MICHAEL K. SHEPARD

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EDUCATION

1994 Ph.D. Washington University, Earth and Planetary Sciences. Advisor, Raymond Arvidson.
1984 B.S. Physics. Vanderbilt University

POSITIONS

2014-	Chair, Department of Environmental, Geographical, & Geological Sciences
2003-	Professor, Bloomsburg University, Bloomsburg, Pennsylvania.
2000-2003	Associate Professor, Bloomsburg University, Bloomsburg, Pennsylvania.
1995-2000	Assistant Professor, Bloomsburg University, Bloomsburg, Pennsylvania.
1999	NASA-ASEE Faculty Fellow Jet Propulsion Laboratory, Pasadena, California.
1994-1995	Garber Postdoctoral Fellow, Smithsonian Institution, Washington, D. C.
1994	Postdoctoral Research Associate, Washington University, St. Louis, Missouri.
1990-1994	Research/Teaching Assistant, Washington University, St. Louis, Missouri.
1984-1989	Nuclear Propulsion Officer, United States Navy.

PROFESSIONAL SOCIETIES

American Geophysical Union
Division of Planetary Sciences, American Astronomical Society

VISITING ASTRONOMER

Arecibo Observatory, Puerto Rico,
NASA Infrared Telescope Facility, Hawaii,

PANELS AND COMMITTEES

Bloomsburg University Curriculum Committee (BUCC, 2013-2015, 2016)
Friends of the Bloomsburg Public Library (2010-, Secretary 2012-2016, President 2018-)
NASA Planetary Geology and Geophysics Review Panel (various years)
Bloomsburg University Tenure Committee (2003-2004)
Mars Exploration Rover 2003 Landing Site Selection Committee (2001-2003)
Chair, NASA Planetary Cartography and Geological Mapping Working Group (2000-2001)
NASA Planetary Cartography and Geological Mapping Working Group (1997-2001)
Bloomsburg University Faculty Professional Development Committee (1997-1998)
Advisory Board Member, *Earth in Space*, American Geophysical Union, (1995-2000).
Johns Hopkins Applied Physics Laboratory "Red Team" member (Aug 1997, June 1998)

HONORS & AWARDS

Asteroid 20392 MIKESHEPARD
Bloomsburg University 175th Anniversary Faculty Speaker (2014).
Maroon and Gold Quill Award, Friends of the Bloomsburg University Library (2013).
Dean's Award for Excellence in Teaching, Research, and Service (2011, 1998).
Bloomsburg University Graduation Commencement Speaker, (Dec. 2005).
NASA-ASEE Summer Faculty Fellowship (Summer, 1999) Jet Propulsion Laboratory

PUBLICATIONS AND PRESENTATIONS

BOOKS

Shepard, M.K. ***Introduction to Planetary Photometry.*** Cambridge University Press 2017.
Shepard, M.K. ***Asteroids: Relics of Ancient Time***. Cambridge University Press 2015.

POPULAR PRESS

Shepard, M.K. ***Skill Builders: Introducing "The Star Deck"***, Night Sky, March/Apr 2007 (final issue).
Shepard, M. ***Why do Asteroids Come in Pairs?*** Sky and Telescope, December 2012.

Guest Columnist, Bloomsburg Press-Enterprise, (http://www.pressenterpriseonline.com/).
The Curious Professor – a 700 word science column. Weekly 2010, Biweekly 2011-2012, 2014-present

BOOK CHAPTERS

Campbell, B. A., R. E. Arvidson, **M. K. Shepard**, and R. A. Brackett, *Surficial Geology of Venus*, in Venus II, University of Arizona Press, 1997.

PEER-REVIEWED JOURNAL ARTICLES

Takir, D., Reddy, V., Sanchez, J., **Shepard, M.K**., Emery, J.P. 2017. Detection of water and/or hydroxyl on asteroid (16) Psyche. Astronomical Journal 153, 6pp. DOI: 10.3847/1538-3881/153/1/31.

Shepard, M.K., and 21 coauthors. 2017. Radar observations and shape model of asteroid 16 Psyche. Icarus 281, 388-403.

