



THE UNIVERSITY OF ARIZONA  
COLLEGE OF SCIENCE

# LUNAR & PLANETARY LABORATORY

LUNAR AND PLANETARY LABORATORY NEWSLETTER

SPRING 2019

## Powerful Particles and Tugging Tides in TRAPPIST-1

by Emily Walla, University Communications, UA/NASA Space Grant Communications Intern



An artist's impression of the perpetual sunrise that might greet visitors on the surface of planet TRAPPIST-1f. Image credit: NASA/JPL-Caltech

TRAPPIST-1, a system where seven Earth-sized rocky planets orbit a cool star, includes three planets in the habitable zone, the region of space where liquid water can flow on a planet's surface. Two new studies by LPL scientists may lead astronomers to redefine the habitable zone in the case of TRAPPIST-1.

The three planets in the habitable zone face a formidable opponent to life: high-energy particles spewed from the system's star, TRAPPIST-1A, make it difficult for them to harbor life, according to [Federico Fraschetti](#) (LPL Associate Staff Scientist) and a team of scientists who have calculated how hard these particles are hitting the planets.

However, LPL graduate student [Hamish Hay](#) has found that the gravitational tug-of-war in the TRAPPIST-1 system is raising tides, possibly driving volcanic activity or warming ice-insulated oceans on planets that are otherwise too cold to support life.

TRAPPIST-1A is extremely active, emitting huge amounts of high-energy protons. Fraschetti's team simulated the journeys of these high-energy particles through the star's magnetic field and found that the fourth planet may be experiencing a powerful bombardment of protons. Flares on TRAPPIST-1A cause turbulence in the magnetic field, allowing the protons to sail away from the star, bringing energetic protons directly to the fourth planet's surface, where they could either break apart complex molecules that are needed to build life or serve as catalysts for the creation of these molecules.

Not all hope of life is lost—TRAPPIST-1 planets are likely tidally locked; the night side may be warm enough for life and safe from radiation. Moreover, oceans could also shield against destructive high-energy protons, as deep water could absorb the particles before they tear apart the building blocks of life.

By calculating how the gravity of TRAPPIST-1 planets would tug on and deform each other, Hay found it might be possible the subsequent tidal heating may be strong enough to fuel volcanic activity, which can in turn sustain atmospheres. Though TRAPPIST-1's innermost planets are likely too hot on their day side to sustain life, a volcano-fueled atmosphere could help move some heat to their otherwise-too-cold night side, warming it enough to keep living things from freezing.

TRAPPIST-1g is experiencing tidal tugging from both the star and the other planets. It is the only planet in the system where tidal heating due to the other planets is as strong as that caused by the central star. If TRAPPIST-1g is an ocean world, tidal heating could keep its waters warm.

M-dwarf star systems like TRAPPIST-1 offer astronomers the best opportunity to search for life outside the solar system, and Fraschetti and Hay's studies may help scientists choose how to explore the system in the future.

## Welcome from the Director



**Timothy D. Swindle, Ph.D.**

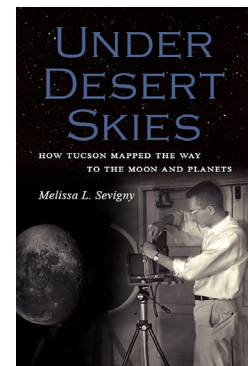
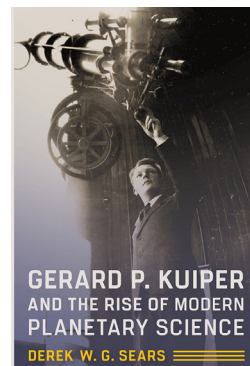
Department Head and Laboratory Director

Welcome to the latest edition of the *LPL Newsletter*. Those of you with families work to the rhythm of the school calendar. LPL isn't quite as tied to a school-year calendar, but May still has that end-of-the-year feel. The end of the academic year is a time when a lot of awards are announced, and not just for students. In this issue, you'll find discussions of awards to students, but also to faculty and to staff. These are all important, because while we sometimes take it for granted that LPL is full of clever, capable, dedicated people, we don't tell them often enough how valuable their work is. Take a look at some of the impressive things people at LPL have been doing, as seen through the lens of the awards they've been getting.

And of course, there is the great science, highlighted here, but also available from [lpl.arizona.edu](http://lpl.arizona.edu) in our monthly newsletter. Enjoy reading about what's going on at LPL, and have a great summer.

