

CURRICULUM VITAE

Kirby D. Runyon

Postdoctoral Research Scientist
The Johns Hopkins University Applied Physics Laboratory

Visiting Scientist
The Johns Hopkins University Department of Earth & Planetary Sciences
email: kirby.runyon_at_gmail_dot_com

Education

PhD in Planetary Geology, The Johns Hopkins University. 2017

Dissertation title: Agents of Planetary Geomorphic Change: Martian Aeolian Morphodynamics and the Emplacement of Crater Ejecta

Master of Science in Planetary Geology, Temple University. 2011

Thesis title: Structural Characterization of the Cerberus Fossae and Implications for Paleodischarge of Athabasca Valles, Mars.

Bachelor of Arts in Physics; Mathematics minor, Houghton College, 2008

Research Interests

I seek to understand how planetary landscapes evolve. I accomplish this using remote sensing data (mainly visible-wavelength images and laser topography) and with laboratory experiments. My current interests include:

- Finding and characterizing possible impact melt deposits on the Moon to constrain lunar chronostratigraphy and the early Earth-Moon impactor flux.
- Tracking and quantifying sand ripple and sand dune slipface migration on Mars using the HiRISE camera on Mars Reconnaissance Orbiter, on which I am a Collaborator. My aeolian interest extends to Titan, Venus, Earth, and Comet 67P.
- Mapping paleo-aeolian deposits on Mars to infer past aeolian regimes informed from current aeolian processes.
- Aeolian wind tunnel studies to understand initiation of grain movement in Titan's atmosphere.
- Using low-gravity platforms (e.g., parabolic aircraft flights) for experiments into ejecta emplacement on small solar system bodies (proposed).
- Simulating the granular dynamics and resulting morphology of impact crater ejecta emplacement in a lab setting, applicable to any solid solar system body.
- Interpretation of geomorphology on Pluto and Charon; I am an affiliate member on the New Horizons Geology and Geophysics Imaging Team. Mars and Pluto are surprising analogs of each other in regards to sublimation-driven geology.
- Human spaceflight-enabled science; I am a geological spacesuit test subject with NASA/Johnson Space Center's Crew and Thermal Systems Division. I have also worked in astronaut geology training curriculum development.
- Structural geology controls on floods and volcanism at the Cerberus Fossae and Athabasca Valles, Mars.

Mission Experience

New Horizons mission to Pluto and the Kuiper Belt, 2014-present.

Geology and Geophysics Imaging group affiliate: I interpret and discuss the photographed geology of Pluto and Charon and have been a co-author on two high profile publications.

- **Awarded NASA Group Achievement Award** for contributions to the New Horizons reconnaissance of the Pluto System, 2016.

Mars Reconnaissance Orbiter/HiRISE Camera at Mars, 2013-present.

Collaborator: I assist in image planning and targeting, participate in science team discussions and telecons, and promote education and public outreach.

Lunar Reconnaissance Orbiter (LRO)/Camera (LROC) at the Moon, 2017-present

Post-doctoral fellow: I am currently mapping the distribution of basin impact melt locations to inform future sample sites for constraining the early lunar impactor flux.

Mars2020/Mars Environmental Dynamics Analyzer (MEDA) launching to Mars, 2017-present.

Collaborator: Participate in the planning and analyzing of Martian atmospheric and dust data.

Concurrent mission concept design at APL iteratively integrating science and engineering constraints for conceptual robotic mission, 2013, 2017.

Occupational Experience

Community Service

- **Lunar & Planetary Science Conference program committee**, aeolian geology lead, 2018.
- **Executive secretary** for a NASA grant review panel, 2017
- **Peer-reviewer** for planetary science journal *Icarus*, 2015, 2016.
- **Co-supervisor** for undergraduate intern in planetary geology, 2015.
- **Aeolian session chair** for the Lunar and Planetary Science Conference aeolian geology session, 2015, 2016.

Human Spaceflight

- **Spacesuit** test subject volunteer with NASA/JSC, 2015-present.
- **Test subjects volunteer** for NASA's Human Exploration Research Analog (HERA) program (pending).
- **Spaceflight** medical centrifuge test subject with University of Texas Medical Branch and the National Aerospace Training and Research Center (NASTAR), 2016.
- **Executive secretary** with the Lunar Exploration Analysis Group Geologic Astronaut Training Special Action Team (GAT-SAT), 2016.