Shepard, M.K., and 15 coauthors. 2015. A radar survey of M- and X-class asteroids III. Insights into their composition, hydration state, and structure. *Icarus* 245, 38-55. 10.1016/j.icarus.2014.09.016

Neeley, J.R., Clark, B.E., Ockert-Bell, M.E., **Shepard, M.K.**, Conklin, J., Cloutis, E.A., Fornasier, S., Bus, S.J. 2014. The composition of M-type asteroids II. Synthesis of spectroscopic and radar observations. *Icarus* 238, 37-50. 10.1016/j.icarus.2014.05.008

Johnson, J.R., **Shepard, M.K.,** Grundy, W.M., Paige, D.A., Foote, E.J. 2013. Spectrogoniometry and modeling of martian and lunar analog samples and Apollo soils. *Icarus* 223, 383-406. DOI: 10.1016./j.icarus.2012.12.004.

Domingue, D.L., Murchie, S.L., Denevi, B.W., Chabot, N.L., Blewett, D.T., Laslo, N.R., Vaughan, R.M., Kang, H.K, **Shepard, M.K.** 2011. Photometric correction of Mercury's global color mosaic. *Planet. Space Sci.* 59, 1873-1887, DOI: 10.1016/j.pss.2011.03.014.

Brozovic, M. and 22 coauthors (including **Shepard, M.K.**) 2011. Radar and optical observations and physical modeling of triple near-Earth asteroid (136617) 1994 CC. *Icarus* 216, 241-256. DOI: 10.1016/ j.icarus.2011.09.002.

Rivkin, A.S., Clark, B.E., Ockert-Bell, M., Volquardsen, E., Howell, E.S., Bus, S.J., Thomas, C.A., **Shepard, M.** 2011. Asteroid 21 Lutetia at 3 um: Observations with IRTF SpeX. *Icarus*, 216 62-68. DOI: 10.1016/ j.icarus.2011.08.009.

Shepard, M.K., Harris, A.W., Taylor, P.A., Clark, B.E., Ockert-Bell, M., Nolan, M.C., Howell, E.S., Magri, C., Giorgini, J.D., Benner, L.A.M. 2011. Radar observations of Asteroids 64 Angelina and 69 Hesperia. *Icarus* 215, 547-551. DOI: 10.1016/j.icarus.2011.07.027.

Shepard, M.K., and Helfenstein, P. 2011. A laboratory study of the bidirectional reflectance from particulate samples. *Icarus* 215, 526-533. DOI: 10.1016/j.icarus.2011.07.033.

Helfenstein, P., and **Shepard, M.K.** 2011. Testing the Hapke photometric model: Improved version and the porosity correction. *Icarus* 215, 83-100. DOI: 10.1016/j.icarus.2011.07.002.

Souchon, A.L., Pinet, P.C., Chevrel, S.D., Daydou, Y.H., Baratoux, D., Kurita, K., **Shepard, M.K.**, Helfenstein, P. 2011. An experimental study of Hapke's modeling of natural granular surface samples. *Icarus* 215, 313-331. DOI: 10.1016/j.icarus.2011.06.023.

Ockert-Bell, M.E., Clark, B.E., **Shepard, M.K.**, Isaacs, R.A., Cloutis, E.A., Fornasier, S., Bus, S.J., 2010. The composition of M-type asteroids: Synthesis of spectroscopic and radar observations. *Icarus*, 210 674-692, DOI: 10.1016/j.icarus.2010.08.002.

Shepard, M.K., Clark, B.E., Ockert-Bell, M., Nolan, M.C., Howell, E.S., Magri, C., Giorgini, J.D., Benner, L.A.M., Ostro, S.J., Harris, A.W., Warner, B.D., Stephens, R.D., Mueller, M. 2010. A radar survey of M- and X-class asteroids II. Summary and synthesis. Icarus 208, 221-237. DOI: 10.1016/j.icarus.2010.01.017.

Hapke, B., **Shepard, M.K.**, Nelson, R.M., Smythe, W.D., Piatek, J. 2009. A quantitative test of the ability of models based on the equation of radiative transfer to predict the bidirectional reflectance of a well-characterized medium. *Icarus*. 199, 210-218. DOI: 10.1016/j.icarus.2008.09.006.

