

Paul O. Hayne

University of Colorado, Boulder
Astrophysical & Planetary Sciences Department
391 UCB
Boulder, CO 80309

Paul.Hayne@Colorado.edu
<https://www.colorado.edu/aps/paul-hayne>
Office: Duane Physics D221
Phone: (303) 735-6399 [O] (720) 390-9276 [M]

Summary My research focuses on the surfaces and atmospheres of icy planets and moons. I develop computational models and use the latest observational data to better understand these planetary bodies. Teaching, mentoring, and public engagement are also fundamental to my work.

Positions Held **University of Colorado, Boulder**
Assistant Professor, January 2018 – present
Astrophysical & Planetary Sciences Department,
and Laboratory for Atmospheric & Space Physics

NASA – Jet Propulsion Laboratory, California Institute of Technology
Research Scientist, 2012 – 2017

California Institute of Technology
Postdoctoral Scholar, 2011 – 2012 (Advisor: Oded Aharonson)

Education **University of California, Los Angeles**
Ph.D., Geophysics & Space Physics, 2010 (Advisor: David A. Paige)

Stanford University
M.S., Geophysics, 2005 (Advisors: Norman H. Sleep & Jack J. Lissauer)
B.S., Geophysics, 2003

Mission Involvement **NASA Lunar Compact Infrared Imaging System (L-CIRiS)**
Principal Investigator (2019–present)

NASA Janus
Co-Investigator and Instrument Scientist (2019–present)
Thermal IR Camera

NASA Europa Clipper
Co-Investigator (2017–present) and *Investigation Scientist* (2015–2018)
Europa Thermal Emission Imaging System (E-THEMIS)

NASA Mars Reconnaissance Orbiter
Co-Investigator (2017–present)
Mars Climate Sounder

NASA Lunar Flashlight
Co-Investigator (2012–present)

NASA Lunar Reconnaissance Orbiter
Co-Investigator (2011–present)
Diviner Lunar Radiometer Experiment

Science Team Affiliate: NASA OSIRIS-REx (2018–present),
NASA Dawn (2016–2019), and **NASA/ESA Cassini-Huygens** (2006–2014)

Visiting
Appointments

Lawrence Livermore National Laboratory

Visiting Scientist (2017)

Planetary Defense Program / Weapons and Complex Integration (WCI)

Weizmann Institute of Science, Israel

Visiting Scientist (2015, 2016)

The Helen Kimmel Center for Planetary Science

Leadership
& Service
(External)

Keck Institute for Space Studies, California Institute of Technology

Study Co-Lead

2017–2018: [Unlocking the Climate Record Stored within Mars' Polar Layered Deposits](#)

2013–2014: [New Approaches to Lunar Ice Detection and Mapping](#)

American Astronomical Society, Division for Planetary Sciences

Member of the Federal Relations Subcommittee (2017–present)

Local Organizing Committee, Annual Meeting (2016)

Panelist, Annual Meeting (2015)

American Geophysical Union

Session Organizer (Mars Atmosphere), Annual Meeting (2014–2020)

Young Scientists for Planetary Exploration

Co-founder (2012) and *Co-leader* (2012–present)

World-wide advocacy organization for early-career planetary scientists

Ad Astra Academy

Co-founder and Co-leader, Ad Astra - Brazil (2015–present)

Science and exploration program for school-aged students in developing countries

NASA Science Mission Directorate

Appointed Member, Mars Exploration Program:

Ice and Climate Evolution Science Assessment Group (2018–2019)

Review Panel Member (2012–present)

National Research Council – Space Studies Board

Raconteur, Planetary Science Decadal Survey (2009–2010)

Earth & Space Sciences Student Organization, UCLA

President (2007–2008)

Stanford Astronomical Society

President (2002–2004)

Referee for major scientific journals:

Journal of Geophysical Research

Geophysical Research Letters

Icarus

Astrophysical Journal

Planetary & Space Science

Advances in Space Research

Space Science Reviews

Geology

Science Advances

Nature Astronomy

Honors & Awards	2013	<i>NASA Group Achievement Award</i> , Diviner Lunar Radiometer science team		
	2011	<i>NASA Group Achievement Award</i> , Mars Climate Sounder science team		
	2010	<i>Best Student Paper Award</i> , NASA Lunar Science Forum		
	2010	<i>NASA Group Achievement Award</i> , Diviner Lunar Radiometer operations team		
	2010	<i>NASA Group Achievement Award</i> , Diviner Lunar Radiometer science team		
	2008	<i>Simon Latimer Award for Service</i> , UCLA		
	2006	<i>Graduate Fellowship</i> , Institute of Geophysics and Planetary Physics		
	2006	<i>Chancellor's Prize</i> , UCLA		
	2003	<i>Graduate Fellowship</i> , Dept. of Geophysics, Stanford University		
2001	<i>Summer Research Fellowship</i> , Dept. of Physics, Stanford University			

Departmental Service	<i>Committee Membership:</i>			
	2020/2021	Fall Semester Planning Committee		CU APS
	2020/2021	Grad Welcome and Social Committee		CU APS
	2019/2020	Social Committee (Chair)		CU APS
	2019/2020	Colloquium Committee		CU APS
	2019/2020	Undergraduate Curriculum and Concerns Comm.		CU APS
	2018/2019	Social Committee (Acting Chair)		CU APS
	2018/2019	Colloquium Committee		CU APS
	<i>Undergraduate Mentoring:</i>			
	2018–present	APS Department Undergraduate Student Mentor		
2018–present	APS Department Graduate Student Mentor			
<i>Additional Service:</i>				
2018-2019	Co-organizer: “Planet Lunch”		CU Boulder	
2018-2020	Organizer: Natural Sciences New Faculty Coffee		CU Boulder	

Exam Committee Service	<i>Comprehensive Examinations:</i>				
	2020	E. Fernando Cruz	Comps II	CU APS	Non-advocate Chair
	2020	Rachel Hoover	Comps II	CU GEOL	
	2019	Eryn Cangi	Comps II	CU APS	
	2019	Noora Alsaeed	Comps II	CU APS	Non-advocate Chair
	2019	Raven Larson	Comps II	CU APS	Research Advisor
	2019	Andrew Wilcoski	Comps II	CU APS	Research Advisor
	2019	Perianne Johnson	Comps II	CU APS	Non-advocate Chair
	2019	William Waalkes	Comps II	CU APS	
	2018	Momchil Molnar	Comps II	CU APS	
2018	Arika Egan	Comps II	CU APS		
<i>Dissertation Defenses:</i>					
2019	Dr. Marek Slipski		CU APS		
<i>Honors Thesis Defenses:</i>					
2019	Carlos Eytan Gary Bicas		CU APS		
2018	Amanda Alexander		CU GEOL		

Teaching

University of Colorado Boulder

ASTR 3750: Planets, Moons, and Rings (Fall, 2020)

Co-Professor (w/ David Brain) for undergraduate majors course (~100 students)

ASTR 5800: Planetary Surfaces & Interiors (Fall, 2019)

Professor for graduate course (~15 students)

ASTR 1030: Accel. Introductory Astronomy (Fall, 2018)

Professor for undergraduate majors course (115 students)

ASTR 3720: Planets and their Atmospheres (Spring, 2018)

Professor for upper-division undergraduate course (84 students)

California Institute of Technology

Ge 151: Planetary Surfaces (2011)

Guest Lecturer for graduate course (~6 students)

University of California, Los Angeles

ESS 10: Exploring Mars (2008)

Teaching Assistant and Guest Lecturer for undergraduate course (60 students)

Stanford University

Geophysics 150: Physics of the Earth (2004, 2005)

Teaching Assistant for graduate course (~6 students)

Physics 50: Observational Astronomy (2002, 2003)

Teaching Assistant for undergraduate course (~20 students)

Mentoring

Laboratory for Atmospheric and Space Physics

Postdocs

2019–present: Dr. Margaret Landis

Graduate Students

2020–present: Kya Sorli (APS Dept., U. Colorado)

2020–present: Noora Alsaeed (APS Dept., U. Colorado)

2018–present: Andrew Wilcoski (APS Dept., U. Colorado)

Undergraduate Students

2018–present: Tara Tomlinson (APS Dept., U. Colorado)

2019–present: Shaelyn Raposa (CU Boulder, B.S. → N. Ariz. U., Ph.D.)