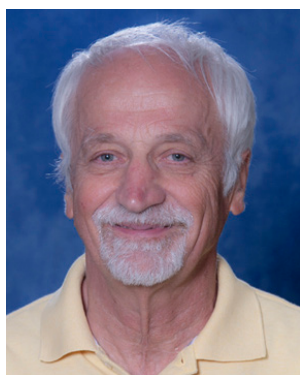
## Kuiper Biography by Derek Sears

LPL is gearing up to celebrate the 50th anniversary of the Apollo 11 Moon landing with a focus on the contributions that LPL scientists made to mapping the Moon and supporting the first lunar spacecraft missions. If you have an interest in learning about the role Gerard P. Kuiper played in bringing planetary science to Tucson, consider adding Derek Sears' biography of G.P. Kuiper to your summer reading list: *Gerard P. Kuiper and the Rise of Modern Planetary Science* (Derek W.G. Sears, 368p, University of Arizona Press, 2019). More information about the founding of LPL is available from *Under Desert Skies: How Tucson Mapped the Way to the Moon and Planets* by Melissa L. Sevigny (184p, University of Arizona Press, 2016). Use discount code AZFLR to receive a 30% discount on your order from UA Press; the Sears biography will be for sale and available at a 40% discount at [Summer Science Saturday](http://Summer Science Saturday) on July 20. See [lpl.arizona.edu/ss](http://lpl.arizona.edu/ss) for details.



## Faculty

### Kota Retirement



Senior Research Scientist **Dr. Jozsef Kota** retired from LPL this spring (2019). Dr. Kota began his career at LPL in 1996 as a Staff Scientist; however, Jozsef has been working at or with LPL since 1985 under the title of Visiting Scientist.

Dr. Kota received his Ph.D. in Physical Sciences from Roland Eötvös University (Budapest, Hungary) in 1980. His research interests include galactic and anomalous cosmic rays in the heliosphere and solar modulation and anisotropies of cosmic rays; theoretical and numerical modeling of the transport and acceleration of charged energetic particles; space weather; solar energetic particles; solar wind and modeling the evolution of shock waves; and the interaction of solar wind and interstellar matter.

## Faculty

### Two Honors for Alfred McEwen

LPL is proud to announce that [Professor Alfred McEwen](#) has been appointed as a [Regents' Professor](#) by the Arizona Board of Regents. The title of Regents' Professor is reserved for full professors whose exceptional achievements merit national and international distinction. Regents' Professor appointments are limited to no more than 3% of the total number of the university's tenured and tenure track faculty members.

Professor McEwen is also the recipient of the 2019 [G.K. Gilbert Award](#), presented by the Planetary Geology Division of the Geological Society of America (GSA) in recognition of outstanding contributions to the interdisciplinary field of planetary geology. The Gilbert Award will be presented at the GSA meeting on September 24.

Professor McEwen is the principal investigator for the [High Resolution Imaging Science Experiment](#), or [HiRISE](#), on the Mars Reconnaissance Orbiter. HiRISE has produced extremely-high-resolution images of the Martian surface since the launch of the Mars Reconnaissance Orbiter in 2005.

McEwen has made two discoveries about the geology of Mars from his detailed analyses of HiRISE and other Martian data. First, McEwen says Martian slopes show enigmatic flows that are actively forming at the present day and may provide evidence for water on Mars. Second, McEwen has shown that the practice of counting small craters is not always a reliable indicator of the age of a planetary surface, as many small craters can be produced from the high-velocity ejecta of larger impacts.

McEwen's work has helped change the scientific viewpoint of Mars from that of a dead planet to one with a dynamic surface, largely as a result of science done using the HiRISE camera, the construction and operations of which he has led for more than a decade.

McEwen's accomplishments were recognized with a NASA Distinguished Public Service Medal in 2011, the American Geophysical Union Whipple Award in 2015, and designation as a UA College of Science Galileo Circle Fellow in 2015.

McEwen, a planetary geologist, has been a member of the UA faculty since 1996. He is a professor of planetary sciences at the UA Lunar and Planetary Laboratory, a professor of geosciences and director of the [Planetary Image Research Laboratory](#). In addition to HiRISE, his spacecraft involvement currently includes being co-investigator on the Colour and Stereo Surface Imaging System on the ExoMars Trace Gas Orbiter, launched in 2016, co-investigator on the LROC team on the Lunar Reconnaissance Orbiter mission to the moon, and deputy principle investigator of the Europa Imaging System on the Europa Clipper mission, to launch in 2022 or later. Previously, McEwen was a member of the imaging science team of the Cassini mission to Saturn, which began in 1990 and ended in 2018, among other missions.

He is also a devoted educator. McEwen designed the "Mars" course for upper-level graduates and has served as a mentor for many students at all degree levels.



### Barman and Carter: Promotion and Tenure



Congratulations to [Dr. Travis Barman](#), who was promoted to Full Professor, and to [Dr. Lynn Carter](#), who has earned Tenure. Travis has been with LPL since 2013; his research interests include exoplanets and planetary formation and evolution. Lynn joined LPL in 2016; her research focus is planetary surfaces.



## Department

### 2019 Staff Excellence Awards

Congratulations, **Edith Camacho** and **Rod Heyd**!