Benner, L.A.M., Ostro, S.J., Magri, M., Nolan, M.C., Howell, E.S., Giorgini, J.D., Jurgens, R.F., Margot, J.L, Taylor, P.A., Busch, M.W., **Shepard. M.K.,** 2008. Near-Earth asteroid surface roughness depends on compositional class. Icarus. 198, 294-304. DOI: 10.1016/j.icarus.2008.06.010.

Shepard, M.K. and 19 coauthors. 2008. A radar survey of M- and X-class asteroids. Icarus, 195, 184-205.

Shepard, M.K., Kressler, K.M*****., Clark, B.E., Ockert-Bell, M.E., Nolan, M.C., Howell, E.S., Magri, C., Giorgini, J.D., Benner, L.A.M., Ostro, S.J. 2008. Radar observations of E-class Asteroids 44 Nysa and 434 Hungaria. Icarus, 195, 220-225. DOI:10.1016/j.icarus.2007.12.018.

Ockert-Bell, M.E., Clark, B.E., **Shepard. M.K**., Rivkin, A.S., Binzel, R.P., Thomas, C.A., DeMeo, F.E., Bus, S.J., Shah, S. 2008. Observations of X/M asteroids across multiple wavelengths. Icarus 195, 206-219.

Shepard, M.K., and 16 coauthors. 2008. Multi-wavelength observations of Asteroid 2100 Ra-Shalom, Icarus, 193, 20-38. DOI:10.1016/j.icarus.2007.09.006

Shepard, M.K. and Helfenstein, P. 2007. A test of the Hapke photometric model. J. Geophys. Res. 112, E03001, DOI: 10.1029/2005JE002625.

Johnson, J.R., Sohl-Dickstein, J., Grundy, W.M., Arvidson, R.E., Bell, J., Christensen, P., Graff, T., Guinness, E.A., Kinch, K., Morris, R., **Shepard, M.K.** 2006. Radiative transfer modeling of dust-coated Pancam calibration target materials: Laboratory visible/near-infrared spectrogoniometry. J. Geophys. Res 111, E12S07, DOI: 10.1029/2005JE002658.

Shepard, M.K., J.L. Margot, C. Magri, M.C. Nolan, J. Schlieder*****, B. Estes*****, S.J. Bus, E.L. Volquardsen, A.S. Rivkin, L.A.M. Benner, J.D. Giorgini, S.J. Ostro, M.W. Busch 2006. Radar and infrared observations of binary near-Earth asteroid 2002 CE26. Icarus 184, 198-210.

Shepard, M. K., L.A.M. Benner, S.J. Ostro, D.B. Campbell, J.F. Chandler, I.I. Shapiro. Radar detection of near-Earth asteroids 1915 Quetzalcoatl, 3199 Nefertiti, 3757 (1982 XB), and 4034 (1986 PA). *Icarus*,**172**, 170-178, 2004.

Clark, B.E., S.J.Bus, A.S. Rivkin, **M.K. Shepard**, S. Shah, X-type asteroid spectroscopy. *Astron. J,* **128**, 3070-3081, 2004.

Clark, B.E., S.J. Bus, A.S. Rivkin, T. McConnochie, J. Sanders, S. Shah, T. Hiroi, **M. Shepard**, E-type asteroid spectroscopy and compositional modeling. *J. Geophys. Res.*,**109**,2004.

Johnson, J.R., W.M. Grundy, **M.K. Shepard**, Visible/near-infrared spectrogoniometric observations and modeling of dust-coated rocks. *Icarus*, **171**, 546-556, 2004.

Kehoe-Forutan, S.J., B.A. Campbell, **M.K. Shepard**. Penetrating the mystery beneath Millville Friends Meeting cemetary, *AGS Quarterly*, **28**, 11-12, 2004.

Campbell, B. A. and **M. K. Shepard**, Coherent and incoherent components in near-nadir radar scattering: Applications to radar sounding of Mars. *J. Geophys. Res.*, 108, 5132-5140, 2003.

Bell, J.F. III, S. W. Squyres, K.E. Herkenhoff, J.N. Maki, H.M. Arneson, D. Brown, S.A.Collins, A. Dingizian, S.T. Elliot, E.C. Hagerott, A.G. Hayes, M.J. Johnson, J.R. Johnson, J. Joseph, K. Kinch, M.T. Lemmon, R.V. Morris, L. Scherr, M. Schwochert, **M.K. Shepard**, G.H. Smith, J.N. Sohl-Dickstein, R.J. Sullivan, W.T. Sullivan, and M. Wadsworth, Mars Exploration Rover Athena Panoramic Camera (Pancam) investigation, J. Geophys. Res., 108, 8063-8093, 2003.

