



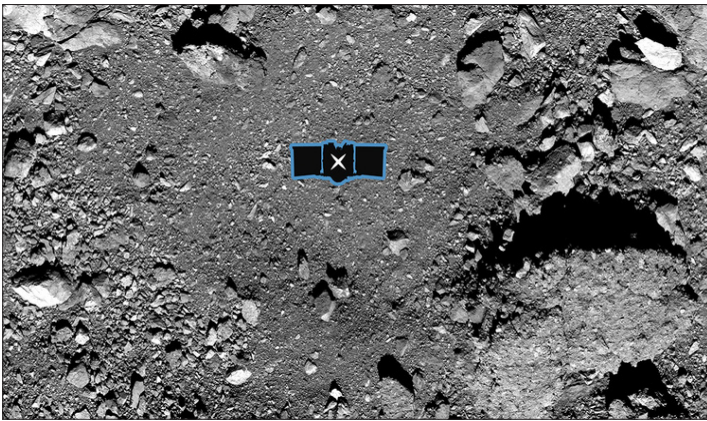
THE UNIVERSITY OF ARIZONA  
COLLEGE OF SCIENCE

# LUNAR & PLANETARY LABORATORY

LUNAR AND PLANETARY LABORATORY NEWSLETTER

FALL 2019

## X Marks the Spot: NASA Selects Site for Asteroid Sample Collection



After a year scoping out asteroid Benu's boulder-scattered surface, the team leading NASA's first asteroid sample return mission has officially selected a sample collection site.

The Origins, Spectral Interpretation, Resource Identification, Security, Regolith Explorer, or **OSIRIS-REx**, mission team concluded a site designated "Nightingale" – located in a crater high in Benu's northern hemisphere – is the best spot for the OSIRIS-REx spacecraft to snag its sample.

The OSIRIS-REx team, led by LPL [Professor Dante Lauretta](#), spent the past several months evaluating close-range data from four candidate sites in order to identify the best option for the sample collection. The candidate sites – dubbed Sandpiper, Osprey, Kingfisher and Nightingale – were chosen for investigation because, of all the

potential sampling regions on Benu, these areas pose the fewest hazards to the spacecraft's safety while still providing the opportunity for great samples to be gathered.

"After thoroughly evaluating all four candidate sites, we made our final decision based on which site has the greatest amount of fine-grained material and how easily the spacecraft can access that material while keeping the spacecraft safe," said [Dante Lauretta](#), OSIRIS-REx principal investigator at the University of Arizona. "Of the four candidates, site Nightingale best meets these criteria and, ultimately, best ensures mission success."

Site Nightingale is located in a northern crater 460 feet (140 meters) wide. Nightingale's regolith – or rocky surface material – is dark, and images show that the crater is relatively smooth. Because it is located so far north, temperatures in the region are lower than elsewhere on the asteroid and the surface material is well-preserved. The crater also is thought to be relatively young, and the regolith is freshly exposed. This means the site would likely allow for a pristine sample of the asteroid, giving the team insight into Benu's history.

The Nightingale site poses challenges for sample collection. The original mission plan envisioned a sample site with a diameter of 164 feet (50 m). While the crater that hosts Nightingale is larger than that, the area safe enough for the spacecraft to touch is much smaller – approximately 52 feet (16 m) in diameter, resulting in a site that is only about one-tenth the size of what was originally envisioned. This means the spacecraft has to very accurately target Benu's surface. Nightingale also has a building-size boulder situated on the crater's eastern rim, which could pose a hazard to the spacecraft while backing away after contacting the site.

Site Osprey was selected as a backup sample collection site. The spacecraft is designed to autonomously "wave-off" from the Nightingale site if its predicted position is too close to a hazardous area. During this maneuver, the exhaust plumes from the spacecraft's thrusters could potentially disturb the surface of the site, due to the asteroid's microgravity environment. In any situation where a follow-on attempt at Nightingale is not possible, the team will try to collect a sample from site Osprey instead.

With the selection of final primary and backup sites, the mission team will undertake further reconnaissance flights over Nightingale and Osprey, beginning in January and continuing through the spring. Once these flyovers are complete, the spacecraft will begin rehearsals for its "touch-and-go" sample collection event, which is scheduled for August. The spacecraft will depart Benu in 2021 and is scheduled to return to Earth in September 2023.

## Welcome from the Director



Welcome to the latest edition of the LPL Newsletter, the last of the 2010s. A lot has happened over this decade, which also coincides with the length of time we've been putting out a regular newsletter (the first one came out in Fall 2010).

If you've been around LPL awhile, and you look at the directory of our faculty, you'll realize that there are a lot of new names and faces. In fact, nearly 60% of the people listed there were not on that page in 2010. We've also graduated 48 students in that time, many of whom have already made their mark in planetary science and other endeavors. Our faculty, students, staff, and alumni have won numerous awards, ranging from membership in the National Academy of Sciences to awards for service. LPL scientists have generated some amazing scientific results, which we've been chronicling in these newsletters. Moreover, we have won the largest spacecraft mission contract LPL has ever managed, **OSIRIS-REx**, which is now just months away from its critical touch-and-go sampling maneuver.

