KARLY M. PITMAN, Ph.D.

Planetary Science Institute
1700 E. Fort Lowell Rd., Suite 106, Tucson, AZ 85719
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PROFILE:

- Research areas: planetary surfaces and atmospheres, small bodies (satellites, asteroids, meteorites), laboratory astrophysics, astrophysics (dust, interstellar medium)
- Technical areas of expertise: radiative transfer modeling, optical constant derivation, laboratory and field spectroscopy at far-IR to mid-UV wavelengths, remote sensing/hyperspectral analysis

EDUCATION:

Ph.D., Physics and Astronomy **2005**
Dissertation: "Radiative Transfer Modeling of Thermal IR Emissivity Spectra: Applications to Martian Regolith Observations" (adviser: G. C. Clayton)

M.S., Physics **2002**
LOUISIANA STATE UNIVERSITY, Baton Rouge, Louisiana

A.B., Astronomy and Geology (Correlate: Physics) **1999**
VASSAR COLLEGE, Poughkeepsie, New York

AWARDS AND HONORS:

Nomination, Annie Jump Cannon Award, American Astronomical Society **2007**
NASA Postdoctoral Program Fellowship, NASA/ORAU/JPL **2006-2009**
NASA Planetary Science Summer School, Jet Propulsion Laboratory **2004**
LPI Graduate Fellowship, Lunar & Planetary Institute **2003**
Board of Regents Fellowship, The Graduate School, Louisiana State University **1999-2003**
Frances W. Pick Scholarship; Westlake Scholarship, Westlake Foundation **1995-1999**

POSITIONS HELD:

Research Scientist **2010 - p**
Associate Research Scientist **2008 - 2010**
PLANETARY SCIENCE INSTITUTE, Tucson, AZ (Director: M. V. Sykes)
Leading and developing independent, externally funded research programs through NASA, NSF grants; coding projects for the Dawn Gamma Ray and Neutron Detector (GRaND) instrument team.

Contractor **2009 - p**
JET PROPULSION LABORATORY, Pasadena, CA
Supervisor: J. B. Dalton, III
Deriving optical constants (real and imaginary indices of refraction) for ice and cryogenic salt compounds to infer composition and abundances on outer solar system icy satellites from Galileo Near Infrared Mapping Spectrometer and Cassini Visual & Infrared Imaging Spectrometer.

Consultant **2009 - 2010**
Dept. of Earth & Planetary Sciences, WASHINGTON UNIVERSITY, St. Louis, MO
Supervisors: A. M. Hofmeister, A. K. Speck
Acquired and analyzed mid- to far-infrared laboratory reflectance, absorption, and transmission spectra of interstellar and circumstellar dust analogs for application to Spitzer Space Telescope, Infrared Space Observatory observations.

NASA Postdoctoral Program Fellow **2006 - 2009**
JET PROPULSION LABORATORY, Pasadena, CA
Adviser: B. J. Buratti (Division 32, Asteroids, Comets, Satellites Group)
Research area: Radiative Transfer Modeling; Titan Atmosphere & Surface; Saturnian Icy Satellites
Leader in U.S. development of surface-atmospheric radiative transfer separation methods for Cassini Visual & Infrared Mapping Spectrometer (VIMS) data from Titan. Responsible for data reduction with ENVI and ISIS software, hyperspectral analysis surface composition and cloud cover, and archiving of incoming and past data from Cassini mission for Saturnian moons; prepared

reports on VIMS results for Titan Orbiter Science Team. Performed disk-integrated photometry and derived bolometric Bond albedo values for Rhea, Enceladus, Dione, Tethys, and Mimas.

Postdoctoral Research Associate **2005 - 2006**
Dept. of Earth & Planetary Sciences, WASHINGTON UNIVERSITY, St. Louis, MO
Advisers: A. M. Hofmeister, A. K. Speck
Research area: Astromineralogy; Laboratory FT-IR Spectroscopy

Utilized laboratory reflectance and absorbance spectroscopy to infer composition and physical properties of circumstellar and interstellar dust (AGB, carbon stars). Derived optical constants using Kramers-Kronig and classical Lorentz-Lorenz dispersion theory, e.g., new optical constants for silicon carbide, a major dust carrier in carbon stars, C-rich stellar outflows, novae, and supernovae, to address community need for bulk properties from UV to far-IR. Developed public database of mid- and far-infrared high-resolution spectra of space and terrestrial analogs.