**Edith Camacho** is the recipient of the 2019 LPL Outstanding Classified Staff Award. Edith is an Administrative Associate who began her career at LPL in 2012. She supports 8 faculty members and 14 other graduate students, postdocs, staff scientists, and support staff. A large part of her job is supporting proposal preparation, which requires careful attention to detail—one nomination cites her “essential” assistance in preparing proposals and budgets. For several years, Edith also supported the Theoretical Astrophysics Program (TAP). Her work with TAP has been described as “exemplary and above-and-beyond,” especially efforts in creating and maintaining a new web site, organizing “TAP Meet Yourself” gatherings, and supporting the reinvention of the TAP speaker series.

Edith’s expert work with budget preparation, organization and ability to quickly learn and apply new policies, techniques, and methods mean that she is not only an asset for those she supports but to the entire department.

**Rod Heyd** was recognized with the 2019 LPL Appointed Personnel Award.

Rod has been with LPL since 2005, when he began his career as a Senior Computer Database Specialist for HiRISE (High Resolution

Imaging Science Experiment). He moved into the position of Project Manager in 2009. Rod is downlink manager for HiRISE but he also oversees production of planning and data processing software for the Colour and Stereo Surface Imaging System (CaSSIS) instrument on ESA’s ExoMars Trace Gas Orbiter.

As a result of critical and last-minute staffing changes on CaSSIS, Rod took on the work of the software developer for the radiometric processing of images—essentially the equivalent of a second full-time position made especially challenging with an eight-hour time difference that required Rod to be available outside of and in addition to normal working hours. He learned to use new pipeline software and how to make everything work overseas, including the Co-I institutions in 6 countries. Thanks to these efforts, Rod was able to provide the European group with data processing software and the database structures required to operate it. He applied his unique understanding and expertise with new NASA requirements for archiving data (PDS4) to CaSSIS and was able to transfer the data to the remote operations center; consequently, there is now a fully functional pipeline for image processing in operation in Bern that produces beautiful color and map-projected images. He has also developed new work methods that are now applied to HiRISE, increasing project efficiency and allowing for adaptation to the slow funding decline. Rod’s work is consistently outstanding and deserving of recognition.

### Thibodeaux-Yost selected by AGU



**Singleton Thibodeaux-Yost**, Science Operations Engineer with HiRISE, was selected by the American Geophysical Union (AGU) as an advocate in the Voices for Science program. Singleton was selected from a highly competitive applicant pool for her strong communication skills and enthusiasm for communicating the importance of Earth and Space Science to lawmakers, the press, and the public. As part of the Voices for Science class of 2019, Singleton had the opportunity to attend an interactive two-day workshop in Washington, D.C., which focused on building skills and toolkits for communication and policy development. The Voices for Science program provides for additional networking and collaboration opportunities with the other 2019 program participants as well as members of the 2018 Voices for Science cohort. The Voices for Science program will provide funding for travel and registration to the Fall 2019 AGU Meeting, to be held in San Francisco, December 9-13.



The 2019 Voices for Science cohort includes 5 participants from the University of Arizona (UA). The UA group plans to develop a “Science & Policy Cafe” on campus and to host monthly luncheons to discuss topics like current political trends and how they relate to science funding and how science is applied to decision-making and governing. Singleton says, “We will provide resources to stay engaged, and tips and training on how to build relationships with legislators. We will also be inviting guest speakers who have dealt with the application of science to policy in the real world.”

## Department

### Meet LPL Postdoc Pranabendu Moitra



Dr. Pranabendu Moitra joined LPL in August 2018 as a Postdoctoral Research Associate working with Associate Professor Jeffrey Andrews-Hanna. Pranabendu is broadly interested in understanding magma migration and volcanic eruption on Earth and other planetary bodies. His current research focuses on explosive magma-water interaction and volcanic eruption dynamics on Mars. He combines observation and modeling to tackle his current research problems.

Pranabendu grew up in Kolkata, West Bengal, India. He completed his M.Sc. in Applied Geology from Jadavpur University, India, in 2008. He received a Ph.D. in Earth Science with a focus on physical volcanology in 2015 from Rice University. His Ph.D. topic focused on the violent eruption of basaltic magma combining rheology experiments, field observation, and numerical modeling. Before arriving at LPL, Pranabendu was a postdoctoral researcher and an adjunct instructor at the University at Buffalo.

### Michael Sori named 2019 UA Outstanding Postdoctoral Scholar

Dr. Michael Sori was presented with the Outstanding Postdoctoral Scholar Award at the 2019 Awards of Distinction Luncheon and Ceremony, on April 1st.

After receiving his Ph.D. in Planetary Science at the Massachusetts Institute of Technology, Dr. Michael Sori joined the University of Arizona Lunar and Planetary Sciences Laboratory in 2014 to pursue postdoctoral training under the mentorship of Dr. Christopher Hamilton and Dr. Shane Byrne. Dr. Sori's research spans a variety of topics in planetary geophysics, including the origin and evolution of ices and what they tell us about the climates and orbital histories of planets, and how volcanism helps to shape planetary surfaces. Using remote sensing data from spacecraft to inform his geophysical models, he has contributed greatly to the study of the Moon, Mars, Ceres, and Uranian satellites.