There have been difficult moments as well. Most of the scientists at LPL have shared the too-common experience of having worked very hard on a proposal that was not selected. In the past decade, three former directors of LPL passed away ([Michael Drake](#), [Charles Sonett](#), and [Laurel Wilkening](#)), as well as faculty member [Tom Gehrels](#), and several other former members of the faculty and staff. On the whole, LPL is a very different place than it was ten years ago, but it is an organization that will continue to excel in the next decade.

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

Department Head and Laboratory Director

## Faculty

- Assistant Professor [Jessica Barnes](#) was profiled by *Nature* magazine (10 July 2019) as a researcher whose work will shape the next 50 years of lunar research.
- Assistant Professor [Kristopher Klein](#) received the 2019 NASA Early Career Investigator Program Award in the first year of the program.
- Professor [Amy Mainzer](#) has been elected Vice Chair of the American Astronomical Society's Division for Planetary Sciences. The position is a one-year term (2019-2020).
- Professor [Adam Showman](#) was elected a Fellow of the American Geophysical Union (AGU); this honor is reserved for 0.1% for the AGU's membership each year. Professor Showman was recognized at Honors Tribute during the fall 2019 AGU meeting

## McMillan Retirement



[Dr. Robert McMillan](#), Associate Research Scientist and Principal Investigator for the Spacewatch program at LPL, retired on June 30, 2019. Bob began his career at LPL in 1979 as a Research Associate and became an Associate Research Scientist in 1995. Although he has "retired," Bob is still managing Spacewatch and scanning the skies from Kitt Peak. The Spacewatch team had the pleasure this summer of hosting a celebration to congratulate Bob on his long career and retirement, and to wish him clear skies on his upcoming observing runs.

## Faculty

### LPL Welcomes Three New Faculty Members

Dr. Jessica Barnes joined the LPL faculty as an Assistant Professor in August (2019), after holding a position as a postdoctoral fellow at NASA's Johnson Space Center. Jess' research centers on understanding the origin and evolution of volatiles in the inner Solar System. She utilizes a combination of electron microscopy and high-resolution secondary ion mass spectrometry to study extraterrestrial materials. Jess' research background is in lunar mineralogy and geochemistry. Most recently she has been using coordinated electron and ion beam studies of meteorites to investigate the evolution of water in the Martian crust and to assess the inventories and origins of volatiles on primitive chondrite and achondrite parent bodies.



Jess was born in London, grew up in Belfast, and later moved to Scotland where she graduated from the University of St. Andrews with a B.Sc. in Geosciences. She obtained her Ph.D. in Planetary and Space Sciences from The Open University (England). Her doctoral work focused on measuring water in lunar samples in order to better understand the accretion history and magmatic evolution of the Moon. As pastimes, Jess enjoys going to the gym, hiking, and travelling.

Dr. Pierre Haenecour joined LPL as an Assistant Professor in October 2019. He grew up in Brussels (Belgium) and graduated with B.A. and M.S. degrees in Geology and Geochemistry from the Free University of Brussels. In 2011, Pierre moved to St. Louis (Missouri) for his Ph.D. in Earth and Planetary Sciences at Washington University, where he studied stardust grains (also referred as circumstellar 'presolar' grains) identified in early solar system materials, such as meteorites and micrometeorites. He then worked at LPL as a postdoctoral research associate with Dr. Tom Zega to investigate the origin of organic matter in meteorites.



Pierre's background is in geochemistry and cosmochemistry, from terrestrial samples (Pb and Zn isotopes in Archean komatiitic lava flows) to primitive extraterrestrial samples, using multi-collector inductively coupled plasma mass spectrometry and a variety of in situ ion- and electron-microscopy techniques (nanoscale secondary ion mass spectrometry and transmission electron microscopy). His current research interests focus on the building blocks and early history of the Solar System, and the origin of life through the coordinated study of circumstellar and interstellar dust grains and organic molecules in unequilibrated planetary materials (micrometeorites and interplanetary dust particles).



Dr. Amy Mainzer, one of the world's leading scientists in asteroid detection and planetary defense, began her career at LPL this fall (2019). Dr. Mainzer was previously a senior research scientist in the Science Division at NASA's Jet Propulsion Laboratory, where she specialized in astrophysical instrumentation and infrared astronomy.

As principal investigator of NASA's Near-Earth Object Wide-field Infrared Survey Explorer mission, or NEOWISE, Dr. Mainzer has overseen the largest space-based asteroid-hunting project in history, resulting in the detection and characterization of an unprecedented number of asteroids and comets, including objects that could potentially pose a hazard to Earth at some point in the future. Dr. Mainzer also is the principal investigator of the proposed NASA Near-Earth Object Camera, or NEOCam, a next generation space telescope that would use a similar scientific approach to fulfill a mandate from the U.S. Congress to discover nearly all of the space rocks that could pose a significant threat to Earth.