Financial

- **Awarded** the JHU/Applied Physics Laboratory Graduate Student fellowship for three consecutive years, 2012-2017.
- **Competitively won** multiple internal JHU/Earth and Planetary Sciences department grants for educational travel, 2013-2015.

Political

- **Space policy activist** speaking with Congressional staffers in the House of Representatives and the Senate, 2014-present.

Other

- **Science consultant**, Mohawk Games: Martian and planetary geologic and spaceflight realism, 2014-present.
- **Exploration Intern**, Lunar and Planetary Institute, 2011.

Awards

- Named **Young Alumnus of the Year**, Houghton College, 2018 (to be conferred October, 2018).

Publications

Peer-Reviewed Papers

- Beyer, R. (including **K. Runyon**), 2018, The Nature and Origin of Charon's Smooth Plains. *Science*, *Accepted*.
- Runyon, K.D.**, Barnouin, O.S., 2018, Preliminary laboratory investigations of ejecta emplacement dynamics and morphology with planetary applications, *Planetary and Space Science*, doi:10.1016/j.pss.2018.03.014
- Runyon, K.D.**, Bridges, N.T., and Newman, C.E., 2017. Martian sand sheet characterization and implications for formation: A Case Study, *Journal of Aeolian Research*, 29, 1-11, <http://dx.doi.org/10.1016/j.aeolia.2017.09.001>.
- Runyon, K.D.**, Bridges, N.T., Ayoub, F., Newman, C.E., and Quade, J.J., 2017, An integrated model for dune morphology and sand flux on Mars, *Earth and Planetary Science Letters*, 457, 204-212, doi:10.1016/j.epsl.2016.09.054.
- Robbins, S.J., **Runyon, K.D.**, Singer, K., Bray, V., Schenk, P., McKinnon, W.B., et al. 2017, Investigation of Charon's Craters with Abrupt Terminus Ejecta, Comparisons with Other Icy Bodies, and Formation Implications, *Journal of Geophysical Research Planets*, DOI: 10.1002/2017JE005287.
- Moore, J.M. and 40 others (including **Runyon, K.**), 2016, The Geology of Pluto and Charon through the eyes of New Horizons: *Science*, 351, 1284-1293, DOI: 10.1126/science.aad7055.
- Robins, S.J. and 28 others (including **Runyon, K.**), 2017, Craters of the Pluto-Charon system: *Icarus*, 287, 187-206, <https://doi.org/10.1016/j.icarus.2016.09.027>.
- Stern, A.S., and 150 others (including **Runyon, K.**), 2015, The Pluto system: Initial results from its exploration by New Horizons: *Science*, 350, 1815-1:1815-8, DOI: 10.1126/science.aad1815.
- Lemelin, M., Blair, D.M., Roberts, C.E., **Runyon, K.D.**, Nowka, D., Kring, D.A., 2015, High-priority lunar landing sites for in situ and sample return studies of polar

volatiles: Planetary and Space Sciences, 101, 149-161, DOI:
10.1016/j.pss.2014.07.002.

Conference Abstracts (Selected, 1st-Authored)

