



THE UNIVERSITY OF ARIZONA  
COLLEGE OF SCIENCE

# LUNAR & PLANETARY LABORATORY

SPRING 2021

## LPL NEWSLETTER



LPL Associate Professor **Christopher Hamilton** is a **National Science Foundation (NSF)-Fulbright Arctic Scholar** currently working from the University of Iceland to document the products and impacts of Icelandic flood lava eruptions. On February 21, 2021, an earthquake swarm began on the Reykjanes Peninsula, near the capital of Reykjavik, and on March 3, volcanic tremor was identified—signaling magma movement within the crust. Considering a volcanic eruption to be imminent, Christopher worked with **Solange Duhamel**, Associate Professor with UArizona's **Department of Molecular and Cellular Biology** (with a faculty appointment in LPL), to obtain funding to investigate the eruption.

With support from the university's **Research, Innovation, and Impact Office** and the **NSF Rapid Response Research Program**, Solange and Christopher have been developing times-series monitoring of the geomorphology and microbiology of the Reykjanes region, before and after the start of the eruption, which began on March 19 at 8:45 p.m. GMT. LPL graduate student **Joana Voigt** and Research Specialist **Michael Christoffersen** traveled to Iceland in April to conduct novel measurements of the active eruption using drones (i.e., Unoccupied Aircraft Systems) and other state-of-the-art instruments to contribute to Iceland's volcano monitoring effort and address fundamental questions related to planetary volcanism and astrobiology. The eruption will continue into the summer, providing additional opportunities for students to develop first-hand observations of this unique event as a planetary analog.





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# WELCOME TO THE LPL NEWSLETTER

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## MARK S. MARLEY

DEPARTMENT HEAD AND LABORATORY DIRECTOR

This week, I was privileged to assume the LPL Directorship from **Tim Swindle**. Tim has done an outstanding job guiding the Department and Laboratory over this past decade for which we should all be very grateful. Looking forward, I have quite a few plans to continue to nurture and grow LPL and I'll be telling you more about them in future newsletters. For now though, please don't hesitate to check in, introduce yourselves, and send in any suggestions you might have for how we can continue to improve our communications and outreach. (May 21, 2021)

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Mark is originally from Phoenix and is a third-generation Arizonan. Inspired by early planetary exploration missions like Apollo and Viking, he went on to receive his Bachelor of Science degree in Geophysics and Planetary Science from the California Institute of Technology and his Doctorate degree in Planetary Science from the Lunar and Planetary Laboratory at UArizona. He will be the first LPL Director to have graduated from the program.

Before becoming LPL Head and Director, Mark was a Research Scientist at **NASA Ames**, where he studied the atmospheres and interiors of planets and brown dwarfs. He is particularly interested in the intersection of planetary and exoplanetary science, a field he has been engaged with since the first discoveries of extrasolar planets. Before his career with NASA Ames, Mark was an Associate Professor of Astronomy at **New Mexico State University**.

Mark is an author on over 250 scientific papers on topics ranging from the rings of Saturn to the atmospheres of giant planets and brown dwarfs to extrasolar planets of all types. Twice awarded NASA's Medal for Exceptional Scientific Achievement, he is also a Fellow of the American Astronomical Society and has served on numerous panels advising NASA on future science directions and future large space telescope concepts. In his free time, Mark enjoys hiking and gardening with his wife, two daughters, and their dog.

## NOTE FROM TIM SWINDLE

OUTGOING DEPARTMENT HEAD AND LABORATORY DIRECTOR

It's time for a change. After about a decade leading this wonderful organization, I've just retired, and **Mark Marley** has taken over as Director of the Lunar and Planetary Laboratory and Head of the Department of Planetary Sciences.

It's been a great decade for me, and I'm satisfied with where LPL is in many ways (although there are always things that a person wishes they'd done better), but, again, it's time for a change, and I'm thrilled that it's Mark. He's an LPL alum (the first one to become Director), an accomplished scientist, and he's got lots of good ideas for ways to move LPL forward. In the last 10 years, LPL has been able to hire some great scientists and teachers, has produced some outstanding graduates, and this brilliant bunch has produced more than enough great ideas and projects to keep this newsletter full. In fact, LPL has been so productive that we've started a monthly newsletter full of press releases about our science. I hope you enjoy the newsletter, I hope you stay in touch with LPL, and I want to thank all the faculty, staff, students, alumni, and friends of LPL who have made this, as my predecessor Mike Drake once told me, "the best job on campus."