Dr. Mainzer holds a doctorate from the University of California, Los Angeles and a Master of Science degree from the California Institute of Technology. She graduated with honors from Stanford University with a Bachelor of Science. Prior to joining JPL in 2003, she worked as an engineer at Lockheed Martin, where she built the fine guidance camera for NASA's Spitzer Space Telescope.

Passionate about making science accessible to all, Mainzer serves as the curriculum adviser and on-camera host for the PBS Kids series "Ready Jet Go!" – a television show aimed at teaching space and Earth science to children ages 3-8 that airs in 176 countries around the world with nearly 300 million views. Mainzer also has appeared in numerous interviews for the History Channel, National Geographic, Discovery Channel, the BBC and other networks.

## Department

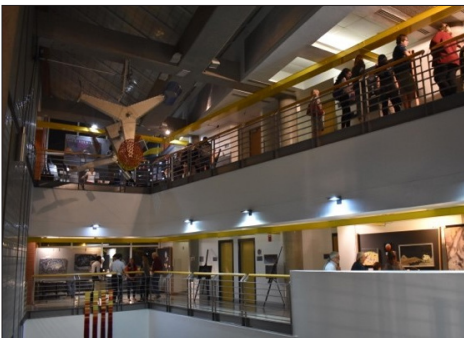
### The Art of Planetary Science 2019: An Exhibition

by Allison McGraw

The 2019 Art of Planetary Science exhibit, held November 15-17 in the Kuiper Space Sciences building, hosted six new experiences and showcased over 200 works of space-themed art created by over 100 artists. The exhibit broke previous attendance records, welcoming 700 visitors over three days. The exhibit was organized to feature two main art categories—Data Art and Fine Art—creating a showcase of diverse work from artists within LPL as well as the national and international community of scientists and space artists. The 2019 exhibit included the event's first special highlight section called "Arizona Asteroid Art," which featured art inspired by the Psyche mission (Arizona State University) and OSIRIS-REx (University of Arizona).

On opening night, visitors had the opportunity to talk with artists about their work and to rock out under the Moon Tree with music provided by local band *Galactic Cactus*. The *Physics Factory* bus was on scene to quiz the audience on their knowledge of women scientists. The University of Arizona undergraduate *Astronomy Club* hosted telescope viewing on the mall. As a special opening-night highlight, LPL Postdoctoral Research Associate *Dr. Ali Bramson* and Associate Staff Scientist *Dr. Michael Sori* hosted "Super Mario Explores the Solar System," which showcased their series of Super Mario levels designed to evoke the surfaces and aqueous environments on various planets and moons in the solar system. The public was invited to play these levels on the big screen in Kuiper room 308; the activity was a big hit with small kids and big kids alike.

Featured on the second day of the exhibit was local space artist and aerospace engineer *Michelle Rouch*, who gave a presentation in the Flandrau Eos Planetarium Theater on the topic of technology as a tool rather than a pacifier. The event weekend concluded with a screening of the documentary *Chesley Bonestell: A Brush With the Future* at the Flandrau Eos Planetarium Theater. The film was introduced by LPL alumnus and space artist *Dr. William Hartmann*. Dr. Hartmann considered Bonestell to be one of his inspirations and eventually had the opportunity to meet him.



### Brenton Awarded for Advising

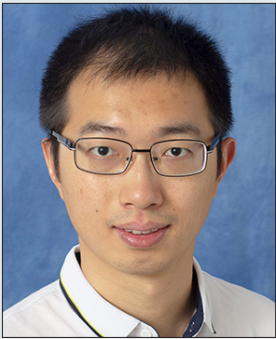


LPL academic advisor *Amy Brenton* received funding from a University Professional Advising Council (UPAC) travel grant and a College of Science Staff Advisory Council (CoSSAC) professional development grant to attend the annual National Academic Advising Association (NACADA) conference held October 20-23 in Louisville, Kentucky. Amy reports that conference highlights included the keynote address by Dr. Tyrone Howard, titled "Why Equity Matters," as well as conference sessions focused on student support on a variety of issues including mental health, advocacy, and communication for both graduate and undergraduate students. Besides networking and meeting advisors from across the country, Amy also was able to participate in regional sessions that will continue meeting and working after the conference and will help her to better support our students' advising needs.

In July, Amy was named an outstanding advisor by the UArizona Advising Resource Center (ARC). She was recognized for her commitment to advising and professional growth, including her participation in campus advising seminars and advising learning communities.

## Department

### Meet LPL Postdoctoral Research Associates

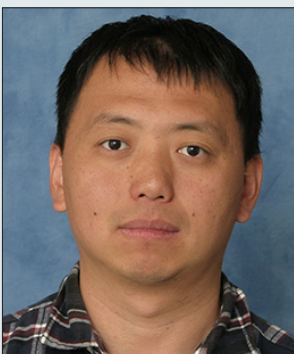


Chenliang Huang joined LPL in August 2019 as a Postdoctoral Research Associate working with Assistant Professor Tommi Koskinen. His research focuses on developing models of the upper atmosphere of extrasolar gas giant planets to interpret existing observations and to prepare for the NASA Colorado Ultraviolet Transit Experiment (CUTE). Comparing the observed atomic lines (H, He, Na, Mg, Fe, etc.) in the transmission spectrum and the result suggested by the model, he tries to constrain the physical properties of the exoplanet upper atmosphere, such as its temperature, number densities of each species, mass loss rate, and radiation field.