Dr. Sori has made outstanding contributions to University of Arizona's research, outreach, and teaching missions. Since beginning his tenure as a postdoctoral scholar, he has obtained his own funding through NASA and published 14 peer-reviewed articles in high-profile journals such as Nature and Science. These publications illustrate the breadth of his technical ability and understanding of fundamental scientific problems. His discoveries have caught the public's eye, with one being among the University's highest profile news stories in 2018. His classroom teaching and mentoring have also earned him the reputation of being a "natural educator." The University of Arizona is privileged to serve as the postdoctoral home for Michael Sori who is, in the words of his nominators, "a talented and reliable collaborator, an insightful scientist, a great mentor, and a respected role model within our department and within the broader Planetary Sciences community."

### CoSSAC Award to Joshua Sosa



LPL webmaster Joshua Sosa received a CoSSAC Professional Development Grant in support of travel to DrupalCon 2019, held April 8-12 in Seattle. Highlights included sessions on database optimization, Drupal migration strategies, and real-time asynchronous tools.

Joshua received a B.A.S. in Internet and Web Development from Arizona State University in 2017 and is currently working on his M.S. in Technology, also from Arizona State University. Joshua is an active member of the UA Digital Team, which works with UA Brand to develop web assets (primarily Drupal) to the university community.



## Department

### LPL Fieldtrip Spring 2019

by Allison McGraw

The Spring 2019 594A field trip, led by [Shane Byrne](#) and [Joe Spitale](#), began with exploration of basins east of Tucson to observe Earth-bound examples of mafic lava flows, maars, and a unique dune field. At the Aden Lava Flows, we walked across mafic basalt flows with interesting cooling structures in the form of large-scale polygons that approach 10 meters in width. While this pattern is better appreciated from an aerial view, the opportunity to walk on a basaltic flow allowed for its own unique views. The Aden Lava field is approximately 80,000 years old and sits atop a major tectonic feature known as The Rio Grande Rift. Plate tectonic activity in the form of extensional stretching allowed for hot, mafic lava flows to protrude from below. This process subsequently allowed a plumbing system of magma to surge towards the top of the basin stratigraphy. We camped among these basalt flows in near-perfect weather conditions for the first night of the trip.



The next destination was a volcanic crater known as Kilbourne Hole, where the LPLers saw a textbook example of stratigraphy related to maars and tuff-ring cones from ash-fall deposits. A maar is a volcano that ascends through volatiles such as liquid water or ice and thus becomes more reactive and explosive as the mafic lava flows onto the surface. We examined a classic example of maar activity with a ~2-meter diameter volcanic bomb that was deposited into the ash-tuff cone layer. The volcanic bomb displays the characteristic “bombsag” feature (see photo above) where the ash layers located directly below the bomb are compressed and deviate from the ash deposited along the surface. Additionally, the basaltic rock at Kilbourne Hole contains xenoliths composed of olivine and pyroxene, indicating that this deep-rooted volcanism is piped up through a diatreme, where upper mantle tapping occurs.

The final leg of the trip involved the largest gypsum dune field on Earth—White Sands National Monument. The gypsum sand crystals are strikingly white, creating a unique and intriguing place to study planetary dune analogs. This site was heavily used by the U.S. government in the early 1930s for testing rockets and weaponry, but it was declared a National Monument by President Hoover in 1933. The dunes there typically migrate ~60 feet per year, but a recent high-speed wind event moved the dunes 80 feet in one afternoon; measured wind speeds averaged 60 mph (100 km/h)! Evidence of this massive dune migration was still apparent as a few of the posted signs in the monument were partially covered by the very fine-grained gypsum sand. White Sands is dominated by crescent-shaped barchan dunes, but it also contains transverse dunes and dome-shaped dunes throughout the field. The soapstone yucca is one of the few endemic plant species that resides here, and it often grows huge root structures that reach the water table, which is about 3 feet below the average elevation of the inter-dune regions. Anchoring by these plants can also lead to the parabolic dunes we saw here, which don't have a direct planetary analog. The inter-dune regions also contained well-defined dune footprints, more evidence of dune migration. Finally, we hiked to Alkali Flats, at the western boundary of the monument. Undetonated munitions were a danger beyond this point, so, rather than not to test our luck with explosive Anthropocene processes, we headed back to Tucson.



## Outreach

### LPL Outreach Update

by Shane Stone

Over the past academic year, 15 LPL graduate students organized and volunteered at more than 20 outreach events in the Southern Arizona community. We were able to reach more than 2,300 children and adults! We participated in the [Tucson Festival of Books](#), [Connect2STEM](#) at the [UA College of Medicine](#) in Phoenix, and the [Pima Association of Governments Teen Leadership Summit](#), hosted children from [UA Fusion Camp](#), continued to organize monthly space science talks at [Borderlands Brewery](#), and visited numerous elementary, middle, and high schools in Tucson, Vail, and Sahuarita to bring planetary science to people of all ages. We continue to build ties with as many schools in our community as possible. This year we were delighted to visit [Sahuarita Middle School](#), [Vail Academy and High School](#), [Ocotillo Ridge Elementary](#), [Coronado K-8 School](#), and [Old Vail Middle School](#) to inspire the next generation of scientists. We look forward to strengthening these relationships and forging new ones in the future!