## ENDOWED ADAM P. SHOWMAN DISTINGUISHED VISITING LECTURESHIP

Thanks to the generous gifts from friends, family, and colleagues, the Showman Distinguished Visiting Lectureship, established in memory of LPL **Professor Adam Showman**, has been fully endowed.

The first **Adam P. Showman Distinguished Visiting Lecturer** will be announced in the Fall of 2021. This distinguished scholar will engage with our students and share the latest scientific discoveries from among Adam's great diversity of interests. We can think of no better way to honor both the joy Adam exhibited in his work and his broad perspective than by bringing an outstanding scholar that embodies the same passion for scientific discovery to campus.



Adam P. Showman passed away unexpectedly on March 16, 2020, at his home in Tucson, Arizona. The international planetary science community lost an outstanding theorist, dedicated teacher, and a sought-after collaborator to a world-wide network of exoplanet astronomers.





# RECENTLY RETIRED

BALLESTER, BOYNTON, SWINDLE



**Research Professor Dr. Gilda Ballester** joined LPL in 2000. Her interests include exoplanets, planetary formation and evolution, planetary astronomy, and planetary atmospheres.

Gilda conducted early research on Io's atmosphere and plasma torus, as well as on the upper atmospheres, auroras, and magnetospheric interactions of Jupiter, Saturn, and Uranus using both imaging and spectroscopy.

Gilda's work with the **Hubble Space Telescope** Panchromatic Comparative Exoplanet Treasury program focused on characterizing ultra-hot to hot Jupiters, warm exoplanets from Jupiter to super-Earth masses and their host stars based on observations and modeling. During the course of her career, Gilda built a large network of international collaborators.

**Professor William Boynton** is a Mission Instrument Scientist with **OSIRIS-REx**. As a cosmochemist, his research focused on understanding the role of volatile materials, chiefly water, carbon dioxide and argon, as probes for planetary processes.

Since beginning his faculty career at LPL in 1977, Professor Boynton has been a member of eight other NASA flight missions, including as Principal Investigator for instruments on the Comet Rendezvous/Asteroid Flyby (Comet Penetrator-Lander) and Mars Odyssey 2001 (Gamma-Ray Spectrometer, GRS). He served as Team Leader for the Mars Observer GRS and for Geochemistry on Near-Earth Asteroid Rendezvous Shoemaker Mission to Asteroid 433 Eros. As Co-Investigator with MESSENGER, Bill was responsible for data from the X-ray and gamma-ray spectrometers. As Co-I of Mars Phoenix Lander, he managed the design, fabrication, testing, and operation of the Thermal and Evolved-Gas Analyzer (TEGA). Bill was also Co-I for the Cassini-Huygens Surface-Science Package.

Professor Boynton is a **Fellow of the Meteoritical Society** and the recipient of four NASA Group Achievement Awards. In 2005, he was awarded the **NASA Public Service Medal** for outstanding leadership of the 2001 Mars Odyssey GRS team; in 2010, he was awarded the **NASA Exceptional Public Service Medal** for leading the TEGA investigation with the LPL-led Phoenix mission to Mars.



**Dr. Timothy Swindle** joined LPL in 1986 and became Department Head and Laboratory Director in 2012. His research interests include cosmochemistry, lunar studies, and small bodies. He uses measurements of the noble gases in extraterrestrial materials (lunar samples and meteorites) to study the evolution of the solar system.

Tim was awarded the **Antarctic Service Medal** (2000) and is a **Fellow of the Meteoritical Society** (2008). He serves as Director of the Arizona Space Grant Consortium. Highlights of Tim's tenure as Head and Director include his efforts in the formation of UArizona science clusters for **Space Situational Awareness** and **Earth Dynamics Observatory** and in the creation of the Arizona Space Institute; his active support and advocacy for increased diversity, equity, and inclusion efforts and awareness; development of the **Kuiper Materials Imaging and Characterization Facility**; and development and expansion of **The Art of Planetary Science**.



## DANTE LAURETTA REGENTS PROFESSOR

**Dr. Dante Laretta** has been confirmed as a **University of Arizona Regents Professor**.

Professor Laretta is an expert in near-Earth asteroid formation and evolution and Principal Investigator of the **OSIRIS-REx** mission to collect and return material from the asteroid Bennu. OSIRIS-REx, the largest sponsored project ever conducted at UArizona, will likely yield fundamental knowledge about the origin of the terrestrial planets. The recently acquired sample will be delivered to Earth in 2023.



Professor Laretta has taught at all levels, from undergraduate general education to graduate classes. He also has taught in multiple formats, from large-audience lectures and a TEDx talk to small seminar classes. He has served on advisory boards for both the College of Humanities and the Honors College.