2018–2019: Carlos Eytan Gary Bicas (CU Boulder, B.S. → Stony Brook U., Ph.D.)

2018–2019: Tyler Horvath (CU Boulder, B.S. → UCLA, Ph.D.)

Caltech Summer Undergraduate Research Fellows (SURF)

2017: James Haber (Cornell University, B.S. → Purdue U., Ph.D.)

2015: Léa Bonnefoy (Cornell University, B.S. → U. Arizona, Ph.D.)

2014: Clifford Watkins (Carleton College, B.S. → U. Hawaii, Ph.D.)

2011: Michael Lauria (Caltech, B.S.)

Maximizing Student Potential (MSP)

2015–2018: José Martínez Camacho (Citrus College → SMU, Ph.D.)

Caltech Postdoctoral Fellows at JPL

2017–2018: Dr. Quentin Vinckier (*co-mentor* with Dr. R. Glenn Sellar)

2016–2018: Dr. Catherine M. Elder

External Grants	2019–2022	<i>Lunar Compact Infrared Imaging System (L-CIRiS)</i> PI: P. Hayne NASA Lunar Science and Instrument Technology Payloads / \$3,000,000
	2019–2021	<i>Janus Mission</i> PI: D. Scheeres (Co-I: P. Hayne) NASA SIMPLEx Program / ~ \$100,000 for P. Hayne
	2015–2026	<i>Europa Thermal Emission Imaging System</i> PI: P. Christensen (Co-I: P. Hayne) NASA Europa Clipper Mission / ~\$200,000 allocation for P. Hayne
	2013–2021	<i>Lunar Flashlight Science Investigation</i> PI: B. Cohen (Co-I: P. Hayne) NASA Advanced Exploration Systems / ~\$600,000 for P. Hayne
	2016–2022	<i>Lunar Reconnaissance Orbiter Extended Mission 3 & 4</i> PI: D. Paige (Co-I: P. Hayne) NASA Discovery Program / ~\$1,200,000 allocation for P. Hayne
	2016–2022	<i>Mars Reconnaissance Orbiter Extended Mission 4 & 5</i> PI: J. T. Schofield (Co-I: P. Hayne) NASA Mars Program / ~\$640,000 allocation for P. Hayne
	2018–2021	<i>Boulders on Bennu: Modeling Thermal Emission from Boulders for Yarkovsky Effect and Thermal Inertia Investigations</i> PI: P. Hayne (Science PI: C. Elder) NASA OSIRIS-REx Participating Scientist Program / \$346,000
	2017–2018	<i>Unlocking the Climate Record Stored within Mars' Polar Layered Deposits</i> PI: P. Hayne W. M. Keck Institute for Space Studies / \$50,000
	2015–2018	<i>Inter-seasonal and Inter-annual Surface Dust Fluxes on Mars</i> PI: P. Hayne (Science PI: S. Piqueux) NASA Mars Data Analysis Program / \$330,690
	2013–2017	<i>Volatile Regolith Thermal Investigation Consortium for Exploration and Science (VORTICES)</i> PI: A. Rivkin (Co-I: P. Hayne) NASA Solar System Exploration Research Virtual Institute / ~\$120,000

- 2014–2016 *Thermal Infrared Observations of the Moon during Lunar Eclipse*
 PI: P. Lucey (Co-I: P. Hayne)
 NASA Planetary Astronomy / \$142,810 allocation for P. Hayne
- 2013–2014 *Development of Large Format Rad-Hard Focal Plane Arrays and Readouts for Thermal Radiometer for Europa Clipper Mission*
 PI: M. Kenyon (Co-I: P. Hayne)
 Instrument Concepts for Europa Exploration / \$16,460 for P. Hayne
- 2013–2014 *New Approaches to Lunar Ice Detection and Mapping*
 PI: P. Hayne
 W. M. Keck Institute for Space Studies / \$50,000