Chenliang grew up in Beijing, China, and he received his B.S. in Physics in 2011 from the Peking University. He earned his Ph.D. in Astronomy from the University of Virginia with Professor Phil Arras and Professor Roger Chevalier (2017). During his graduate program, Chenliang studied the Ly $\alpha$  resonant scattering within the atmosphere to interpret the observed H $\alpha$  transmission spectrum of HD 189733b, and studied the effect of electron scattering that broaden the emission line of interacting supernovae.

Before arriving at LPL, Chenliang was a postdoctoral scholar at the University of Nevada Las Vegas working with Assistant Professor Jason Steffen on the modeling of the interior structure of terrestrial planets.

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Fayu Jiang has been with LPL since March 2019, when he began work as a Postdoctoral Research Associate working with Professor Roger Yelle. Fayu's research focuses on the study of mesospheric thermal structure, aerosols, and wave activities on Mars with stellar occultation data from the Imaging Ultraviolet Spectrograph on board the Mars Atmosphere and Volatile Evolution spacecraft.

Fayu grew up in Qingdao, Shandong Province, China. He received his B.E. in Material Science and Engineering from Shandong University in 2009. He earned his Ph.D. in Astrophysics from the University of Chinese Academy of Sciences in 2015. Fayu's graduate work focused on the study of small magnetic activities on the Sun with SDO and IRIS data. After graduation, Fayu shifted his research interests to planetary aeronomy, working with Professor Jun Cui on the atmospheric escape from Titan with Cassini/INMS data.



In May 2019, Antony Trinh began a position as a Postdoctoral Research Associate working with Associate Professor Isamu Matsuyama. Antony's research seeks to constrain the interior structure of planets and moons by interpreting space-geodetically measurable global features, such as their topography, gravity field, tides, rotation, and obliquity. He is also interested in the heat budget and orbital evolution of satellite systems, in connection with the geological activity and tectonic patterns observed over the surface of these bodies.

Antony lived in Brussels, Belgium, before moving to Tucson. He completed his M.S. in Theoretical Physics at Université Libre de Bruxelles. He earned his Ph.D. degree at UC Louvain, conducting research at the Royal Observatory of Belgium on various topics, including the relationship between shape and gravity of planets and moons, the tides and rotation of terrestrial and icy bodies, the dynamics of rotating fluids, and the formation of the Martian moons. Antony's dissertation work combined Cassini's measurements of Enceladus's shape, gravity, and libration into a consistent model of the moon's interior. As a passionate advocate of reproducible research, he also developed a Mathematica package to assist in the theoretical modeling of geodynamic processes.

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## Department

### LPL Fieldtrip Fall 2019

by Christopher Hamilton

For the Fall 2019 semester (October 17–21), the Lunar and Planetary Laboratory (LPL) graduate student field trip class (PTYS 594A) ventured to the Zuni–Bandera Volcanic Field in New Mexico. The volcanic field is part of the Jemez Lineament, which extends from central Arizona to northeastern New Mexico. The Jemez Lineament includes approximately 100 volcanoes, which erupted during the past 16 Ma. This semester's field trip primarily focused lava tubes within the Hoya de Cibola lava flow-field, lava stratigraphy and inflation features within McCarty's lava flow-field, and Bandera Crater.



LPL field trippers at the entrance to Haltun Cave

During the first day of the field trip, the group met with members of the National Park Service and travelled with Ranger Nicholas (“Nick”) Poister to the Haltun Cave. This provided students with a unique opportunity to explore an exceptional lava tube system within the El Malpais National Monument. On the second and third days, the class examined 20 m (65’) thick lava flow units within the McCarty’s lava flow-field. This approximately 3000-year-old lava flow-field was emplaced over older Hoya de Cibola lava units as well as Holocene alluvial sediments. McCarty’s lava flow units include outstanding examples of inflation features, which formed as the flows were supplied by lava through internal pathways and gradually swelled like a balloon. Similar structures are identified on Mars and provide valuable information about eruption timescales. Additionally, using ground-penetrating radar (GPR) and Global Positioning System (GPS) measurements, the class examined McCarty’s lava units, estimating their thickness and identifying buried contacts with older materials (i.e., lava and sedimentary units) as analogs for imaging subsurface interfaces within volcanic terrains on Mars using the shallow radar (SHARAD) instrument. During the final of the field trip the visited Bandera Crater and an “ice cave” formed where meteoric water infiltrates into a cold lava tube to form perennial ice deposits.