Research Assistant **2003 - 2005**
SPACE SCIENCE INSTITUTE, Boulder, CO
Adviser: M. J. Wolff
Research area: Planetary Surfaces and Atmospheres; Radiative Transfer Modeling

Derived theoretical phase functions for Mars Global Surveyor Thermal Emission Spectrometer Emission Phase Function sequences of nonspherical Mars aerosols via quad-precision T-matrix computer models. Performed numerical discrete ordinates radiative transfer modeling of planetary regolith and compacted grains. Explored different particle topologies and ensembles of clustered spheres, utilizing multisphere code SCSMFO and geometrical optics codes.

LPI Graduate Fellow **2003**
LUNAR & PLANETARY INSTITUTE, Houston, TX
Adviser: A. H. Treiman
Research area: Mars Meteorite Analysis (XRD, EMP)

Executed X-ray diffraction, optical microscopy, and electron microprobe analyses on Mars meteorite thin sections. Utilized MELTS software to model parent compositions.

Guest Researcher **2002 - 2004**
MARS SPACE FLIGHT FACILITY, ARIZONA STATE UNIVERSITY, Tempe, AZ
Host: J. L. Bandfield
Research area: Laboratory & Field IR Spectroscopy of Mars Analog Terrain

Performed laboratory FT-IR spectroscopy on quartz, clay, sulfate, and Mars-relevant compounds. Improved experimental design of sample acquisition and containment, coordinating resources at ASU and LSU, including directing an undergraduate assistant, machine shop technicians, and external laboratories. Designed and implemented remote sensing thermal infrared directional emissivity field experiment with Designs & Prototypes™ micro-FT-IR field portable spectrometer. Wrote field site proposals and negotiated between National Park Services, ASU, LSU, and SSI.

Graduate Research Assistant **1999 - 2005**
Dept. of Physics & Astronomy LOUISIANA STATE UNIVERSITY, Baton Rouge, LA
Adviser: G. C. Clayton
Research area: Astrophysics of the ISM; Mineralogy of Interstellar Dust

Performed radiative transfer modeling of light scattering and absorption properties of interstellar dust grains. Determined through research that, as of 2000, no quasi-stellar object (QSO) was known to display the broad absorption feature at 2175 Angstroms, disproving earlier reports of the feature in QSOs. Maintained research group websites and represented the group at conferences.

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COMPUTER SKILLS:

Platforms:	UNIX, Linux, PC, Mac OS X
Languages:	FORTRAN77, Fortran 90/95, C/C++, shell scripting, HTML, Perl, VBScript
Packages:	IDL, ENVI, MATLAB, ISIS, Mathematica, Excel
Advanced:	Parallel computing experience on CaSPer, Supermike clusters at LSU
	High performance computing on JPL and SSI supercomputing clusters
	Light systems administration on Mac OS X and Linux machines

PROFESSIONAL SOCIETIES AND SERVICE ACTIVITIES

American Astronomical Society, Full Member; AAS Division for Planetary Sciences **2000 – p**

- Ad hoc working group on longitudinal studies of astronomy/employment (2010-p)
- AAS Demographics Committee (2011-p)
- AAS DPS Professional Development Subcommittee (Chair, Dec. 2012+)
- Contributing author, STATUS newsletter, AAS Committee for the Status of Women in Astronomy

American Physical Society **1999 – p**

- American Physical Society Women Speakers Program (2010-p)

American Geophysical Union, Full Member; Planetary Sciences, Mineral & Rock Physics **2000 – p**

Association for Women In Science (AWIS) **2000-2005**

- AWIS-Baton Rouge, LA chapter: President (2000-2003), Webmaster (2002-2003)

Session Chair, AAS-DPS, LPSC, Spring AGU meetings **2006-2010**

Referee for papers submitted to *Journal of Geophysical Research – Planets, Icarus, IEEE Transactions, Planetary & Space Science,* Titan After Cassini book **2006 – p**