Invited Lectures

- 2020 Planetary Science Decadal Survey
 2020 Observatoire de la Côte d'Azur
 2020 NASA Lunar Surface Science Workshop
 2018 Applied Physics Laboratory, Johns Hopkins University
 2017 Lawrence Livermore National Laboratory
 2017 University of Colorado, Boulder
 2016 Lunar & Planetary Institute
 2016 Weizmann Institute of Science (Israel)
 2015 International Space Exploration Coordination Group,
 2015 NASA Exploration Science Forum
 2015 University of California - Santa Cruz
 2014 SETI Institute
 2013 Lunar & Planetary Institute
 2012 California Institute of Technology
 2012 NASA – Jet Propulsion Laboratory

Professional Affiliations

- American Astronomical Society - Division for Planetary Sciences
 American Geophysical Union
 European Geosciences Union
 Asia Oceania Geosciences Society
 Geochemical Society
 Sigma Xi

Skills & Training

**Remote sensing & spacecraft instrumentation,
 Modeling and numerical simulation**

Computer programming languages

Proficient/expert: C/C++, Python, MATLAB, IDL
 Familiar: Fortran 90/95, awk, javascript, etc.

Mission formulation experience

Team-X, NASA Jet Propulsion Laboratory
Team-A, NASA Jet Propulsion Laboratory
Capture Lead Training, NASA Jet Propulsion Laboratory
 Co-I and Deputy PI on mission proposals to NASA's *Discovery* and *New Frontiers* programs
 PI on multiple instrument proposals to NASA mission programs

Additional training

Astrobiology Winter School and Field Course (2011)
International Astrobiology Summer School (2008)
PADI Open Water Diver scuba certification (50+ dives)
Eagle Scout (1998), BSA Troop 676, Issaquah, WA

Publications: Refereed Journal Articles

Number of peer-reviewed publications: 52 (as of December, 2020)

First-author: 8 / Student first-author: 3 / Postdoc first-author: 3

h-index: 25 (Web of Science), 25 (Google Scholar)

Total citations: 1,865 (Web of Science), 2,316 (Google Scholar)

(*) indicates (U,G) **student** or **postdoc** supervised or co-supervised by Hayne

2020

1. **Hayne, P. O.**, Aharonson, O., & Schörghofer, N. (2020), Micro cold traps on the Moon, *Nature Astron.*, 1-7. doi: [10.1038/s41550-020-1198-9](https://doi.org/10.1038/s41550-020-1198-9)
2. Lucey, P. G., **Hayne, P. O.**, Costello, E. S., Green, R., Hibbitts, C. A., Goldberg, A., ... & Honniball, C. (2020), The spectral radiance of indirectly illuminated surfaces in regions of permanent shadow on the Moon, *Acta Astronautica*, 180, 25-34. doi: [10.1016/j.actaastro.2020.11.032](https://doi.org/10.1016/j.actaastro.2020.11.032)
3. *(G) Wilcoski, A. X. & **Hayne, P. O.** (2020), Surface roughness evolution and implications for the age of the North Polar Residual Cap of Mars, *J. Geophys. Res.*, 125(12), e2020JE006570.
4. *(U) Gary-Bicas, C. E., **Hayne, P. O.**, *(U) Horvath, T., Heavens, N. G., Kass, D. M., Kleinböhl, A., Piqueux, S., Shirley, J., & McCleese, D. J. (2020), Asymmetries in snowfall, emissivity and albedo of Mars' seasonal polar caps: Mars Climate Sounder observations. *J. Geophys. Res.*, 125(5), e2019JE006150.
5. Feng, J., Siegler, M. A., & **Hayne, P. O.** (2020), New constraints on thermal and dielectric properties of lunar regolith from LRO Diviner and CE-2 Microwave Radiometer, *J. Geophys. Res.*, 125(1), e2019JE006130.
6. Siegler, M. A., Feng, J., Lucey, P. G., Ghent, R. R., **Hayne, P. O.**, & White, M. N. (2020), Lunar titanium and frequency dependent microwave loss tangent as constrained by the Chang'E-2 MRM and LRO Diviner Lunar Radiometers, *J. Geophys. Res.*, e2020JE006405.
7. Cohen, B. A., **Hayne, P. O.**, Greenhagen, B., Paige, D. A., Seybold, C., & Baker, J. (2020), Lunar Flashlight: illuminating the lunar south pole, *IEEE Aerospace and Electronic Systems*, 35(3), 46-52.
8. Smith, I. B., **Hayne, P. O.**, Byrne, S., Becerra, P., Kahre, M., Calvin, W., ... & Horgan, B. (2020), The Holy Grail: A road map for unlocking the climate record stored within Mars' polar layered deposits, *Planet. Space Sci.*, 184, 104841.
9. Lyra, W., ... **Hayne, P. O.**, & Marlow, J. (2020), Ad Astra Academy: Using Space Exploration to Promote Student Learning and Motivation in the City of God, Rio De Janeiro, Brazil, *Comm. Astron. with the Public*, 27, 5-13.