In 2002, Dr. Laretta was awarded the **Alfred O. Nier Prize** of the Meteoritical Society for "his experimental studies of iron-bearing sulfide formation in the solar system." He was selected as a **Kavli Fellow of the National Academy of Sciences** in 2008 and was recognized by Discover magazine in 2004 for a top-100 science discovery. In 2006, the UArizona College of Science honored him with a **Distinguished Early Career Teaching Award**.

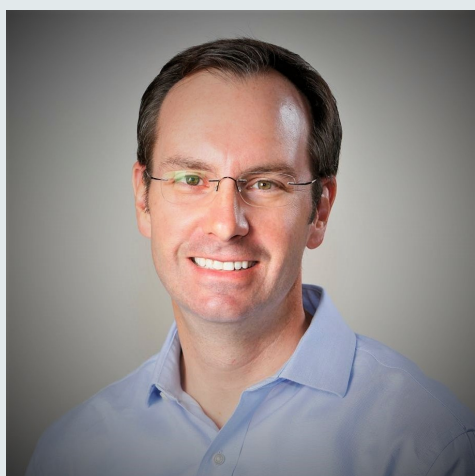
The designation of **Regents Professor** is an honored position reserved for faculty scholars of exceptional ability who have achieved national or international distinction. The Regents Professor title serves as recognition of the highest academic merit and is awarded to faculty members who have made a unique contribution to the quality of the university through distinguished accomplishments in teaching, scholarship, research or creative work.

## PROMOTIONS FOR APAI AND ZEGA

### DANIEL APAI AND TOM ZEGA MOVE TO FULL PROFESSOR



**Daniel Apai** is an astrophysicist specializing in studies of extrasolar planets with the long-term goal of identifying planetary systems capable of supporting life. He studies the interface of planetary sciences and astronomy and holds a joint appointment with Steward Observatory. Professor Apai is Principal Investigator for **Project EOS: Earths in Other Solar Systems**, a NASA-funded astrobiology research team exploring the potential of nearby planetary systems for supporting life. He is also the Principal Investigator of the **Nautilus Space Telescope**, a space mission concept designed for a very large-scale biosignature survey. Dr. Apai is founder of **Project EDEN**, one of the largest programs searching for habitable worlds in the solar neighborhood. He served on a variety of science advisory boards and steering committees. He has been with LPL since 2011.



**Tom Zega** joined LPL in 2011. He applies a microscopy- and microanalysis-based approach to study the chemical and physical evolution of the early solar system and ancient stars, specifically the origin of the circumstellar grains that formed in ancient stars, refractory inclusions that formed the first solar-system solids, primitive organic compounds, and development of analytical techniques for investigations of such materials.

Tom has developed two courses for the Planetary Sciences curriculum at LPL: Planetary Materials (with Dr. Krishna Muralidharan, MSE) and Nanoscale Analysis of Materials Using Transmission Electron Microscopy. He leads the **Planetary Materials Research Group** at LPL and is the Scientific Director as well as TEM/FIB Instrument Scientist for the **Kuiper Materials Imaging and Characterization Facility**.





## LYNN CARTER

### UNIVERSITY DISTINGUISHED SCHOLAR

**Associate Professor Lynn Carter** is the recipient of a Distinguished Scholars Award from the University of Arizona. The award recognizes outstanding mid-career faculty who create transformative innovations in their disciplines and make highly valued contributions to the teaching, research, and outreach priorities set out in the University of Arizona's Strategic Plan. In 2016, Dr. Carter received the **Presidential Early Career Award**, the highest honor bestowed by the U.S. government to outstanding scientists who show exceptional promise for leadership and for contributions to public education and outreach.

Dr. Carter is an expert in the use of radar to explore planetary surfaces and subsurfaces; she is currently a team member on six spacecraft instruments. Dr. Carter has held advisory and leadership positions both nationally (NASA steering committees and advisory panels) and locally, serving on the Executive Committee of the **Earth Dynamics Observatory** and as a member of the inaugural Executive Panel for the **Arizona Space Institute**, organized from the Strategic Plan call to provide a systematic approach to compete for spacecraft instruments and missions.

Dr. Carter's contributions to UArizona extend to her service as an exceptional mentor and advisor to graduate students and postdoctoral researchers and her ongoing and demonstrated advocacy for inclusiveness, especially in STEM fields.