## 3D Printing the Solar System

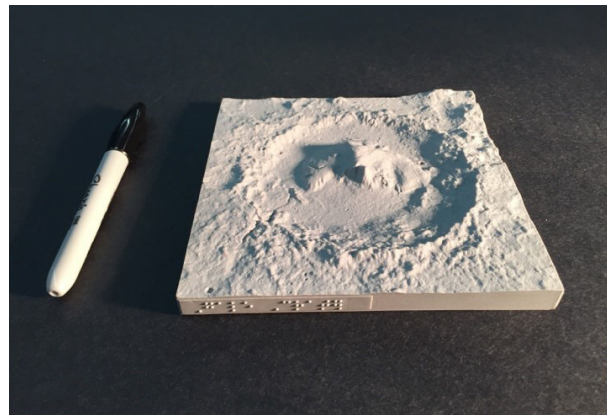
Dr. Steve Kortenkamp, LPL Associate Professor of Practice, is combining the capabilities of 3D printers with high-resolution spacecraft data (including those from LPL's HiRISE instrument orbiting Mars) to produce tactile models of planetary terrain. The effort is part of an NSF-funded research project being carried out with his colleagues Drs. Sunggye Hong and Irene Topor in UA's College of Education. Their group is designing and teaching a planetary science course for young students who are blind or visually impaired, with the aim of identifying ways to increase the representation of these students in STEM fields.

Kortenkamp is developing techniques that begin with software processing of spacecraft data and then add 3D printing of prototype models, culminating with a method of molding and casting duplicates of the models for each of his students. His work with the blind and visually impaired was featured at a Science City booth during the Tucson Festival of Books in March.

During the first year, Dr. Kortenkamp's students are focusing on impact craters as a tool for studying planetary characteristics. They begin their studies locally by exploring 3D models of Arizona's Meteor Crater. Then they reach out to the Moon by studying Tycho, Orientale Basin, and the near-side/far-side surface dichotomy. The class culminates on Mars with terrain that reveals evidence of water, such as craters in Athabasca Valles as well as Gusev and Gale craters. In subsequent years, Kortenkamp's class will include 3D models of volcanoes, canyons, dune fields, asteroids, and cometary nuclei.



Dr. Kortenkamp (right) with his 3D models at Science City. The visitor is using her fingers to read the Braille label on a model of the Moon's Tycho Crater.



Cast of a 3D-printed model of Gale Crater on Mars. Gale's central mountain complex is currently being explored by NASA's Curiosity rover. (Model includes Braille label. Standard Sharpie marker shown for scale.)



## Department

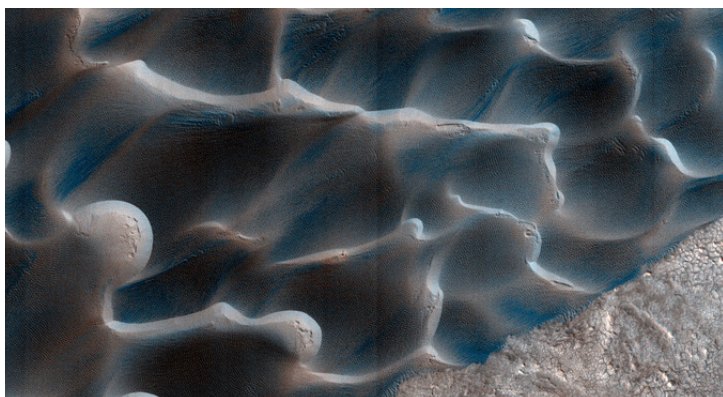
### Apollo 11 50th Anniversary Events

LPL, the University of Arizona, and venues across the city of Tucson are celebrating the 50th anniversary of the Apollo 11 lunar landing with a variety of events that will take place through the end of the year.

On July 20, LPL will host its annual [Summer Science Saturday](http://lpl.arizona.edu/sss) event ([lpl.arizona.edu/sss](http://lpl.arizona.edu/sss)), featuring Apollo and lunar science, and highlighting scientific contributions made by LPL. Also on July 20, Flandrau Science Center and Planetarium will provide special Apollo programming and the UA Special Collections Library will open a wonderfully curated Moon exhibit, which will showcase materials from the Ewen Whitaker collection, in addition to other exhibits and activities related to lunar science. For a complete list of anniversary events, visit [flandrau.org/Apollo](http://flandrau.org/Apollo).