NASA Review Panelist for Mars Data Analysis Program (MDAP), Planetary Geology & Geophysics Program (PG&G), Outer Planets Research Program (OPR), Lunar Advanced Science & Exploration Research Program (LASER), Cassini Data Analysis & Participating Scientist (CDAPS), NASA Postdoctoral Program, NASA Earth & Space Science Fellowship (NESSF), Discovery mission AO **2006 – p**

Featured scientist, 51 Women in Planetary Science project; **2010**
Sally Ride Festival, New Orleans, LA, LIGO Livingston Observatory; **2010**
NASA Solar System Exploration website, http://solarsystem.nasa.gov/index.cfm **2012**

Judge, Stephen Dwornik Student Presentation Awards, Lunar & Planetary Sci. Conference; **2011**
Chambliss Astronomy Achievement Student Award, American Astronomical Society **2012**

Panelist, Early Career Scientist Workshop Career Pathways, AAS-DPS; LPSC **2010-2011**

PUBLICATIONS

- 2012 Dalton, J.B., III, **Pitman, K.M.** *Low temperature optical constants of some hydrated sulfates relevant to planetary surfaces*, Journal of Geophysical Research – Planets, 117, E09001, doi:10.1029/2011JE004036.

- 2011 **Pitman, K.M**., Speck, A.K., Hofmeister, A.M., Corman, A.B. *Optical properties and applications of silicon carbide in astrophysics*, Silicon Carbide – Materials, Processing and Applications in Electronic Devices, edited by Dr. Moumita Mukherjee, InTech Open Access Publishing (ISBN 978-953-307-968-4), http://www.intechopen.com/articles/show/title/optical-properties-and-applications-of-silicon-carbide-in-astrophysics.

- 2011 Prettyman, T.H., Feldman, W.C., McSween, H.Y. Jr., Dingler, R.D., Enemark, D.C., Patrick, D.E., Storms, S.A., Hendricks, J.P., Morgenthaler, J., **Pitman, K.M.**, Reedy, R.C. Dawn's Gamma Ray and Neutron Detector. *Space Science Reviews*, ISSN 0038-6308, pp. 1-89, doi: 10.1007/s11214-011-9862-0, http://dx.doi.org/10.1007/s11214-011-9862-0.

- 2010 **Pitman, K.M.**, Dijkstra, C., Hofmeister, A.M., Speck, A.K. *Infrared laboratory absorbance spectra of olivine: Using classical dispersion analysis to extract peak parameters*, Monthly Notices of the Royal Astronomical Society, 406, pp. 460-481.

- 2010 Prettyman, T. H., **Pitman, K. M.** *Dawn Gamma Ray and Neutron Detector DC041 Activity Report*, NASA Dawn mission technical document, 20 Sep. 2010.

- 2010 **Pitman, K.M.**, Buratti, B.J., Mosher, J.A. *Disk-integrated bolometric Bond albedos and rotational light curves of saturnian satellites from Cassini Visual and Infrared Mapping Spectrometer*, Icarus, 206(2), pp. 537-560, doi:10.1016/j.icarus.2009.12.001.
- 2009 Hofmeister, A.M., **Pitman, K.M.**, Corman A.B., Speck A.K., Goncharov, A. *Optical properties of silicon carbide for astrophysical applications II. Single-crystal absorption spectra*, Astrophys. J., 696, pp. 1502-1516.

- 2009 Rodriguez, S., Le Mouelic, S., Rannou, P., Tobie, G., Baines, K.H., Barnes, J.W., Griffith, C.A., Hirtzig, M., **Pitman, K.M.**, Sotin, C., Brown, R.H., Buratti, B.J., Clark, R.N., Nicholson, P.D. *Global circulation as the main source of cloud activity on Titan*, Nature, 459, pp. 678-682.

- 2009 Barnes, J.W., Brown, R.H., Soderblom, J.M., Jaumann, R., Jackson, B., Le Mouelic, S., Sotin, C., Buratti, B.J., **Pitman, K.M.**, Baines, K.H., Clark, R.N., Nicholson, P.D., Turtle, E.P., Perry, J. *Shoreline features of Titan's Ontario Lacus from Cassini/VIMS observations*, Icarus, 201, pp. 217-225.