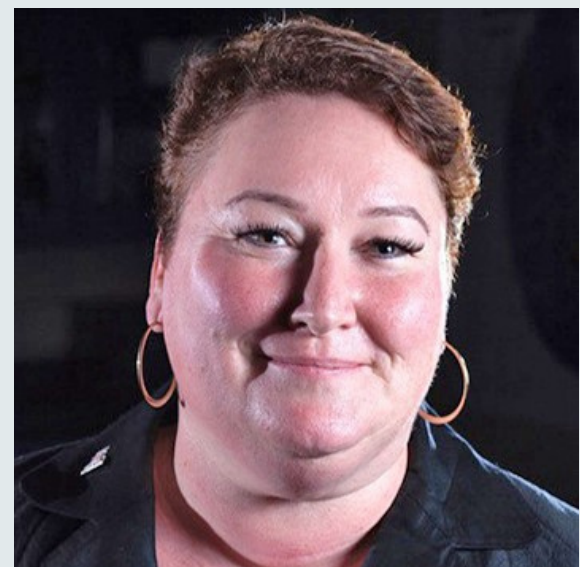
## JOELLEN RUSSELL

### UNIVERSITY DISTINGUISHED PROFESSOR

**Dr. Joellen Russell** has been named a University Distinguished Professor in recognition of her long-term commitment and outstanding contributions to undergraduate education. Professor Russell is best known as a teacher for her very popular Introduction to Oceanography class, which had more than 1000 students one semester. She has also regularly taught an undergraduate course on the topic of Teaching Geosciences.

Professor Russell's research uses global climate and earth system models to simulate the climate and carbon cycle of the past, the present and the future, and develops observationally-based metrics to evaluate these simulations. She leads the modeling theme of the Southern Ocean Carbon and Climate Observations and Modeling project and chairs the NOAA Science Advisory Board's Climate Working Group; she also serves as an Objective Leader for the Scientific Committee on Antarctic Research's AntarcticClimate21, and on the National Center for Atmospheric Research's Community Earth System Model Advisory Board.

Professor Russell holds faculty appointments in the departments of Geosciences, Planetary Sciences, Hydrology and Atmospheric Sciences, and Mathematics, and has been the **Thomas R. Brown Distinguished Chair of Integrative Science** since 2017. She has been at the University of Arizona since 2006, and on the LPL faculty since 2012.





# 2021 GALILEO CIRCLE SCHOLARSHIPS

**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**. The scholarships are supported through the generous donations of **Galileo Circle** members. Galileo Circle Scholars receive \$1,000 and the opportunity to introduce themselves and their research to the Galileo Circle patrons.



**Claire Cook**

*Advisor: Shane Byrne*

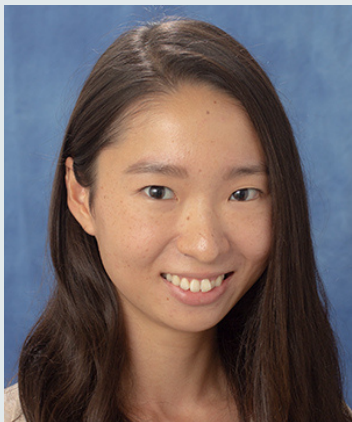
Seeks to understand climate and habitability throughout the solar system using remote sensing and modeling of icy deposits.



**Indujaa Ganesh**

*Advisor: Lynn Carter*

Studies volcanic landforms on planets like Mars and Venus to understand how a planet's volcanic past and changes in volcanic style through time shaped its surface that we see today.



**Kana Ishimaru**

*Advisor: Dante Lauretta*

Analyzing asteroid Bennu's layered boulders using OSIRIS-REx remote sensing data to understand the implications for the geologic processes that occurred there in the early solar system.



**Tyler Meng**

*Advisor: Jack Holt*

Research interests include geophysics, glaciology, and surface processes.



**Patrick O'Brien**

*Advisor: Shane Byrne*

Using numerical modeling to study surface processes, creating a generally applicable landscape evolution model for atmosphereless bodies like the Moon, Mercury, and Ceres.



**Laura Seifert**

*Advisor: Tom Zega*

Analyzes circumstellar grains preserved inside primitive meteorites using transmission electron microscopy.



**Amanda Stadermann**

*Advisor: Jessica Barnes*

Studies lunar basalts to better understand the Moon in preparation for future sample return missions.



**Zoe Wilbur**

*Advisor: Jessica Barnes*

Investigating the history of volatile loss in Apollo 15 and Apollo 17 basalts utilizing a coordinated analysis campaign.



## ZARAH BROWN ANDERSSON AWARD FOR SERVICE AND OUTREACH

ATTENTION TO BROADER IMPACTS AND INVOLVEMENT IN ACTIVITIES THAT BENEFIT THE DEPARTMENT, UNIVERSITY AND THE LARGER COMMUNITY.