### On Mars, Sands Shift to a Different Drum



The retreat of Mars' polar cap of frozen carbon dioxide during the spring and summer generates winds that drive the largest movements of sand dunes observed on the red planet. (Image: NASA/JPL/University of Arizona/USGS)

A team of planetary scientists led by LPL Associate Staff Scientist [Dr. Matthew Chojnacki](#) have set out to uncover the conditions that govern sand movement on Mars and how they differ from those on Earth. Their study reveals that processes not involved in controlling sand movement on Earth play major roles on Mars, especially large-scale features on the landscape and differences in landform surface temperature.

Because the Martian atmosphere is so thin, sediments on the Martian surface move more slowly than their Earthly counterparts. The Martian dunes observed in this study ranged from 6 to 400 ft tall and were found to creep along at a fairly uniform average speed of two ft per Earth year. "On Mars, there simply is not enough wind energy to move a substantial amount of material around on the surface," Chojnacki said. "It might take two years on Mars to see the same movement you'd typically see in a season on Earth."

Planetary geologists had been debating whether the sand dunes on Mars were relics from a distant past, when the atmosphere was much thicker, or whether drifting sands still reshape the planet's face today, and if so, to what degree. "We wanted to know: Is the movement of sand uniform across the planet, or is it enhanced in some regions over others?" Chojnacki said. "We measured the rate and volume at which dunes are moving on Mars."

The team used images taken by the LPL-led [High Resolution Imaging Science Experiment](#) camera aboard NASA's Mars Reconnaissance Orbiter. The researchers mapped sand volumes, dune migration rates and heights for 54 dune fields, encompassing 495 individual dunes. Across Mars, the survey found active, wind-shaped beds of sand and dust in structural fossae—craters, canyons, rifts and cracks—as well as volcanic remnants, polar basins and plains surrounding craters.

In the study's most surprising finding, the researchers discovered that the largest movements of sand in terms of volume and speed are restricted to three distinct regions: Syrtis Major, a dark spot larger than Arizona that sits directly west of the vast Isidis basin; Hesperus Montes, a mountain range about two-thirds the length of the Cascades; and North Polar Erg, a sea of sand lapping around the north polar ice cap. All three areas are set apart from other parts of Mars by conditions not known to affect terrestrial dunes: stark transitions in topography and surface temperatures.

"Those are not factors you would find in terrestrial geology," Chojnacki explained. "On Earth, the factors at work are different from Mars. For example, ground water near the surface or plants growing in the area retard dune sand movement." On a smaller scale, basins filled with bright dust were found to have higher rates of sand movement, as well. Understanding how sand and sediment move on Mars may help scientists plan future missions to regions that cannot easily be monitored and has implications for studying ancient, potentially habitable environments.



## Graduate

### Kuiper Award to Hamish Hay



Hamish Hay is the 2019 recipient of the [Gerard P. Kuiper Memorial Award](#), the department's highest award for graduate student scholarship. Hamish is also the LPL recipient of the 2019 College of Science Graduate Student Award for Scholarship. Hamish is a fifth-year student who joined LPL after earning a MSci. in Geophysics at Imperial College London. He studies how planets and moons deform in response to tidal forces. Periodic tidal deformation in both the solid and liquid parts of any planet/moon result in heating via friction which has consequences for how their interior structures evolve over time. This is particularly important for the ocean worlds Europa and Enceladus, the most sought after astrobiological targets of future space missions. In particular, Hamish studies how tidal heating occurs in the oceans of icy moons, and how this is affected by miles of ice sitting on top of the ocean's surface.

Hamish held a NASA Earth and Space Science Fellowship from 2015-2018 (*Tidal Dissipation in the Subsurface Oceans of the Icy Satellites*) and was the recipient of a College of Science Galileo Circle Scholarship in 2016 and 2017. He is advised by [Associate Professor Isamu Matsuyama](#).

### Esman Receives Teaching and Mentoring Award



Tracy Esman was named the recipient of the College of Science Outstanding Teaching and Mentoring award for LPL, specifically for her work in Professor Steve Kortenkamp's spring 2018 section of PTYS/ASTR 170B2, for which she received the LPL Outstanding Graduate Teaching Assistant Award.

Tracy received a Bachelor degree in Astronomy-Physics from the University of Virginia in 2015. She is a fourth-year student advised by [Professor Joe Giacalone](#) and [Dr. Jared Espley](#) (NASA Goddard Space Flight Center). Her research interests are the magnetic environments of planets. Specifically, Tracy studies plasma interactions between the solar wind and the Martian system, including the resulting waves. These interactions can affect ion escape and create instabilities in the induced magnetosphere. Tracy also studies the crustal magnetic fields on Mars. Many questions remain

about how they affect escape of the Martian atmosphere. These regions of increased magnetic fields provide limited protection from the solar wind and a unique area of plasma interactions—the crustal fields may be the key to creating an environment capable of producing lightning.

### Recent PTYS Graduates

Congratulations to [Molly Simon](#) and [Joshua Lothringer](#), LPL's newest alumni!