- 2009 Barnes, J.W., Soderblom, J.M., Brown, R.H., Buratti, B.J., Sotin, C., Baines, K.H., Clark, R.N., Jaumann, R., McCord, T.B., Nelson, R.M., Le Mouelic, S., Rodriguez, S., Griffith, C., Penteado, P., Tosi, F., **Pitman, K.M.**, Soderblom, L., Stephan, K., Hayne, P., Vixie, G., Bibring, J.-P., Bellucci, G., Capaccioni, F., Cerroni, P., Coradini, A., Cruikshank, D.P., Drossart, P., Formisano, V., Langevin, Y., Matson, D.L., Nicholson, P.D., Sicardy, B. *VIMS spectral mapping observations of Titan during the Cassini prime mission*, Planetary and Space Science, 57, pp. 1950-1962.

- 2008 **Pitman, K.M.**, Hofmeister, A.M., Corman, A.B., Speck A.K. *Optical properties of silicon carbide for astrophysical applications I. New laboratory infrared reflectance spectra and optical constants*, Astronomy and Astrophysics, 483(2), pp. 661-672.

- 2008 **Pitman, K. M**., Buratti, B. J., Mosher, J. A., Bauer, J. M., Momary, T. W., Brown, R. H. *First high solar phase angle observations of Rhea using Cassini VIMS: Upper limits on water vapor and geologic activity*, Astrophysical Journal Letters, 680(1), pp. L65-L68.

- 2008 Barnes, J. W., Brown, R. H., Soderblom, L., Sotin, C., Le Mouelic, S., Rodriguez, S., Jaumann, R., Beyer, R. A., Buratti, B. J., **Pitman, K**., Baines, K. H., Clark, R., Nicholson, P. *Spectroscopy, morphometry, and photoclinometry of Titan's dunefields from Cassini/VIMS*, Icarus, 195(1), pp. 400-414.

- 2007 Hofmeister, A.M., **Pitman, K.M.** *Evidence for kinks in structural and thermodynamic properties across the forsterite-fayalite binary from thin-film IR absorption spectra*, Physics and Chemistry of Minerals, 34(5), pp. 319-333.

- 2006 **Pitman, K.M.**, Speck, A.K., Hofmeister, A.M. *Challenging the identification of nitride dust in extreme carbon star spectra*, Monthly Notices of the Royal Astronomical Society, 371(2), pp. 1744-1754.

- 2005 **Pitman, K.M.** *Radiative transfer modeling of thermal infrared emissivity spectra: Applications to Martian regolith observations*, Ph.D. dissertation (ISBN: 054244058X), LSU.

- 2005 **Pitman, K.M.**, Wolff, M.J., Clayton, G.C. *Application of modern radiative transfer tools to model laboratory quartz emissivity*, Journal of Geophysical Research – Planets, 110(E08003), doi:10.1029/2005JE002428.

- 2000 **Pitman, K.M.**, Clayton, G.C., Gordon, K.D. *The 2175 Angstrom extinction bump in QSO spectra*, The Publications of the Astronomical Society of the Pacific, 112(770), pp. 537-541.

Manuscripts in press:

- 2012 **Pitman, K.M.**, Hofmeister, A.M., Speck, A.K., *Revisiting astronomical forsterite in the UV to near-IR*, for Earth, Planets, & Space, special issue: Cosmic Dust: Its Formation and Evolution (III).

Manuscripts in review:

- 2012 Jamieson, C.S., Noe Dobrea, E.Z., Dalton, J.B. III, **Pitman, K.M.,** Abbey, W.J. *The spectral variability of kieserite with grain size*, Journal of Geophysical Research – Planets, submitted.

Manuscripts in preparation:

- 2012 **Pitman, K.M.**, Jamieson, C.S., Noe Dobrea, E.Z., Dalton, J. B., III., Abbey, W.J. *Optical functions of kieserite and starkeyite for Mars*, for Journal of Geophysical Research – Planets.