Fifth-year student **Zarah Brown** is the recipient of the **2021 LPL Leif Andersson Award for Service and Outreach** and the **College of Science Excellence in Service Award for LPL**. Zarah has been active in service and outreach throughout her career as a graduate student and the Andersson award recognizes her many service and mentoring activities and dedication to communicating planetary science to the public.



Zarah is a frequent volunteer for events like Science City at the Tucson Festival of Books and STEAM Room at SpaceFest. She has participated in multiple outreach efforts to local schools, including Sahuarita Middle School, where she was part of an LPL graduate student effort to gather and design activities for the Math in Science program, with a goal of inspiring students about space science studies and applying themselves in math classes.

But Zarah's passion for education and communicating science goes beyond volunteering. She completed a **Graduate Certificate in Science Communication**, which included an independent study course to study and suggest methods of communicating effectively to a range of audiences in order to make space science more accessible. Zarah put her studies into practice by sharing her experience with others through outreach events and a blog and reaching out to varied audiences, from working on a terraforming project with San Diego grade school students to lecturing about her own research to the Tucson Amateur Astronomy Association.

This year, **The Art of Planetary Science** (TAPS) will feature a children's art component, thanks to Zarah's leadership and coordination. Zarah, a long-time TAPS volunteer, is collaborating with a local 6th grade teacher to engage local students with the artwork and writing themes of TAPS, specifically the topic of space travel, and encourage submissions to the exhibit.

Zarah's dedication to accessible outreach for the broader public is perhaps best evidenced by her project as an **Arizona NASA Space Grant Graduate Fellow**, a fellowship that has just been renewed for a second year. Zarah is developing a scale model of our solar system on the University of Arizona's campus. Zarah's scale model solar system will communicate the roles that LPL and the university have played in space exploration and will have a lasting physical legacy that educators on campus and in the community can use for years to come.



## THEODORE KARETA GERARD P. KUIPER MEMORIAL AWARD

**Teddy Kareta** is the recipient of the LPL **Kuiper Memorial Award** and **College of Science Excellence in Scholarship Award for LPL** for 2021. He is a fifth-year student whose dissertation will focus on the near-Earth asteroid Phaethon. Teddy has presented his analysis of Phaethon observation data in well-received talks, including a 2018 press conference, resulting in a press release for a first author paper [Kareta et al. 2018. Rotationally Resolved Spectroscopic Characterization of Near-Earth Object (3200) Phaethon. *Astron. J.* 156(6):287]. Teddy has extended this work by completing observations of the related asteroid 2005 UD, which led to an invited talk at the International Dust and Parent Body conference in Tokyo in 2019. His research also extends to Centaur objects.

Teddy can currently claim four published first-author papers and one accepted, with nine published co-author papers. In addition to his productive research, Teddy has been an effective mentor for undergraduates. His advisor, **Associate Professor Vishnu Reddy**, writes, "The diversity of Teddy's published research speaks to his command over the knowledge and skills required to answer key questions about solar system origin."

*The **Gerard P. Kuiper Memorial Award** is presented to students of the planetary sciences who best exemplify, through the high quality of their research and the excellence of their scholastic achievements, the goals and standards established and maintained by Gerard P. Kuiper, founder of the Lunar and Planetary Laboratory and the Department of Planetary Sciences at the University of Arizona*





Daniel Lo



Shane Stone

## GRADUATION FOR LO AND STONE

CONGRATULATIONS DANIEL LO AND SHANE STONE

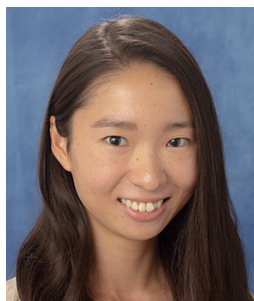
**Shane Stone's** dissertation defense was held on April 23. The title of his dissertation is *Martian Upper Atmospheric Thermal Structure, Composition, and Water and Their Significance for Atmospheric Escape and Evolution*. Shane has accepted a position as a NASA Postdoctoral Program Fellow at NASA Goddard Space Flight Center.

**Daniel Lo** defended his dissertation, *Carbon Photochemistry and Escape in the Present-day Mars Atmosphere*, on May 6. Daniel has accepted a postdoctoral position at the University of Michigan.

Daniel and Shane were advised by **Roger Yelle**.

## LPI Career Development Awards

Awarded to students for first-author abstracts submitted to the **52nd Lunar and Planetary Science Conference** (March 2021). Award selection is made by a panel of planetary scientists. Students receive support for cost of conference registration. LPSC allows students to showcase their research and provides excellent networking opportunities.