This semester’s field trip involved the increased usage of high-tech (e.g., GPR and GPS) and low-tech (e.g., notebooks, measuring tape, compass, and hand lens) tools to develop detailed measurements and descriptions, with a focus on lava tube and other lava flow structures as analogs for volcanic terrains on the Moon and Mars, as well as elsewhere in the Solar System. Next semester, the field trip will explore a different region of the Southwest, with a trip to the Mojave Desert.

## Lava Tubes and Cinder Cones



The fall 2019 section of core course PTYS 554 (Planetary Surfaces), led by Professor Shane Byrne, traveled to the Flagstaff (Arizona) region to study cinder cones and lava tubes.

Highlights of the field trip included Montezuma's Well, Rattlesnake Canyon, and Meteor Crater on the way to exploring SP crater and Lava Tube Cave.

Left: LPLers exploring the Lava River (aka Government) Cave (a lava tube).

## Outreach

### LPL Public Education and Outreach

This fall, LPL staff and students were busy reaching out not only to the local community but all of Arizona as well. Several events centered around [moonfest](#), the University of Arizona's extended celebration of the Apollo moon landings and future lunar exploration. We were able to "multiply our impact" at many public events with engagement by the [Space Imagery Center](#), LPL Graduate Student Outreach, and [OSIRIS-REx](#), thereby allowing us to reach more than 7000 people.

[Spacefest](#) brought together astronauts, artists, and space aficionados from all over the world including quite a few LPL alumni and longtime "friends of LPL" who stopped by the STEAM tables to say hello! We provided educational activities and exhibits for a range of ages and backgrounds from the STEM Showcase at [Ocotillo Ridge Elementary School](#) to [Southern Arizona Technology Council](#) industry leaders at the Tucson Convention Center. We presented the OSIRIS-REx mission's "Final Four" Candidate sites in UArizona's Research Innovation and Impact (RII) tent during UArizona homecoming and the [Mt. Lemmon SkyCenter](#) Office and Science Shop open house that coincided with the transit of Mercury.

LPL and baseball? Sure! On July 20, LPL joined [Raytheon](#) for Space Day at the [Arizona Diamondbacks](#) baseball game in Phoenix and also provided an assortment of OSIRIS-REx hands-on activities and demonstrations for Goddard Space Flight Center's STEM Education Day at Fenway Park in Boston. [LPL Director Tim Swindle](#) kindly volunteered to staff the Diamondbacks outreach event—double duty on July 20 after hosting LPL's Summer Science Saturday Apollo anniversary celebration in Tucson. In addition to external community events, we conducted OSIRIS-REx and meteorite tours for [Smithsonian Astrophysical Observatory](#) volunteers and presentations for [Kitt Peak](#) docents, [IEEE Tucson and Sierra Vista](#), [Osher Lifelong Learning Institute](#), [Prescott Astronomy Club](#), and the [Huachuca Astronomy Club](#). Summer and fall were been jam-packed with wonderful opportunities to showcase LPL and our contributions to planetary science, past, present, and future.

### Moonfest: Apollo 11 50th Anniversary

The centerpiece of outreach for LPL in 2019 was the 50th anniversary of the Apollo 11 Moon landing. The public outreach and education events maintained a focus on local contributions to the Apollo program, with an emphasis on the contributions by LPL, which was established in 1960 in large part because [Gerard Kuiper](#) wanted to study the Moon. When President John Kennedy made sending humans to the Moon within the decade a national priority the next year, the fledgling LPL was perfectly situated.

For the 50th anniversary of the Apollo 11 landing, LPL, the University of Arizona, and venues across the city of Tucson celebrated the anniversary and the foundational contributions made by scientists and talented engineers and craftspeople not only from LPL but also from other local organizations. In recognition of the local contributions, by Proclamation of [Mayor Jonathan Rothschild](#), July 2019 was declared [Tucson Moon Month](#). Venues and events across Tucson joined the fun by sponsoring Moon related exhibits, movies, and lectures as part of UArizona Apollo 11 50th anniversary moonfest events.

The 2019 calendar was filled with a variety of activities, including LPL's annual [Summer Science Saturday](#), held this year on July 20 and attended by 800 guests. Also on July 20, Flandrau Science Center and Planetarium provided special Apollo programming and the UA Special Collections Library debuted a wonderfully curated Moon exhibit, which showcased materials from the [Ewen Whitaker](#) collection, in addition to other exhibits and activities related to lunar science. UANews produced a comprehensive suite of articles detailing the LPL-UArizona-Apollo connections.

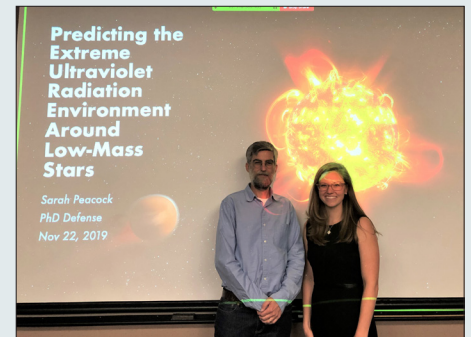


## Graduate

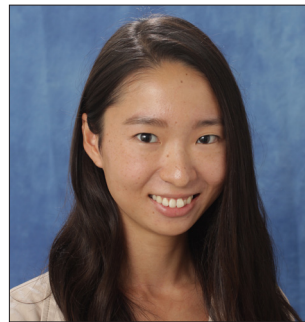
### Ph.D. for Peacock

Congratulations to [Sarah Peacock](#), LPL's newest alumna!