10. Buhler, P. B., Ingersoll, A. P., Piqueux, S., Ehlmann, B. E., **Hayne, P. O.** (2019), Coevolution of Mars's atmosphere and massive south polar CO₂ ice deposit. *Nature Astron.*, *4*(4), 364-371. doi: [10.1038/s41550-019-0976-8](https://doi.org/10.1038/s41550-019-0976-8)
11. *Hofgartner, J. D., Buratti, B. J., **Hayne, P. O.**, Young, L. A. (2019), Ongoing resurfacing of KBO Eris by volatile transport in local, collisional, sublimation atmosphere regime. *Icarus*, *334*, 52-61. doi: [10.1016/j.icarus.2018.10.028](https://doi.org/10.1016/j.icarus.2018.10.028)
12. Piqueux, S., ..., **Hayne, P. O.** (2019), Widespread shallow water ice on Mars at high latitudes and midlatitudes. *Geophys. Res. Lett.*, *46*, 14,290-14,298. doi: [10.1029/2019GL083947](https://doi.org/10.1029/2019GL083947)
13. Farrell, W. M., Hurley, D. M., Poston, M. J., **Hayne, P. O.**, Szalay, J. R., & McLain, J. L. (2019), The young age of the LAMP-observed frost in lunar polar cold traps. *Geophys. Res. Lett.*, in press. doi: [10.1029/2019GL083158](https://doi.org/10.1029/2019GL083158)
14. Sefton-Nash, E., Williams, J. P., Greenhagen, B. T., Warren, T. J., Bandfield, J. L., Aye, K. M., Leader, F., Siegler, M. A., **Hayne, P. O.**, & Paige, D. A. (2019), Evidence for ultra-cold traps and surface water ice in the lunar south polar crater Amundsen. *Icarus*, *332*, 1-13. doi: [10.1016/j.icarus.2019.06.002](https://doi.org/10.1016/j.icarus.2019.06.002)
15. Hendrix, A. R., Hurley, D. M., Farrell, W. M., Greenhagen, B. T., **Hayne, P. O.**, Retherford, K. D., ... & Liu, Y. (2019), Diurnally migrating lunar water: evidence from ultraviolet data, *Geophys. Res. Lett.*, *46*(5), 2417-2424. doi: [10.1029/2018GL081821](https://doi.org/10.1029/2018GL081821)
16. Jordan, A. P., Stubbs, T. J., Shusterman, M. L., Izenberg, N. R., Wilson, J. K., **Hayne, P. O.**, ... & Spence, H. E. (2019), How dielectric breakdown may contribute to the global weathering of regolith on the moon, *Icarus*, *319*, 785-794. doi: [10.1016/j.icarus.2018.10.025](https://doi.org/10.1016/j.icarus.2018.10.025)
17. Bapst, J., Byrne, S., Bandfield, J. L., & **Hayne, P. O.** (2019), Thermophysical properties of the north polar residual cap using MGS TES, *J. Geophys. Res.*, in press. doi: [10.1029/2018JE005786](https://doi.org/10.1029/2018JE005786)
18. *Vinckier, Q., Hardy, L., Gibson, M., Smith, C., Putman, P., **Hayne, P. O.**, & Sellar, R. G. (2019), Design and characterization of the multi-band SWIR receiver for the Lunar Flashlight CubeSat Mission, *Remote Sensing*, *11*(4), 440. doi: [10.3390/rs11040440](https://doi.org/10.3390/rs11040440)
19. Landis, M. E., Byrne, S., Combe, J. P., Marchi, S., Castillo-Rogez, J., Sizemore, H. G., Schörghofer, N., Prettyman, T. H., **Hayne, P. O.**, Raymond, C. A., & Russell, C. T. (2019), Water vapor contribution to Ceres' exosphere from observed surface ice and postulated ice-exposing impacts, *J. Geophys. Res.*, *124*(1), 61-75.