### KANA ISHIMARU

Apparently Layered Boulders with Multiple Textures on Bennu's Surface (Advisor: **Dante Lauretta**)



### AMANDA STADERMANN

Apollo Sample 12032,366-18: Characterization and Experimental Investigation of a Chemically Evolved Lunar Basalt (Advisor: **Jessica Barnes**)

## INDUJAA GANESH WINS CURSON TRAVEL AWARD

SUMMER FIELDWORK IN NEVADA

Fourth-year graduate student Indujaa Ganesh will spend two weeks in the Nine Hill paleovalley region in Western Nevada to research and understand the emplacement of the Nine Hill Tuff (NHT) there. The Nine Hill paleovalley hosts six different units of the NHT, one of the many extensive and long runout pyroclastic density current (PDC) deposits in the Great Basin. Indujaa's work will involve using anisotropy of magnetic susceptibility to estimate flow directions and also measuring outcrop thicknesses, grain size distributions, and lithofacies to understand the flow properties.

This research is relevant to Indujaa's current research on the mechanics of long runout PDC deposits on Venus. Indujaa adds, "This is also an opportunity to gain field experience in volcanic landscapes and build valuable geophysical skill sets, both of which will open up potential planetary analog research avenues in the future."



**The Curson Education Plus Fund in Planetary Sciences and LPL** was established by Shirley Curson, a generous donor and friend of LPL, for the purpose of supporting travel expenses outside the state of Arizona during summer break. The award is open to students in the Department of Planetary Sciences and Lunar and Planetary Laboratory who propose to fund study, museum visits, special exhibits, seminars, instruction, competitions, research and other endeavors that are beyond those provided by the normal campus environment and are not part of the student's regular curriculum during the recipient's school year.



## KEARA BURKE

### 2021 LPL STAFF EXCELLENCE AWARD

This year's recipient of the LPL Staff Excellence Award is **Keara Burke**, Image Processing Engineer with the **OSIRIS-REx** mission. Keara began working with OSIRIS-REx as an undergraduate on a project that had her counting rocks. In 2019, after completing her degree in Systems Engineering, she went on to co-lead the OSIRIS-REx site-selection campaign's boulder counting effort, tallying more than 30,000 boulders over the course of the mission. This meant long hours of tedious analysis and some 60-hour work weeks due to staffing shortages.



In addition to nominal job duties, Keara regularly takes on special projects such as taking the lead on a now-published article that synthesized the OSIRIS-REx boulder-counting results. Over the past year, she has supported several large-scale proposal efforts and pitched in on high-value proposal development. Beginning in 2020, Keara has worked primarily as a systems engineer within LPL's spaceflight seismometer program, SIIOS PSTAR. In that role, Keara is responsible for generating, tracking, and verifying instrument requirements by reviewing design and test documentation for spaceflight seismic sensors.

Keara is an extraordinary engineer who has already made outstanding contributions to LPL and UArizona. The skills and experience she has cultivated will continue to play an important role in the future of research and exploration at LPL.



## MANPREET SINGH

### POSTDOCTORAL RESEARCH ASSOCIATE

**Dr. Manpreet Singh** joined LPL in March 2021 as a Postdoctoral Research Associate working with Research Scientist **Dr. Federico Fraschetti**. Manpreet studies interplanetary and astrophysical collisionless shock waves and particle acceleration.

Manpreet is from Batala (Punjab, India). He obtained his B.Sc. (Physics, Chemistry, Mathematics) in 2010 from Government College Gurdaspur, and his M.Sc. (Applied Physics) in 2012 and Ph.D. with specialization in Space Plasma Physics in 2019 from the Department of Physics, Guru Nanak Dev University. His Ph.D. research was focused on the theoretical study of dispersive

Alfvén waves in multi-species and dusty plasmas in space environments. In 2013, Manpreet earned a Bachelor of Education degree with specialization in pedagogy of science and mathematics. In his free time Manpreet likes to play cricket, watch science documentaries and science fiction movies, gardening, and travel to new places.

## HEATHER ENOS RETIRES

### EXPERTISE IN PROJECT MANAGEMENT AND MISSION DEVELOPMENT

**Heather Enos** served as Deputy Principal Investigator and Project Planning and Control Officer for the **OSIRIS-REx** mission. She began her career at LPL in 1997 with the Mars Odyssey Gamma Ray Spectrometer program. Heather has held key management roles in many other missions, including Mars Phoenix Lander Mission, Lunar Reconnaissance Orbiter, and Mars Science Laboratory (Curiosity Rover).