Campbell, B.A., R.R. Ghent, and **M.K. Shepard**, Limits on inference of Mars small-scale roughness from MOLA data, *Geophys. Res. Letters*, 30, 1115, 2003

Shepard, **M. K.**, B. A. Campbell, M. H. Bulmer, T. G. Farr, L. R. Gaddis, J. J. Plaut, The roughness of natural terrain. A planetary and remote sensing perspective. *J. Geophys. Res*., 106, 32777-32795, 2001.

Shepard, **M. K.**, L. A. M. Benner, S. J. Ostro, A. W. Harris, K. D. Rosema, I. I. Shapiro, J. F. Chandler, D. B. Campbell, 2000. Radar observations of asteroid 2100 Ra-Shalom, *Icarus, 147*, 520-529, 2000.

Shepard M. K. and B. A. Campbell, Near-Nadir Microwave Scattering from a Self-Affine Fractal Surface, *Icarus*, **141**, 156-171, 1999.

Shepard M. K. and R. E. Arvidson, The Opposition Surge and Photopolarimetry of Fresh and Coated Basalts, *Icarus*, **141**, 172-178, 1999.

Helfenstein, P. and **M. K. Shepard**, Submillimeter-Scale topography of Undisturbed Lunar Soils, *Icarus*, **141**, 107-131, 1999.

Shepard M. K. and B. A. Campbell, Shadows on a Planetary Surface and Implications for Photometric Roughness, *Icarus*, **134**, 279-291, 1998.

Guinness, E. A., R. E. Arvidson, I. H. D. Clark, and **M. K. Shepard**, Optical Scattering Properties of Terrestrial Varnished Basalts Compared with Rocks and Soils at the Viking Lander Sites, *Journal of Geophysical Research*, 102, 28,687-28,704, 1997.

Campbell, B. A. and **M. K. Shepard**, Effect of Venus Surface Illumination on Photographic Image Texture, *Geophysical Research Letters*, 24, 731-734, 1997.

Campbell, B. A. and **M. K. Shepard,** Lava Flow Surface Roughness and Depolarized Radar Scattering, *Journal of Geophysical Research*, 101, 18,941-18,952, 1996.

Shepard, M. K., R. A. Brackett, and R. E. Arvidson, Self-Affine (Fractal) Topography: Surface Parameterization and Radar Scattering, *Journal of Geophysical Research*, 100, 11,709-11,718, 1995a.

Shepard, M. K., R. E. Arvidson, M. Caffee, B. Finkel, and L. Harris, Cosmogenic Exposure Ages of Basalt Flows: Lunar Crater Volcanic Field, Nevada, *Geology*, *23*, 21-24, 1995b.
Pollack, J. B., M. E. Ockert-Bell, and **M. K. Shepard**, Viking Lander image analysis of Martian atmospheric dust, *Journal of Geophysical Research*, 100, 5235-5250, 1995.

Shepard, M. K., R. E. Arvidson, R. A. Brackett, and B. A. Fegley, A Ferroelectric Model for the Low Emissivity Highlands on Venus, *Geophysical Research Letters*, *21*, 469-472, 1994.

Arvidson, R. E., R. A. Brackett, **M. K. Shepard**, N. R. Izenberg, B. Fegley, Jr., and J. J. Plaut, Microwave Signatures and Surface Properties of Ovda Regio and Surroundings, Venus, *Icarus, 112(1)*, 171-186, 1994.

Shepard, M. K., R. E. Arvidson, and E. A. Guinness, Specular Scattering from a Terrestrial Playa and Implications for Planetary Surface Studies, *Journal of Geophysical Research*, 98, 18,707-18,718, 1993.

Arvidson, R. E., **M. K. Shepard**, E. A. Guinness, S. B. Petroy, J. J. Plaut, D. L. Evans, T. G. Farr, R. Greeley, N. Lancaster, L. R. Gaddis, Characterization of Lava-Flow Degradation in the Pisgah and Cima Volcanic Fields, California, using Landsat Thematic Mapper and AIRSAR data, *Bulletin, Geological Society of America*, 105, 175-188, 1993.