On May 7 Molly defended her dissertation, *Part I: How Did We Get Here? College Students' Preinstructional Ideas on the Topic of Planet Formation, And the Development of the Planet Formation Concept Inventory; Part II: Evidence for Magnetically Driven Protoplanetary Disk Winds*. Molly's advisor was [Professor Chris Impey](#). She will begin a position as Education Postdoctoral Fellow with Zooniverse at the Adler Planetarium in Chicago.



Joshua defended his dissertation, *Characterizing the Atmospheres of Exoplanet Populations: From Sub-Jovian to Ultra-Hot Jupiter Exoplanets*, on May 31. In August, Joshua will begin a postdoctoral fellowship at Johns Hopkins University. Joshua was the recipient of the 2019 [Theoretical Astrophysics Program \(TAP\) Graduate Student Research Prize](#). He presented his prize talk, *Extremely Irradiated Hot Jupiters: Non-Oxide Inversions, H- Opacity, and Thermal Dissociation of Molecules*, on April 1. [Professor Travis Barman](#) served as Joshua's advisor.



## Invest in LPL

### 2019 Galileo Circle Scholarships

Congratulations to LPL's 2019 Galileo Circle Scholarship recipients: [Rachel Fernandes](#), [Hamish Hay](#), [Daniel Lo](#), [Joshua Lothringer](#), [Kyle Pearson](#), and [Shane Stone](#). Galileo Circle Scholarships are awarded to the University of Arizona's finest science students and represent the tremendous breadth of research interests in the University of Arizona College of Science.

Galileo Circle Scholars receive \$1,000 each; the Galileo Scholars were honored at an early evening reception held on April 15, 2019.



Rachel Fernandes  
Advisor: Pascucci



Hamish Hay  
Advisor: Matsuyama



Daniel Lo  
Advisor: Yelle



Joshua Lothringer  
Advisor: Barman



Kyle Pearson  
Advisor: Griffith



Shane Stone  
Advisor: Yelle

### 2019 Curson Travel Award

Second-year student [Rachel Fernandes](#) won funding support for travel to the 3rd Advanced School on Exoplanetary Science (ASES3), which was held in Vietri sul Mare (Salerno), Italy, from May 27-31.

Rachel's research interests are planet formation with a background in dynamics of young disks. Her current research focus is on exoplanet characterization and habitability with the NASA NExSS Earths in Other Solar Systems (EOS) team at the University of Arizona. Her advisor is [Associate Professor Ilaria Pascucci](#). Rachel anticipates that attending ASES3 will help her formulate long-range research plans for her graduate work and help her to build professional relationships with international researchers.

We'll report on Rachel's travel and research in the [LPL Fall Newsletter](#)!

### Support LPL with a Gift for Student and Staff Career Development

Thanks to the generosity of the late [Shirley Curson](#), LPL has been able to fund summer travel for students for the last few years. However, the number of excellent applications for that award made it clear that there is a real need for additional funding to help LPL students and staff trying to explore new avenues of research and develop new skills. [Dan Cavanagh](#), chair of LPL's [External Advisory Board](#), has provided additional support for the last several years, but now the entire Advisory Board has made a commitment to fund career-development travel for both students and staff. We have made a call for proposals to students and staff and anticipate bringing you the experiences of our grant awardees in the Fall 2019 newsletter. If you're not on the Advisory Board, but would like to contribute to this fund, please do—just make a donation to LPL, and include a note indicating the purpose as "career development travel."

## Invest in LPL

### Andersson Award to Alessondra Springmann



This year's **Leif Andersson Award for Service and Outreach** was presented to Alessondra Springmann for her many service, outreach, and mentoring activities—some of her many and varied efforts and activities include: moderating internet support forum of over 1,200 women alumni from her alma mater, Wellesley College; communicating and advocating science with outreach visits to schools, local organizations, events, and research institutions; promoting science with her microblogging and commentary via various podcasts and media such as the Weekly Space Hangout YouTube Series. Notable among Alessondra's outreach efforts is her engagement in activities aimed at middle and high school students in the Tohono O'odham Nation.

Alessondra is an advocate for equity and inclusion in professional science, especially for gender inclusion and for accessibility and inclusion for scientists with disabilities; she speaks publicly on the topic of sexual harassment in science. At LPL, Alessondra works with the Department Life Committee and was key to creating the committee web site, which provides collection of resources related to workplace climate, equity and inclusion. She is also an active member of the LPL Women's Group and undertakes other department service, such as serving as graduate alumni chair and creating and administering a grad student Slack channel.

After Hurricane Maria devastated the island of Puerto Rico on September 20, 2017, Alessondra took the initiative to facilitate communication from off-island family to those still on the island and cut-off from other means of communication. She continued her efforts to provide aid to the those affected by the storm, particularly the staff of Arecibo Observatory, by organizing a social media campaign to deliver supplies by using an Amazon wishlist; the result was that the Arecibo Radio Telescope mailroom was stacked with Amazon packages. These supplies came to be known as "SondyAid."