- Runyon, K.D., B. W. Denevi, L. M. Jozwiak, B. A. Cohen, D. Moriarty, C. H. van der Bogert, 2018, Characterization of proposed impact melt facies in Mare Crisium, 49th LPSC, Abstract #1536.
- Runyon, K.D., D. M. Burr, J. P. Emery, S. S. Sutton, E. V. Nield, J. K. Smith, 2018, Titan's aeolian threshold conditions: initial results, 49th LPSC, Abstract #1291.
- Runyon, K.D., Barnouin, O.S., 2017, Preliminary laboratory investigations of ejecta emplacement dynamics and morphology with planetary applications, Geological Society of America fall meeting, Abstract #299557.
- Runyon, K.D., 2017, Geological Spacesuit Testing: Lunar Exploration Analysis Group annual meeting, Abstract.
- Runyon, K.D., Bridgents, N.T., Newman, C.E., 2017, Eroding Dunes? Characterization and implications of Martian sand sheets: 48th LPSC, Abstract # 2187.
- Runyon, K.D., S.A. Stern, T.R. Lauer W. Grundy, M.E. Summers, K.N. Singer, 2017, A geophysical planet definition: 48th LPSC, Abstract #1448.
- Runyon, K.D., 2016, A successful case study of teaching evolutionary geoscience literacy in a conservative Christian church, GSA, Abstract #282890.
- Runyon, K.D., Bridges, N.T., 2016, Morphology and dynamics of a Martian sand sheet, GSA, Abstract #282868.
- Runyon, K.D., Barnouin, O.S., 2016, Ejecta Emplacement in the Lab: 47th LPSC, Abstract #1075.
- Runyon, K.D., Lisse, C.M., Cheng, A.F., Bridges, N.T., Lewis, K., 2015, Controls on and implications of aeolian geomorphology on comet 67P: 4th International Planetary Dunes Workshop, Boise, ID, Abstract #8037.
- Runyon, K.D., Barnouin, O.S., 2015, Gaspra's craters: Implications for production functions and surface processes: 46th LPSC, Abstract #2869.
- Runyon, K.D., Bridges, N.T., 2015, Internal boundary layer control for sediment flux in Herschel Crater, Mars: 4th International Planetary Dunes Workshop, Boise, ID, Abstract #8021.
- Runyon, K.D., Bridges, N.T., Ayoub, F., Mattson, S., 2014, Aeolian Provinces and Activity in Herschel Crater, Mars: 45th LPSC, Abstract #1495.
- Runyon, K.D., Barnouin, O.S., 2014, Experimental Ejecta Emplacement: Early Results: 45th LPSC, Abstract #1071
- Runyon, K.D., 2013, Terrestrial Meteorites as Preservers of Early Biomarkers: Implications for Selection of Golden Spike Landing Sites: Workshop on Golden Spike Human Lunar Expeditions, Lunar and Planetary Institute, Abstract #6020.
- Runyon, K.D., Barnouin, O.S., 2013, Ejecta Emplacement and Regolith Gardening: An Experimental Investigation: 44th LPSC, Abstract #2163.
- Runyon, K.D., Blair, D.M., Lemelin, M., Nowka, D., Roberts, C.E., Paige, D.A., Spudis, P., Kring, D.A., 2012, Volatiles at the Lunar south pole: A case study for a mission to Amundsen crater: 43rd LPSC, Abstract #1619.

Runyon, K.D., Davatzes, A.K., Gulick, V.C., 2012, Putative active brine flows in the Cerberus Fossae, Mars: 43rd LPSC, Abstract #2072.

Runyon, K.D., Davatzes, A.K., Davatzes, N.C., 2011, Structural characterization of the Cerberus Fossae at the Athabasca Valles source region, Mars: 42nd LPSC, Abstract# 1913.

Research Skills

GIS

ArcGIS (proficient), GoogleEarth (highly skilled), Small Body Mapping Tool (highly skilled), JMARS (proficient) ENVI (proficient), COSI-Corr (proficient), ISIS (familiar), SOCET SET (familiar).

Computational

Matlab (proficient) MS Excel (proficient), IDL (familiar).

Laboratory and Field

Laboratory experiment design, setup, implementation, and cleanup for sedimentary morphodynamics (highly skilled); Field geology and field mapping (proficient).

Graphics

Adobe Photoshop (highly skilled), Adobe Illustrator (proficient), QuickTime (highly skilled).

People

Excellent oral and written communication for technical and non-technical audiences; demonstrated small-group leadership

Memberships

- The Planetary Society, 2003-present.
- Geological Society of American student member, 2014-2015.
- Association of Spaceflight Professionals, 2011-present.

Invited Talks

"Small Planets: Brining Pluto Back," Guest Presented, "Astronomy Day," Fernbank Planetarium, Atlanta, GA, April 21, 2018.

"Geology Across the Solar System," Guest Lecturer, Howard Community College Introductory Astronomy, March 8, 2017 and Oct. 19, 2017.

"Morphology and Dynamics of a Martian Sand Sheet," Geological Society of America fall conference, October, 2016.