Campbell, B. A., R. E. Arvidson, and **M. K. Shepard**, Radar Polarization Properties of Volcanic and Playa Surfaces: Applications to Terrestrial Remote Sensing and Magellan Data Interpretation, *Journal of Geophysical Research,* 98, 17,099-17,113, 1993.

Arvidson, R. E., R. Greeley, M. C. Malin, R. S. Saunders, N. Izenberg, J. J. Plaut, E. R. Stofan, and **M. K. Shepard**, Surface Modification of Venus as Inferred from Magellan Observations of Plains, *Journal of Geophysical Research,* 97, 13,303-13,317, 1992.

Shepard, M. K., R. E. Arvidson, E. A. Guinness, and D. W. Deering, Scattering Behavior of Lunar Lake Playa Determined from PARABOLA Bidirectional Reflectance Data, *Geophysical Research Letters*, 18, 2241-2244, 1991.

RESEARCH GRANTS

2011-2012 **NASA Planetary Geology and Geophysics Program**
Remote Sensing of Planetary Surfaces, $51,815

2009-2012 **National Science Foundation, Astronomy & Astrophysics**
Collaborative Proposal RUI: Multi-wavelength Survey and Analysis of X/M/E Asteroids with Dr. B. E. Clark (co-investigator, Ithaca College), $133,284.

2008-2011 **NASA Planetary Geology and Geophysics Program**
Remote Sensing of Planetary Surfaces, $105,000

2006-2008 **National Science Foundation, Astronomy & Astrophysics**
Collaborative Proposal RUI: Multi-wavelength Survey and Analysis of X/M/E Asteroids with Dr. B. E. Clark (co-investigator, Ithaca College), $117,256.

2005-2007 **NASA Planetary Geology and Geophysics Program**
Remote Sensing of Planetary Surfaces, $105,000

2004-2005 **Bloomsburg University Research and Disciplinary Projects**
Radar Investigation of Asteroids $4,865

2003-2005 **National Science Foundation, Astronomy & Astrophysics**
Multi-wavelength Observations and Analysis of Asteroid 2100 Ra-Shalom, with Dr. B. E. Clark (co-investigator, Ithaca College), $71,800.

2002-2004 **NASA Planetary Geology and Geophysics Program**
Remote Sensing of Planetary Surfaces, $103,500

1999-2001 **NASA Planetary Geology and Geophysics Program**
Remote Sensing of Fractal Planetary Surfaces, with Dr. B. Campbell, (co-investigator, Smithsonian Institute). $146,000

1998-1999 **PASSHE Faculty Professional Development Grants**
Geomorphology from Space – Radar $2,100

1997-1998 **NASA Planetary Geology and Geophysics Program**
A Study of the Venusian Surface Utilizing a Self-affine Paradigm, with B. Campbell (co-investigator, Smithsonian Institute), $51,000.

1997-1999 **National Science Foundation Grant for Instrumentation and Laboratory Improvements**
A Computer Laboratory for Geography and Earth Science, with K. Trifonoff (principal investigator, Bloomsburg University) (July 1997-July 1999) ($26K + matching university)

CONFERENCE ABSTRACTS AND PRESENTATIONS

*indicates B.U. Student Involvement

Shepard, M.K., Howell, E., Nolan, M., Taylor, P., Springmann, A., Giorgini, J., Benner, L., Magri, C. 2014. Recent Arecibo radar observations of Main-belt asteroids. AAS Division of Planetary Sciences Meeting #46, Abs. #409.06.

Busch, M.; Jacobson, S. A.; Benner, L.; Brozovic, M.; Howell, E. S.; Margot, J.; Naidu, S.; **Shepard , M. K**.; Taylor, P. A. A Lower Size Limit for Near-Earth Asteroid Satellites. 2013. American Geophysical Union, Fall Meeting 2013, abstract #P23A-1762.