Heather is the recipient of several **NASA Group Achievement Awards**. In 2010, she received the **NASA Exceptional Public Service Medal**. In 2014, Heather was honored with the **Robert H. Goddard Award for New Opportunities Captured** for leadership in winning the OSIRIS-REx mission. In 2018, Heather received the **University of Arizona's Billy Joe Varney Award for Excellence**.





## NEW 3D MODEL ALPHONSUS CRATER

For years, the **Kuiper Space Sciences Building** has had an enigmatic object on the wall of the lobby, just inside of the front entrance. It isn't very colorful, so many haven't even noticed it, but it represents a creative mixture of art and science from the early days of LPL, and has a story that is much more colorful than the wall hanging itself. Thanks to Associate Professor of Practice **Steve Kortenkamp** and HiRISE Photogrammetry and Imaging Processing Scientist (and LPL Ph.D. candidate) **Sarah Sutton**, we now have a display to help put it in context.

In the 1960s, when LPL was mapping the Moon, **Gerard Kuiper** hired sculptor **Ralph Turner** to create 3D models of areas on the lunar surface. Turner would work with telescopic images taken under different lighting conditions and mold his clay until he had something whose shadows looked right as he moved his light to match the different illuminations he had available. It is one of these sculptures, the **central peak of Alphonsus crater**, that has been hanging on the wall for years.

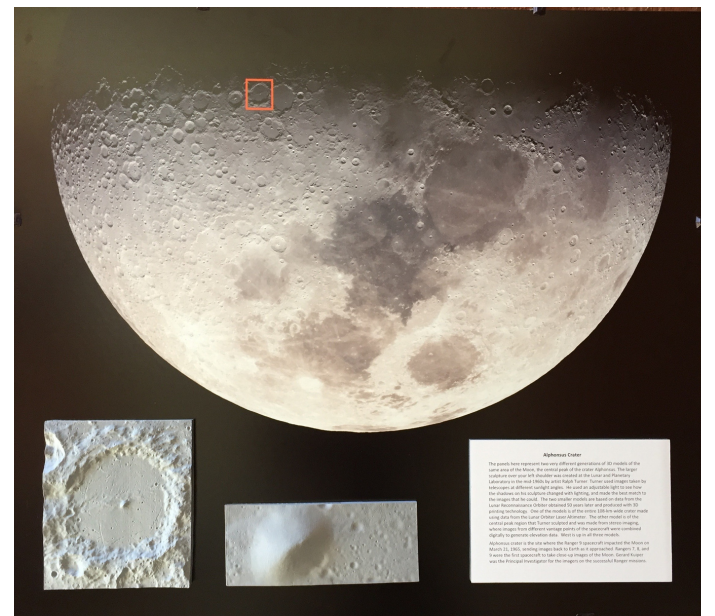
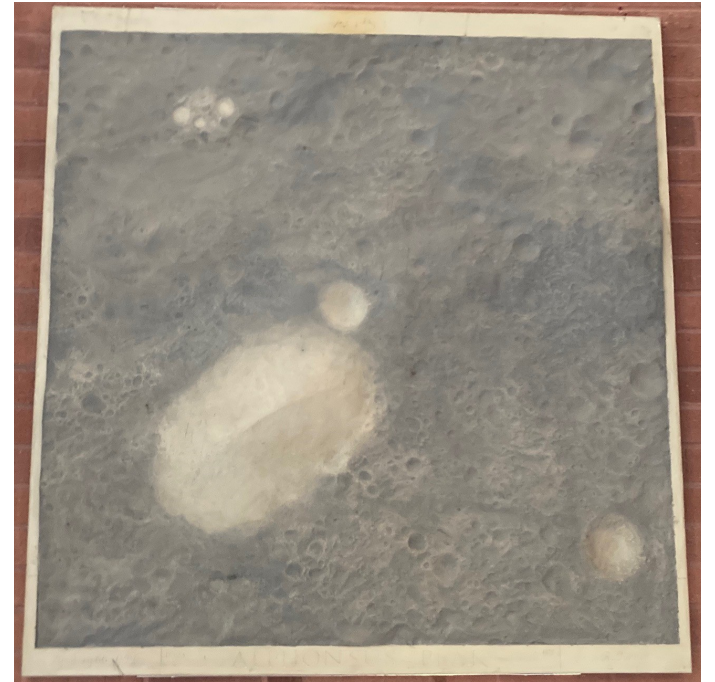
Nearly sixty years later, we still value 3D representations of planetary surfaces, but we don't generate them the same way. Instead, modern 3D images are generated by digitally combining images taken by spacecraft from different angles as they pass over (or even on different passes).