- 2012 Noe Dobrea, E.Z., **Pitman, K.M.**, Wiseman, S., Jamieson, C.S., Dalton, J. B., III, Abbey, W.J. *Mixture modeling of hydrated sulfates at Gale Crater*, for JGRP.

- 2012 Speck, A.K., Buffard, A., **Pitman, K.M.**, Hofmeister, A.M. *Better alternatives to "astronomical silicate:" laboratory-based optical functions of glass with cosmic abundances and application to HD 161796*, for Astrophysical Journal.

- 2012 **Pitman, K.M.**, Speck, A.K., Hofmeister, A.M. *Improved spinel and corundum optical functions for astronomical dust*, for Astrophysical Journal.

- 2012 **Pitman, K.M.**, Dalton, J. B., III. *Optical constants of mirabilite at cryogenic temperatures relevant to planetary surfaces*, for Geophysical Research Letters.

- 2012 **Pitman, K.M.**, Dalton, J. B., III. *Optical constants of $MgSO_4.11H_2O$: Outer solar system applications*, for Geophysical Research Letters.

- 2012 Dalton, J. B., III, **Pitman, K.M.** *Optical constants of Europa-relevant brines*, for GRL.

- 2012 **Pitman, K.M.**, Speck, A.K., Hofmeister, A.M. *Laboratory spectra of astronomical dust analogs at ultraviolet-visible wavelengths*, for Astrophysical Journal.

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70 total (> 40 first author) conference proceedings, presentations, and invited talks as of Sep. 2012 - ref. http://adsabs.harvard.edu/abstract_service.html

GRANTS:

PI Name	Award/ Project Title	Program Name/Agency/ Point of Contact	Period of Performance/Total Budget	Commitment (Person-Months per Year)
Bonnie J. Buratti (JPL)	Maps of the bolometric Bond albedos of Saturn's icy satellites	Cassini Data Analysis Program – NASA Dennis Bogan (202) 358-0359 denis.bogan@hq.nasa.gov	10/01/08-09/30/09 $219.2K	6.0 (Co-I)
Karly M. Pitman (PSI)	Derivation of Optical Constants of Mars Analog Alteration Products: Mg- and Fe-Sulfates	Mars Fundamental Research Program – NASA Mitchell Schulte (202) 358-2127 Mitchell.D.Schulte@nasa.gov HQ-MFRP@mail.nasa.gov	07/29/10-07/28/13 $294.5K	3.0 (PI)
Karly M. Pitman (PSI)	Collaborative Research: A laboratory experimental study of astronomical dust analogs at ultraviolet-visible wavelengths	Astronomy and Astrophysics Research Grants – NSF Nigel Sharp (703) 292-4905 nsharp@nsf.gov	09/01/10-08/31/13 $191.9K	4.2 (Lead PI)
James Bradley Dalton (JPL)	Spectral Characterization of Planetary Surface Materials: Extended Temperature and Wavelength Coverage	Planetary Geology & Geophysics – NASA Michael S. Kelley (202) 358-0607 HQ-PGG@mail.nasa.gov	10/01/11-09/29/15 $441.4K	1.8 (Co-I)
Karly M. Pitman (PSI)	Refractive Indices for Martian Remote Sensing and Extended Boundary Condition Method Modeling for Surface Reflectance Analysis	Mars Fundamental Research Program – NASA Mitchell Schulte (202) 358-2127 Mitchell.D.Schulte@nasa.gov HQ-MFRP@mail.nasa.gov	06/01/12-05/31/15 $226K	3.0 (Year 1) 3.0 (Year 2) 3.6 (Year 3) (PI)
Karly M. Pitman (PSI)	Study of Coherent Backscattering Effect Using Near-Infrared Spectra of Outer Planet Satellites	Outer Planets Research Program – NASA Terry Hurford (202) 358-0780 HQ-OPRP@mail.nasa.gov	08/09/12-08/08/15 $358.8K	3.0 (Year 1) 4.2 (Year 2) 4.2 (Year 3) (PI)

REFERENCES

Dr. Geoffrey C. Clayton
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Dr. Angela K. Speck
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Dr. Anne M. Hofmeister
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