Shepard, Michael K. Taylor, P. Nolan, M.,Howell, E. Springmann, A. Giorgini, J. Benner, L. Warn er, B. Harris, A. Stephens, R. Merline, W. Rivkin, A. Coley, D. Clark, B. Bell, M. Magri, C. Volatiles in the M-class Population: A Lesson from Vesta? . AAS Division of Planetary Sciences Meeting #45, Abs. #201.01.

Springmann, Alessondra; Brozović, M.; Pravec, P.; Taylor, P. A.; Howell, E. S.; Nolan, M. C.; Benn er, L. M.; Busch, M. W.; Giorgini, J. D.; Magri, C.; Margot, J.; Naidu, S. P.; **Shepard, M. K**.; Marsh all, S. E.; Law, M. C.;Galád, A.; Világi, J.; Gary, B. L.; Hicks, M. D.; Hills, K.; Pray, D. P.; Vodniza, A. Q. 2013. Binary Near-Earth Asteroid (285263) 1998 QE2: Goldstone and Arecibo Radar Imaging and Lightcurve Observations. AAS Division of Planetary Sciences Meeting #45, Abs. #101.04.

M. K. Shepard, M. C. Nolan, A. Springmann, E. S. Howell, P. A. Taylor, J.D. Giorgini, L.A.M. Benner, B. D. Warner, A. W. Harris, R. Stephens, W. J. Merline. Radar Observations of Three X/M-Class Main-belt Asteroids. 2013, 44th LPSC. LPI Contribution 1719, id. 2408.

S. P. Levengood*, **M. K. Shepard**, C. Magri, M. Nolan. Asteroid Shape Modeling with CUDA. 2013, 44th LPSC. LPI Contribution 1719, id. 2299.

Busch, M.W., Ostro, S.J., Benner, L.A., Brozovic, M., Magri, C., Scheeres, D.J., Jacobson, S.A., Margot, J.L., Nolan, M.C., Taylor, P.A., Howell, E., **Shepard, M.K**., Giorgini, J.D. Radar Imaging Of 11066 Sigurd, 2000 YF29, And 2004 XL14 And The Obliquity Distribution Of Contact Binary Near-Earth Asteroids. AAS Division of Planetary Sciences Meeting #44, Abs. #302.05, 2012.

Benner, L.A.M., Borzovic, M., Giorgini, J.D., Lawrence, K.J., Taylor, P.A., Nolan, M.C., Howell, E.S., Busch, M.W., Margot, J.L., Naidu, S.P., Magri, C., **Shepard, M.K**. Arecibo and Goldstone radar observations of binary near-Earth asteroid and Marco Polo-R mission target (175706) 1996 FG3. AAS Division of Planetary Sciences Meeting #44, Abs. #102.06, 2012

Benner, L.A.M., Borzovic, M., Giorgini, J.D., Lawrence, K.J., Taylor, P.A., Nolan, M.C., Howell, E.S., Busch, M.W., Margot, J.L., Naidu, S.P., Magri, C., **Shepard, M.K**. Arecibo and Goldstone

radar observations of binary near-Earth asteroid and Marco Polo-R mission target (175706) 1996 FG3. Asteroids, Comets, Meteors 2012. Niigata, Japan, LPI contribution 1667, id. 6403, 2012.

Brozovic, M., Benner, L.A.M., Nolan, M.C., Ostro, S.J., Margot, J.L., Giorgini, J.D., Howell, E.S., Magri, C., Busch, M.W., Taylor, P.A., **Shepard, M.K**. Shape modeling of near-Earth asteroid (53319) 1999 JM8 from Goldstone and Arecibo radar images. Asteroids, Comets, Meteors 2012. Niigata, Japan, LPI contribution 1667, id. 6183, 2012.
Busch, M.W. and 16 coauthors (including **Shepard, M.K**.) Shape and spin of near-Earth asteroid 308635 (2005 YU55) from radar images and speckle tracking. Asteroids, Comets, Meteors 2012. Niigata, Japan, LPI contribution 1667, id. 6179, 2012.

Foote, E.J., Paige, D.A., **Shepard., M.K**., Johnson, Grundy, W.M., J.R., Biggar, S.F., Greenhagen, B.T., Allen, C. Laboratory and Diviner bidirectional reflectance measurements of Apollo soils. 43rd LPSC. LPI Contribution 1659, id. 2357.

