the Moon* [#3057]

## GENERAL DISCUSSION

12:00 LUNCH

### FRIDAY, SEPTEMBER 13, 2002

Lunar Core, Interior and Impacts

1:30 p.m. Tenderfoot Katie's

Chairs: B. R. Hawke and L. Hood

Righter K. \*

*Did the Moon Come from the Impactor? Siderophile Element Constraints* [#3043]

Hood L. L. \* Richmond N. C.

*Next Steps in Understanding Lunar Paleomagnetism and Related Issues* [#3045]

Halekas J. S. \* Mitchell D. L. Lin R. P. Hood L. L.

*Constraints on the Origin of Lunar Crustal Magnetism* [#3024]

Norman M. D. \* Borg L. E. Nyquist L. E. Bogard D. D.

*Crystallization Age and Impact Resetting of Ancient Lunar Crust from the Descartes Terrane* [#3028]

## GENERAL DISCUSSION

2:45 BREAK

Fernandes V. A. \* Burgess R. Turner G.

*North West Africa 773 (NWA773): Ar-Ar Studies of Breccia and Cumulate Lithologies* [#3033]

Korotev R. L. \* Gillis J. J. Haskin L. A. Jolliff B. L.

*On the Age of the Nectaris Basin* [#3029]

Whitford-Stark J. L. \*

*A Manned Lunar Base for Determining the Three-Dimensional Make-Up of a Lunar Mare* [#3023]

Peterson C. A. \* Hawke B. R. Blewett D. T. Bussey D. B. J. Lucey P. G.  
Taylor G. J. Spudis P. D.

*Compositional Units on the Moon: The Role of  
South Pole-Aitken Basin* [#3034]

Spudis P. D. \* Fessler B.

*Searching for Antipodal Basin Ejecta on the Moon* [#3066]

## GENERAL DISCUSSION

4:30 ADJOURN

### SATURDAY, SEPTEMBER 14, 2002

Future Lunar Missions

8:30 a.m. Tenderfoot Katie's

*Chairs: C. Pieters and H. Schmitt*

Foing B. \* [INVITED]

*Overview of ESA's SMART-1 Mission*

Lucey P. G. \* [INVITED]

*Polar Night: A Mission to the Lunar Poles* [#3067]

Mizutani H. \* Fujimura A. Tanaka S. Shiraishi H. Yoshida S.  
Nakajima T. [INVITED]

*Mission Outline of Lunar-A* [#3072]

Neal C. R. \* [INVITED]

*Using the New Views of the Moon Initiative to Define  
Future Missions: The Lunar Seismic Network* [#3071]

Mizutani H. \* Sasaki S. Iijima Y. Tanaka K. Kato M.  
Takizawa Y. [INVITED]

*Scientific Research in SELENE Mission* [#3012]

Williams J. G. Boggs D. H. Ratcliff J. T. \* Dickey J. O. Murphy T. W.  
*Current and Future Lunar Science from Laser Ranging* [#3027]

Shearer C. K. \* Papike J. J. Borg L.

*Future Lunar Sampling Missions. Big Returns on Small Samples* [#3011]

Duke M. B. \* [INVITED]

*Sample Return from South Pole-Aitken Basin* [#3010]

## GENERAL DISCUSSION

11:45 ADJOURN

12:00 FIELD TRIP

# NOTES

# NOTES

## NOTES