20. Williams, J-P., Bandfield, J. L., Paige, D. A., Powell, T. M., Greenhagen, B. T., Taylor, S., **Hayne, P. O.**, Speyerer, E. J., Ghent, R. R., & Costello, E. S. (2018), Lunar cold spots and crater production on the Moon, *Journal of Geophysical Research: Planets*, *123* (9), 2380-2392. doi: [10.1029/2018JE005652](https://doi.org/10.1029/2018JE005652).
21. Heavens, N. G., Kleinböhl, A., Chaffin, M. S., Halekas, J. S., Kass, D. M., **Hayne, P. O.**, McCleese, D. J., Piqueux, S., Shirley, J. H., & Schofield, J. T. (2018), Hydrogen escape from Mars enhanced by deep convection in dust storms, *Nature Astronomy*, *2*, 126-132. doi: [10.1038/s41550-017-0353-4](https://doi.org/10.1038/s41550-017-0353-4).
22. Li, S., Lucey, P. G., Milliken, R. E., **Hayne, P. O.**, Fisher, E., Williams, J-P., Hurley, D. M., Elphic, R. C. (2018), Direct evidence of surface exposed water ice in the lunar polar regions, *Proceedings of the National Academy of Sciences*, *115* (36), 8907-8912. doi: [10.1073/pnas.1802345115](https://doi.org/10.1073/pnas.1802345115).

- 2017 23. **Hayne, P. O.**, Bandfield, J. L., Siegler, M. A., Vasavada, A. R., Ghent, R. R., et al. (2017), Global regolith thermophysical properties of the Moon from the Diviner Lunar Radiometer Experiment, *J. Geophys. Res.*, *122*, 2371–2400. doi: [10.1002/2017JE005387](https://doi.org/10.1002/2017JE005387)
24. ***Elder, C. M.**, **Hayne, P. O.**, Bandfield, J. L., Ghent, R. R., Williams, J.-P., Donaldson Hanna, K. L., & Paige, D. A. (2017), Young lunar volcanic Features: Thermophysical properties and formation, *Icarus*, *290*, 224–237. doi: [10.1016/j.icarus.2017.03.004](https://doi.org/10.1016/j.icarus.2017.03.004)
25. Mitri, G., Postberg, F., Soderblom, J. M., ..., **Hayne, P. O.**, et al. (2017), Explorer of Enceladus and Titan (E²T): Investigating ocean worlds' evolution and habitability in the solar system, *Planetary and Space Science*, doi: [10.1016/j.pss.2017.11.001](https://doi.org/10.1016/j.pss.2017.11.001)
26. Landis, M. E., Byrne, S., Schörghofer, N., Schmidt, B. E., **Hayne, P. O.**, Castillo-Rogez, J., ... Russell, C. T. (2017), Conditions for sublimating water ice to supply Ceres' exosphere, *J. Geophys. Res.*, *122*, 1984–1995. doi: [10.1002/2017JE005335](https://doi.org/10.1002/2017JE005335)
27. Davies, A. G., Gunapala, S., Soibel, A., Ting, D., Rafol, S., Blackwell, M., **Hayne, P. O.**, & Kelly, M. (2017), A novel technology for measuring the eruption temperature of silicate lavas with remote sensing: Application to Io and other planets, *J. Volcanology & Geothermal Res.*, *343*, 1–16. doi: [10.1016/j.jvolgeores.2017.04.016](https://doi.org/10.1016/j.jvolgeores.2017.04.016)
28. Fisher, E. A., Lucey, P. G., Lemelin, M., Greenhagen, B. T., Siegler, M. A., Mazarico, E., Aharonson, O., Williams, J.-P., **Hayne, P. O.**, Neumann, G. A., Paige, D. A., Smith, D. E., & Zuber, M. T. (2017), Evidence for surface water ice in the lunar polar regions using reflectance measurements from the Lunar Orbiter Laser Altimeter and temperature measurements from the Diviner Lunar Radiometer Experiment, *Icarus*, *292*, 74–85. doi: [10.1016/j.icarus.2017.03.023](https://doi.org/10.1016/j.icarus.2017.03.023)
- 2016
29. Piqueux, S., Kleinböhl, A., **Hayne, P. O.**, Heavens, N. G., Kass, D. M., McCleese, D. J., ... & Shirley, J. H. (2016), Discovery of a widespread low-latitude diurnal CO₂ frost cycle on Mars, *J. Geophys. Res.*, *121*, 1174–118. doi: [10.1002/2016JE005034](https://doi.org/10.1002/2016JE005034)
30. Greenhagen, B. T., Neish, C. D., Williams, J. P., Cahill, J. T., Ghent, R. R., **Hayne, P. O.**, ... & Bandfield, J. L. (2016), Origin of the anomalously rocky appearance of Tsiolkovskiy crater, *Icarus*, *273*, 237–247. doi: [10.1016/j.icarus.2016.02.041](https://doi.org/10.1016/j.icarus.2016.02.041)
31. Bennett, K. A., Horgan, B. H., Gaddis, L. R., Greenhagen, B. T., Allen, C. C., **Hayne, P. O.**, ... & Paige, D. A. (2016), Complex explosive volcanic activity on the Moon within Oppenheimer crater, *Icarus*, *273*, 296–314. doi: [10.1016/j.icarus.2016.02.007](https://doi.org/10.1016/j.icarus.2016.02.007)
32. *(U) **Bonnefoy, L. E.**, A. G. Hayes, **P. O. Hayne**, et al. (2015), Compositional and spatial variations in Titan dune and interdune regions from Cassini VIMS and RADAR, *Icarus*, *270*, 222–237, doi:[10.1016/j.icarus.2015.09.014](https://doi.org/10.1016/j.icarus.2015.09.014)