Levengood, S.P.*, **Shepard, M.K**. A GUI-based open source program for viewing and illuminating asteroid shape models. 43rd LPSC. LPI Contribution 1659, id. 1230.

Shepard, M.K., Taylor, P.A., Nolan, M.C., Howell, E.S., Benner, L.A.M., Giorgini, J.D., Warner, B.D., Harris, A.W., Clark, B.E., Ockert-Bell, M., Coley, D. Radar observations of seven X/M-class main-belt asteroids. 43rd LPSC. LPI Contribution 1659, id. 1228.

Neeley, J.R. Ockert-Bell, M.E., Clark, B.E., **Shepard, M.K.**, Cloutis, E.A., Fornasier, S., Bus, S.J. The composition of M-type asteroids: Synthesis of spectroscopic and radar observations. EPSC-DPS Joint Meeting, Nantes, France, Abs. p. 1829. 2011.

Rivkin, A.S., Clark, B.E., Ockert-Bell, M.E., **Shepard, M.K.**, Volquardsen, E.L., Howell, E.S., Bus, S.J. Asteroid 21 Lutetia at 3-4 um: Observations with IRTF SpeX. EPSC-DPS Joint Meeting, Nantes, France, Abs. p. 587. 2011.

Foote, E.J., Paige, D.A., **Shepard., M.K**., Johnson, J.R., Biggar, S.F., Greenhagen, B.T., Allen, C. The bidirectional reflectance of Apollo lunar soils. EPSC-DPS Joint Meeting, Nantes, France, Abs. p. 329. 2011.

Souchon, A.L., Pinet, P.C., Chevrel, S.D., Daydou, Y.H., Baratoux, D., Kurita, K., **Shepard, M.K.**, Helfenstein, P. An experimental photometric study of natural granular surface samples using Hapke's model. 42nd LPSC. LPI Contribution 1608, p. 1785.

Rivkin, A.S., Clark, B.E., Ockert-Bell, M.E., **Shepard, M.K.**, Volquardsen, E.L., Howell, E.S., Bus, S.J. Observations of 21 Lutetia in the 2-4 um region with the NASA IRTF. 42nd LPSC. LPI Contribution 1608, p. 1439.

Shepard, M.K., Cloutis, E. 2011. Laboratory measurements of band depth variation with observed geometry. LPSC 42nd meeting, LPI Contribution 1608, p. 1043. 2011.

Foote, E.J., Paige, D.A., **Shepard., M.K**., Johnson, J.R., Biggar, S.F., Greenhagen, B.T., Allen, C. Apollo 11 and 16 soil bidirectional solar reflectance measurements, models, and LRO Diviner observations. AGU Fall Meeting, Abs. #P53A-1499. 2010.

Johnson, J.R., **Shepard., M.K**., Paige, D.A., Foote, E.J., Grundy, W.M.. Spectrogoniometric measurements and modeling of Apollo soil 68810. AGU Fall Meeting, Abs. #P53A-1498. 2010.

Brozovic, M., Benner, L. A. M. Nolan, M. C. Howell, E. S., Magri, C., Giorgini, J. D., Taylor, P. A., Margot, J. L., Busch, M. W., **Shepard, M. K**., Scheeres, D.J., Carter, L.M., Radar Images And Shape Model Of A Triple Asteroid (136617) 1994CC, Abs 57.02. Division of Planetary Sciences Meeting, Pasadena, CA 2010.

Bell, M., Clark, B. E., **Shepard, M. K**., Issacs, R. A., Cloutis, E. A., Fornasier, S., Bus, S. J. The Composition of M-type Asteroids: Synthesis of Spectroscopic and Radar Observations. Abs 53.06. Division of Planetary Sciences Meeting, Pasadena, CA 2010.

Shepard, M. K., Clark, B. E., Ockert-Bell, M., Nolan, M. C., Howell, E. S., Magri, C., Benner, L. A. M., Giorgini, J. D., Radar Observations of Asteroids 64 Angelina and 69 Hesperia, Abs 53.05. Division of Planetary Sciences Meeting, Pasadena, CA 2010.

Shepard, M.K. The Effects of Albedo and Compaction on the Opposition Surge of Laboratory Particulates, LPI Contribution 1533, p. 1742, Lunar and Planetary Science Conference, Houston, TX, 2010.

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