The **HiRISE** team, led by Sarah, are masters at generating these for Mars and other planetary objects as well, including the Moon. In particular, images from the **Lunar Reconnaissance Orbiter** were used to generate 3D models of the same area that Turner sculpted. The digital model was created by **Nicholas Porter** while he was an undergraduate student working in the HiRISE photogrammetry lab.

Instead of using clay, the preferred method for generating 3D models is now 3D printing. Steve has 3D models of planetary surfaces for use in instruction for visually impaired students.

By combining the talents of our staff and modern scientific techniques and manufacturing technologies, we produced a modern model of the same region. It now hangs on an adjacent wall, along with text to explain what the two images are all about. Included here are photos, but they are two-dimensional and don't provide the sense of depth that either of the models on the wall give.

Take a look at the models, old and new, the next time you are in the Kuiper Space Sciences Building





# LPL IN THE NEWS

Complete list of LPL headlines is available at: [LPL.Arizona.edu/news](https://lpl.arizona.edu/news)

**OSIRIS-REx Spacecraft is Headed Home with Asteroid Sample.** After nearly five years in space, the OSIRIS-REx spacecraft is on its way back to Earth with an abundance of rocks and dust from near-Earth asteroid Bennu.

**Volcanoes on Mars Could be Active, Raising Possibility that Planet was Recently Habitable.** New observations reveal that Mars could still be volcanically active, raising the possibility for habitable conditions below the surface of Mars in recent history.

**ABOR Confirms 6 New Regents Professors at UArizona.** The Arizona Board of Regents confirmed the appointments of University of Arizona faculty members Steven Archer, Sonia Colina, Marwan Krunz, Dante Lauretta, Sallie Marston and Ian Pepper as Regents Professors.

**New Images: OSIRIS-REx Leaves its Mark on Bennu.** New images of Bennu's surface captured during the final flyover reveal dramatic changes to the sample site.

**NASA's OSIRIS-REx Completes Final Tour of Asteroid Bennu.** Mission scientists will compare the final shots of the asteroid Bennu with images taken before the touch-and-go maneuver, which kicked up dust and rocks. Images are expected in about a week and will help scientists understand the asteroid's composition.

**Probing Alien Worlds: NASA's Pandora Mission Builds on LPL Research.** Tools and methods developed at LPL will help scientists study the atmosphere of exoplanets as part of NASA's Pandora mission concept.

**LPL-Led HiRISE Camera Helped Guide Mars Rover to the Perfect Spot.** The camera also captured the descent of NASA's Mars 2020 Perseverance rover.

**A New Way to Look for Life-Sustaining Planets.** New capabilities developed by an international team of astronomers make it possible to directly image planets that could potentially harbor life within the habitable zone of a neighboring star system.

**OSIRIS-REx to Fly a Farewell Tour of Bennu.** The OSIRIS-REx spacecraft will swoop around Bennu one more time to collect information about how the Touch-and-Go sample collection affected the asteroid before returning home.

**LPL-Led OSIRIS-REx Mission Plans for May Asteroid Departure.** Since its launch in September 2016, the OSIRIS-REx spacecraft has traveled billions of miles, mapped the surface of an asteroid in unprecedented detail, and made new scientific discoveries about near-Earth asteroids. Now, it's preparing to bring a piece of asteroid Bennu home.

**With \$3M NASA Grant, LPL Scientists Will Test Mars Exploration Drones in Iceland.** NASA has awarded \$3.1 million to LPL's **Christopher Hamilton** to develop a drone that could act as a "field assistant" to a rover and explore previously inaccessible regions on Mars.

**Striped or Spotted? Winds and Jet Streams Found on the Closest Brown Dwarf.** Planetary scientists wondered if bands of winds or swirling storms dominated the atmospheres of brown dwarfs. U-led research has solved the mystery.

**A Wildcat in Iceland.** Drones and planetary exploration: From Arizona to Iceland... to Mars?

**Why 2020 Was A Stellar Year For Hunting Asteroids.** Despite the challenges of the pandemic and wildfires, **Catalina Sky Survey** was able to continue their operations fairly smoothly.

**Io Volcano Observer: Following the Heat and Hunting Clues to Planet Evolution.** A proposed mission called Io Volcano Observer (IVO) would visit Jupiter's moon Io, which is a true volcanic wonderland with hundreds of erupting volcanos gushing tons of molten lava and sulfurous gases at any moment.