Sarah defended her dissertation, *Predicting the Extreme Ultraviolet Radiation Environment Around Low-Mass Stars*, on November 22, 2019; [Professor Travis Barman](#) served as Sarah's advisor. Sarah will begin a postdoctoral position here at LPL working with Travis Barman in January.



### 2019/2020 Admitted Graduate Students



From left to right:  
[Adam Battle](#) (Ohio State University)  
[Claire Cook](#) (University of Arizona)  
[Kana Ishimaru](#) (University of Tokyo)



From left to right:  
[Kiana McFadden](#) (Jackson State University)  
[Jada Walters](#) (Georgia Institute of Technology)  
[Zoe Wilbur](#) (University of Nevada-Las Vegas)

### 2019 FINESST Awards

Two PTYS graduate students were awarded Future Investigators in NASA Earth and Space Science Technology (FINESST) awards in 2019:

- [Indujaa Ganesh](#), *Plumes and Pyroclasts: Understanding the Dynamics of Explosive Volcanism on Venus* (advisor: [Lynn Carter](#))
- [Allison McGraw](#), *Observational Campaign for the Gefion Asteroid Family* (advisor: [Vishnu Reddy](#)).

Geosciences student [Brandon Tober](#), advised by [Professor Jack Holt](#), also received a FINESST award for *A New Regional View of Alaskan Glaciers: Bed Elevation, Ice Thickness, and Flux*.



## Graduate

### PTYS Graduate Students Partner With Local School

Beginning in 2018, the Planetary Sciences graduate students have been developing a partnership with [Sahuarita Middle School](#) in order to introduce planetary science topics to middle school math students. The goal of this partnership is to teach students that mathematics is important and applicable to many types of science and to communicate to young students the importance of studying advanced mathematics in high school. The graduate students have worked with approximately 300 students through repeat visits to ensure maximum information retention. This year, the graduate students will present four different activities at Sahuarita Middle School, including a Spacecraft to Mars building game and a scale of the Solar System project (in development).



Zarah Brown (left), Cassandra Lejoly (middle), and Shane Stone (right) at Sahuarita Middle School in the spring of 2019.

### LPLC 2019 at ENR2

by Teddy Kareta

As everyone returns to campus at the end of August, one of the first events on the LPL calendar is the [Lunar and Planetary Laboratory Conference](#), or LPLC. LPLC is our graduate student organized and run internal conference which gives each member of the department and the Tucson space science community a chance to update each other on what they've been working on as of late. We are happy to say that LPLC 2019—organized this year by graduate students [Teddy Kareta](#), [Indujaa Ganesh](#), and [Ben Sharkey](#)—was a great success and continues the trend of the event growing in number of both attendees and presentations year over year.

This year had over 70 attendees and 43 presentations from high school age summer interns to esteemed emeritus researchers and included 15 presentations by graduate students. The winner of this year's Best Graduate Student Talk award was [Zarah Brown](#) for her presentation, *What's heating Saturn's thermosphere? Cassini Grand Finale Observations Show Connection Between Circulation and Heating*. The invited speakers were 2018's Best Grad Talk winners, [Allison McGraw](#) and [Hamish Hay](#), as well as LPL Assistant Professor [Tommi Koskinen](#) and UArizona Gender & Womens' Studies Professor [Jennifer Croissant](#). The keynote was by new LPL Assistant Professor [Jessica Barnes](#), titled *Volatiles in the Inner Solar System: A View from Ureilites*.



For the first time this year, LPLC was held in one of the newest and most environmentally friendly buildings on the University of Arizona campus, Engineering and Natural Resources 2 (ENR2). ENR2 is designed to look and feel like a slot canyon—the temperate sand-carved canyons seen in Northern Arizona and a favorite spot of many an LPL field trip. Professor Barnes' talk was followed by a reception in the café and courtyard of the building, a beautiful green space fitting for the end of a long day spent talking about science and meeting new colleagues.

Left: LPLC graduate student organizers: Indujaa, Teddy, and Ben.

### McGraw Named Space Grant Fellow



Second-year graduate student [Allison McGraw](#) (advised by [Vishnu Reddy](#)) was named an Arizona Space Grant Graduate Research Fellow for 2019. Her NASA Space Grant project is the construction of a Meteorite Planetarium Module, where she has the opportunity to teach the public about meteorites, and more specifically to visualize real meteorite data and information in a full 40-foot planetarium dome. Allison's goal is to teach the public and young students the strange wonders of meteorites and the information they encompass about the Solar System through the various types of meteorite data and research techniques. Meteorite data will be visualized and displayed in the full dome, and will be offered within planetarium shows to the general public as well as local Southern Arizona school groups.