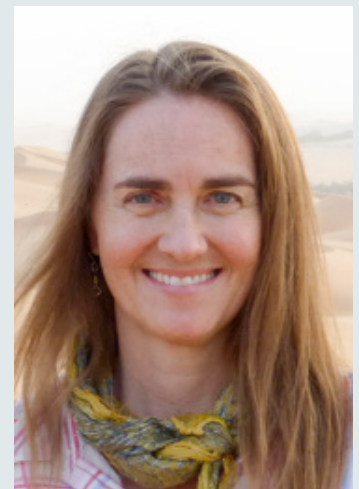
In addition to receiving the Andersson Award, Alessondra was named the LPL winner of the 2019 College of Science Outreach Award.

## Alumni

### Promotion for Radebaugh

Dr. **Jani Radebaugh** has been promoted from Associate to Full Professor in the Department of Geological Sciences at Brigham Young University.

Professor Radebaugh graduated from LPL in 2005; **Alfred McEwen** served as her advisor. She then began postdoctoral work with Dr. Jonathan Lunine, a planetary scientist who specializes in the origins and geologic histories of planetary landscapes from spacecraft images and Earth analogue field studies. Her current investigations include giant sand dunes, mountains, volcanoes, rivers and lakes on Saturn's moon Titan from the Cassini spacecraft and actively erupting volcanoes and mountains on Jupiter's moon Io. Dr. Radebaugh has done field work in the Sahara, Namibia, Arabia, Iran, the Ethiopian Afar Rift, Australia, the Argentine Altiplano, Hawaii and the desert southwestern U.S. She is a regular participant in the U.S. Antarctic Search for Meteorites Program, which returns samples from around the solar system including the Moon and Mars. Jani is a science contributor for the Discovery Channel's How the Universe Works, has given a TEDx talk on exploration, and is a speaker at the Spacefest Apollo astronaut convention. She is also a member of the **LPL External Board of Advisors**. You can follow Professor Radebaugh's geologic adventures on Twitter at @radjanirad.





## LPL in the News

Links to the news stories below and others are available at: [lpl.arizona.edu/news/2019/spring](http://lpl.arizona.edu/news/2019/spring)

**Ashes of a Dying Star Hold Clues about Solar System's Birth** - LPL scientists lead by [Pierre Haenecour](#) discovered a dust grain forged in a stellar explosion predating our solar system which reveals new insights about how stars end their lives and seed the universe with the building blocks of new stars and planets.

**Researchers Find Ice on Saturn's Giant Moon** - While searching for the origins of Titan's methane and the organics that coat its surface, LPL's [Professor Caitlin Griffith](#) and her research team made the unexpected discovery of a large ice feature on Saturn's largest moon.

**What Deep Learning Reveals About Saturn's Storms** - A new technique allows researchers to dive deep into the ringed-giant's atmosphere to gain insights into Saturn's storms on a large-scale.

**Powerful Particles and Tugging Tides May Affect Extraterrestrial Life** - Two new studies by LPL's Associate Staff Scientist [Federico Fraschetti](#) and doctoral candidate [Hamish Hay](#) may bring into question the habitability of TRAPPIST-1 exoplanets, three of which are in the habitable zone of space.

**An Odd Ball in Space: OSIRIS-REx Spacecraft Studies Asteroid Bennu Up Close** - The first close-up observations by the OSIRIS-REx spacecraft of its target, asteroid Bennu, confirm much of the ground-based observations but reveal new details that pose a challenge to the mission's objective of bringing back a sample of pristine material from the birth of our solar system.

**UA Student-led CatSat Mission Selected by NASA** - UA students, including some from LPL, will get hands-on spacecraft hardware development experience thanks to NASA's CubeSat Launch Initiative, which recently selected CatSat to fly as auxiliary payload aboard future space missions.

**LPL Planetary Scientist Wins Bid to Study Moon Samples** - Incoming [Assistant Professor Jessica Barnes](#) will have the opportunity to study a previously unopened sample of a moon rock that was collected in the early 1970s during NASA's Apollo 17 mission.

**UA Study Suggests Possibility of Recent Underground Volcanism on Mars** - A new study conducted by LPL's Associate Staff Scientist [Michael Sori](#) and Postdoctoral Research Associate [Ali Bramson](#) suggests volcanoes may have been recently boiling deep below the surface of the Red Planet, which could explain the potential presence of liquid water underneath the polar ice caps.

**On Mars, Sands Shift to a Different Drum** - In the most detailed analysis of how sands move around on Mars, Associate Staff Scientist [Matt Chojnacki](#) and his team found that processes not involved in controlling sand movement on Earth play major roles on Mars.

**NASA's OSIRIS-REx Spacecraft Enters Close Orbit Around Bennu, Breaking Record** - On December 31, NASA's OSIRIS-REx spacecraft entered into orbit around the asteroid Bennu, and made Bennu the smallest object ever to be orbited by a spacecraft.