"Planetary Sedimentology: Impact Crater Ejecta Emplacement and Martian Sand Dunes," George Mason University geology colloquium series, January, 2016.

“From Pluto, With Love,” Spring Arbor University science outreach series, August, 2015.

“Physical Modeling of Impact Crater Ejecta Emplacement,” Carnegie Department of Terrestrial Magnetism, Spring, 2013.

“Crustal Permeability of the Cerberus Fossae, Mars,” Houghton College Interdisciplinary Science Seminar, Fall, 2010.

In the News

August 3, 2017 – MentalFloss.com – Six Riveting Facts about Mars
<http://mentalfloss.com/article/501979/6-riveting-facts-about-mars>

March 30, 2017 – Now.Space – Geophysical Planet Definition and Pluto
<http://now.space/posts/redefinition/>

March 29, 2017 - Scientific American – Geophysical Planet Definition and Pluto
<https://www.scientificamerican.com/article/tingo-is-a-beetle-hawaii-is-a-state-mdash-why-isnt-pluto-a-planet/>

March 25, 2017 - Vox – Geophysical Planet Definition and Pluto
<http://www.vox.com/science-and-health/2017/3/25/15052084/make-pluto-planet-again>

March 21, 2017 - Reuters – Geophysical Planet Definition and Pluto
<http://www.reuters.com/article/us-space-pluto-idUSKBN16S2GU>

March 21, 2017 USA Today – Geophysical Planet Definition and Pluto
<http://www.usatoday.com/story/tech/nation-now/2017/03/21/nasa-scientists-researchers-will-pluto-become-planet-new-definition/99440868/>

March 20, 2017 - Washington Post – Geophysical Planet Definition and Pluto
https://www.washingtonpost.com/news/speaking-of-science/wp/2017/03/20/a-new-definition-would-add-102-planets-to-our-solar-system-including-pluto/?hpid=hp_hp-cards_hp-card-national%3Ahomepage%2Fcard&utm_term=.e469956542bd

March 17, 2017 - JHU & Phys.Org – Geophysical Planet Definition and Pluto
<http://hub.jhu.edu/2017/03/16/make-pluto-a-planet-again/>

March 2, 2017 - Wired.com - Geophysical Planet Definition and Pluto
<https://www.wired.com/2017/03/pluto-thing/>

February 28, 2017 - Seeker.com – Geophysical Planet Definition and Pluto
<http://www.seeker.com/behind-the-push-to-get-pluto-its-planetary-groove-back-2290287200.html>

February 21, 2017 - Universe Today – Geophysical Planet Definition and Pluto
<http://www.universetoday.com/133525/sad-pluto-110-planets-solar-system-instead/>

February 21, 2017 - CBC Radio, As It Happens – Geophysical Planet Definition and Pluto
<http://www.cbc.ca/radio/asithappens/as-it-happens-tuesday-edition-1.3991263/make-pluto-a-planet-again-nasa-scientists-argue-1.3991265>

February 21, 2017 - Inverse.com – Geophysical Planet Definition and Pluto
<https://www.inverse.com/article/28125-pluto-ninth-planet-new-definition>

May 13, 2016 - The Escapist – Geology Consultant for Video Game
http://www.escapistmagazine.com/articles/view/video-games/editorials/reviews/17037-Offworld-Trading-Company-Strategy-Economy-Simulation#&gid=gallery_6232&pid=5

May, 2016 - Mental_Floss – Geology Consultant for Video Game
<http://mentalfloss.com/article/79318/game-set-mars-next-oregon-trail>

Winter, 2016 - Houghton College Magazine – Pluto Exploration
<http://www.houghtonmagazine.com/open-your-eyes-look-up-to-the-skies-and-see/>

Christmas, 2015 - Home.fm morning show interview – Pluto Exploration
<http://home.fm/wp-content/uploads/2015/08/Kirby-in-Space-EXTENDED.mp3>

June 29, 2015 – Pluto Exploration
http://www.mlive.com/news/jackson/index.ssf/2015/06/kirby_runyon.html

April 5, 2012 - 365 Days of Astronomy Podcast Interview – Human Lunar Mission
<https://cosmoquest.org/x/365daysofastronomy/2012/04/05/april-5th-a-human-mission-to-the-lunar-south-pole/>