## Invest in LPL

### 2019 Carson Fellowship to Jada Walters



Jada Walters is the recipient of the 2019 Carson Fellowship Award, which provides one academic year of support, including salary, tuition, and a supply stipend. Jada is a first-year graduate student at LPL.

Jada attended the Georgia Institute of Technology from 2015 to 2018, graduating with a B.S. in Physics with a concentration in Astrophysics. At LPL, Jada is continuing her research in plasma physics, this time applied to the solar wind, with [Dr. Kristopher Klein](#). She looks forward on to a career in research that allows her to apply theory and computer models to relevant spacecraft data.

### 2019 Curson Travel Award

As reported in our spring newsletter, graduate student [Rachel Fernandes](#) won funding support from the [Curson Education Plus Fund in Planetary Sciences and LPL](#) for her summer research travel. Read on to learn about her trip to the 3rd Advanced School on Exoplanetary Science (ASES3), held in Vietri sul Mare (Salerno), Italy, from May 27-31.



The Curson Travel Award supported my travel to Vietri sul Mare, Salerno, Italy to participate in the 3rd Advanced School for Exoplanetary Science (ASES3) from 27th – 31st of May 2019. This year, the workshop focused on the demographics of planetary systems and was attended by early career exoplanetary scientists from all over the globe. The workshop was structured around a series of lectures by five of the leading researchers in the field: Dr. Scott Gaudi (The Ohio State University), Dr. Andrew Howard (California Institute of Technology), Dr. Alessandro Morbidelli (Observatoire de la Cote d’Azur), Dr. Sean Raymond (Laboratoire d’Astrophysique de Bordeaux) and Dr. Antonino Lanza (Astrophysical Observatory of Catania). Each day, we had 4-6 hours of lectures on the topics of planet formation and dynamical evolution, star-planet interactions as well as observations and statistics from radial velocity and transit surveys (for close-in exoplanets), and microlensing, astrometry and direct imaging surveys (for wide-separation exoplanets).

## Alumni

- [Dr. Elizabeth Turtle](#) (1998), planetary scientist at Johns Hopkins University Applied Physics Laboratory, is Principal Investigator for the Dragonfly mission to explore Titan. The mission leadership team includes another LPL alumnus ([Dr. Jason Barnes](#), 2004) as well as a former LPL postdoctoral research associate ([Dr. Ralph Lorenz](#)). An additional six LPL student alumni are members of the Dragonfly science and engineering team.
- [Dr. Ingrid Daubar](#) (2014) is now Assistant Professor of Research at Brown University. This cross-country move from California (JPL) to Rhode Island is only one of the changes in Ingrid's life this past year—the other being the birth of beautiful baby Arthur.
- [Dr. Sarah Hörst](#) (2011) has been awarded the 2020 Early Career Award from the Laboratory Astrophysics Division of the American Astronomical Society. Dr. Hörst is currently Assistant Professor of Earth and Planetary Sciences at Johns Hopkins University.
- [Dr. Faith Vilas](#) (1984) has been named Editor of *Planetary Science Journal*, a new open-access online journal published by the American Astronomical Society’s Division for Planetary Sciences (DPS). Dr. Vilas is a Senior Scientist with the Planetary Science Institute. In 2018, she was awarded the Masursky Award from DPS for meritorious service to planetary science.
- [Dr. Devon Burr](#) (UArizona Geosciences, 2003, Baker) is now a Professor of Astronomy and Planetary Sciences, Northern Arizona University.
- [Dr. Joshua Emery](#) (2002) has joined the faculty of Northern Arizona University as Professor of Astronomy and Planetary Sciences.

## Invest in LPL

### Annual Donors Travel Award Funds Eight Students

These awards are intended for career advancement, usually associated with travel, for LPL students and staff. They are supported by gifts, typically of \$500 or \$1000, from donors. Visit [lpl.arizona.edu/graduate/awards/travel-award](http://lpl.arizona.edu/graduate/awards/travel-award) to view seven students describing their travel; the eighth student, [Kyle Pearson](#), will be traveling to the 235th meeting of the American Astronomical Society this January 2020.

[Saverio Cambioni](#) spent 3 months at the [Observatoire de la Cote d'Azur in Nice, France](#), where he investigated a new method, based on neural networks, for identifying the oldest collisional families of asteroids that formed in the earliest phases of our solar system and that have so far not been identified using classical methods.

[Claire Cook](#) had the opportunity to attend training for [COMSOL](#) geophysical modeling software that she will use for her graduate research. The training session was held in Redwood City, California, November 12 and 13. COMSOL is multipurpose but so complex that it requires in-person training; and, given that other students and faculty are interested in using the software for their own research groups, Claire's training experience will benefit others as well.

[Cassandra Lejoly](#) attended the [Mike A'Hearn Symposium](#) in August 2019. Cassandra presented results of dust radial profiles of 41P/TKG, 45P/HMP, and 46P/Wirtanen.