2015

33. **Hayne, P. O.**, and Oded Aharonson (2015), Thermal stability of ice on Ceres with rough topography, *J. Geophys. Res.*, *120*, 1567–1584, doi: [10.1002/2015JE004887](https://doi.org/10.1002/2015JE004887)
34. Heavens, N. G., Cantor, B. A., **Hayne, P. O.**, et al. (2015), Extreme detached dust layers near Martian volcanoes: Evidence for dust transport by mesoscale circulations forced by high topography, *Geophys. Res. Lett.*, *42*, 10, 3730–3738. doi: [10.1002/2015GL064004](https://doi.org/10.1002/2015GL064004)
35. **Hayne, P. O.**, A. R. Hendrix, E. Sefton-Nash, P. G. Lucey, K. D. Retherford, J-P. Williams, et al. (2015), Evidence for exposed water ice in the Moon’s south polar regions from Lunar Reconnaissance Orbiter ultraviolet albedo and temperature measurements, *Icarus*, *255*, 58–69, doi:[10.1016/j.icarus.2015.03.032](https://doi.org/10.1016/j.icarus.2015.03.032)
36. Glotch, T. D., Bandfield, J. L., Lucey, P. G., **Hayne, P. O.**, et al. (2015), Formation of lunar swirls by magnetic field standoff of the solar wind, *Nature Communications*, *6*. doi: [10.1038/ncomms7189](https://doi.org/10.1038/ncomms7189)
37. Piqueux, S., Kleinböhl, A., **Hayne, P. O.**, Kass, D. M., Schofield, J. T., & McCleese, D. J. (2015), Variability of the Martian seasonal CO₂ cap extent over eight Mars Years, *Icarus*, doi:[10.1016/j.icarus.2014.10.045](https://doi.org/10.1016/j.icarus.2014.10.045)
38. Bandfield, J. L., **Hayne, P. O.**, Williams, J. P., Greenhagen, B. T., & Paige, D. A. (2015), Lunar surface roughness derived from LRO Diviner Radiometer observations, *Icarus*, *248*, 357–372. doi: [10.1016/j.icarus.2014.11.009](https://doi.org/10.1016/j.icarus.2014.11.009)

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