[Kiana McFadden](#) used travel funds from the LPL External Board to travel to Houston this October (2019) to attend the [Gulf Coast Association of Geological Societies \(GCAGS\)](#) meeting, where she received an award for best student oral presentation of her paper titled, "Sedimentology, Petrography, and Mineralogy of the Tallahatta Formation near the City of Meridian, Mississippi." The presentation was based on work she completed as an undergraduate at Jackson State University.

[Benjamin Sharkey](#) traveled to Geneva, Switzerland, for the 2019 joint meeting of the [European Planetary Science Congress](#) and the [American Astronomical Society Division for Planetary Sciences](#) meeting (Sept. 15-19), which hosted 1730 participants from 52 countries. Ben had the opportunity to present his work on asteroids orbiting near Jupiter.

[Maria Steinrueck](#) presented her work on the mixing of photochemical hazes by the large-scale circulation in the atmospheres of hot Jupiter exoplanets at [Extreme Solar Systems IV](#) in Reykjavik, Iceland, August 18-23, 2019. With over 600 participants, this was the largest exoplanet conference ever held. Maria reports that she was able to participate in in-depth conversations with other scientists about their exoplanet research, resulting in a collaboration on a Hubble Space Telescope proposal.

[Shane Stone](#) attended the 2019 [American Astronomical Society Division for Planetary Sciences](#) meeting in Geneva, Switzerland (Sept. 15-19). Shane presented his work on the delivery of water to the upper atmosphere of Mars.

## Thanks to LPL Donors

We would like to thank all those who have donated to LPL in 2018 and 2019. Thanks to everyone for helping LPL accomplish things we would not be able to without you.

**Individual Donors:** Victor Baker • Ed Beshore & Amy Phillips • Dan Cavanagh • David Choi • Ruben Garcia • Barbara Gray • Alan Hildebrand • Greg Hupe • Dave & Lori Iaconis • Dinah Jasensky • Michael Kaiserman • Xenia King • Norm Komar • Colin Leach • Martha Leake • Toni Littlejohn • Renu Malhotra • Alfred McEwen • Laura McGill • Bob & Gloria McMillan • Jamie Molaro • Kelly Kolb Nolan • Mark & Judy Paris • Jani Radebaugh • Timothy Reckart • Vishnu Reddy • Michelle Rouch • Cristie Street • Timothy Swindle • Eric Tilenius • Robert Ward

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## LPL in the News

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

**Mapping the Moon and Worlds Beyond** - LPL scientists were instrumental in creating the first photographic atlases of the moon, which helped NASA successfully complete the Apollo 11 mission. Fifty years later, LPL scientists are busy mapping worlds throughout our solar system.

**LPL Looks Toward Work on NASA's Potential Asteroid-Hunting Space Telescope** - LPL's Professor Amy Mainzer will provide technical leadership for the projected Near-Earth Object Surveillance Mission, which will include the NEO Surveyor spacecraft.

**First Results from Spacecraft Exploring Sun** - The sun is revealing itself in dramatic detail and shedding light on how other stars may form and behave throughout the universe. LPL researchers involved in the mission report exciting findings from the Parker Solar Probe's first close encounters with our very own star.

**Explaining Bennu's Mysterious Particle Events** - NASA's OSIRIS-REx science team has identified three possible explanations for the particles that asteroid Bennu is tossing into space.

**Close Encounter with the Sun** - Professor Joe Giacalone and Assistant Professor Kristopher Klein are both involved in NASA's Parker Solar Probe mission and are excited about the spacecraft's first close encounters with the sun.

**Best of Both Worlds: Asteroids and Massive Mergers** - UArizona researchers are using the Catalina Sky Survey's near-Earth object telescopes to locate the optical counterparts to gravitational waves triggered by massive mergers.

**Mysteries Behind Interstellar Buckyballs Finally Answered** - Mimicking conditions thought to exist around dying stars, researchers discovered a mechanism that could explain why planetary nebulae are teeming with complex carbon molecules.

**LPL Moon Researchers Helped NASA Nail Apollo 12 Pinpoint Landing** - Lunar and planetary scientist Ewen Whitaker used his incomparable knowledge of lunar geography to help NASA demonstrate a pinpoint landing on the moon with Apollo 12.

**Space Science, Research Reputation Shine in Best Global Ranking** - The University of Arizona ranked No. 21 among U.S. public universities and No. 85 overall in the sixth annual "Best Global Universities" ranking, published by U.S. News & World Report.

**Beyond Jupiter, Researchers Discovered a 'Cradle of Comets'** - Researchers have discovered a region just beyond Jupiter that acts as a "comet gateway," funneling icy bodies from deep space into the inner solar system, where they can become regular visitors of Earth's neighborhood.

**Iron Magma Could Explain Psyche's Density Puzzle** - Volcanism has always intrigued humanity. Less than 50 years ago, scientists discovered cryovolcanism – ice volcanoes on other worlds. Now, researchers may have identified volcanoes of molten metal.