



THE UNIVERSITY OF ARIZONA
COLLEGE OF SCIENCE

LUNAR & PLANETARY LABORATORY

LUNAR AND PLANETARY LABORATORY NEWSLETTER

SPRING 2020

Adam P. Showman, 1968-2020

LPL Professor Adam P. Showman passed away unexpectedly on March 16, 2020, at his home in Tucson, AZ. His untimely passing has been felt widely in the international planetary science community which has lost an outstanding theorist, dedicated teacher of many graduate students, and a sought-after collaborator to a worldwide network of exoplanet astronomers.

Adam Showman was born on October 9, 1968 in Palo Alto, CA. He studied physics at Stanford University, where he earned a B.S. in 1991. He earned a Ph.D. at Caltech in 1999, with a dissertation on the atmosphere of Jupiter as well as the geophysics of its largest moon Ganymede. After two short postdoc stints at the University of Louisville and NASA Ames, Dr. Showman joined the Lunar and Planetary Laboratory at the University of Arizona as an Assistant Professor in 2001; he was named full Professor in 2012. He was recently named a **Galileo Circle Fellow** of the University of Arizona (2018) and a **Fellow of the American Geophysical Union** (2019).

During his career, Dr. Showman directly advised eleven graduate students and mentored many more across the disciplines of planetary science, atmospheric sciences and geosciences. He was a renowned teacher who enjoyed explaining to his students the complicated details of planetary physics and hammering out ideas to solve research problems. He developed eight different courses in the planetary sciences, including two completely new graduate courses, with course notes that are treasured by his students. His early pioneering research on the atmospheric dynamics of exoplanets has been the paradigm of hot gas giant atmospheric circulation models ever since. This work showed that the difference between the day and night side on hot Jupiters would drive strong eastward equatorial winds, comparable to or greater than the speed of sound in the medium. Showman and his collaborators worked out in detail the theoretical predictions that were spectacularly verified in subsequent observations, profoundly shaping the field. Showman extended his innovative theoretical models beyond hot gas giant planets, to tidally-locked and fast-rotating planets of smaller sizes and cooler temperatures as well as to the larger and warmer brown dwarfs. He was deeply involved in the exoplanet science community, collaborating with many observers



to interpret their observations of exoplanet atmospheres and working with theorists to advance modeling techniques. He served the planetary science community in many professional roles, including as Editor of the international planetary science journal, *Icarus*.

Dr. Showman also made notable contributions to our understanding of atmospheric circulation in the four giant planets in our own solar system and of the geophysics of the Galilean satellites. Showman and collaborators used an anelastic general circulation model to explore the deep winds on Jupiter, where density varies by more than four orders of magnitude from the atmosphere to the interior. They find that the winds are aligned with the rotation axis but decay gradually with depth. Their predictions were verified by the Juno mission, which has measured the higher harmonics of Jupiter's gravity field and has shown that the zonal winds extend 3000 km below the visible clouds, a major breakthrough in planetary science. On the icy Galilean satellites, Europa, Ganymede and Callisto, Showman's work encompassed interior thermal structures and their interplay with the orbital dynamics (the formation of a water ocean in Ganymede and implications for the magnetic field detected by the Galileo Orbiter, the peculiar tectonics of Ganymede [graben formation], the putative convection in Europa's ice shell, and the unstable lithosphere of Enceladus. Dr. Showman was equally in command of both gas giant atmospheric dynamics and geophysical fluid dynamics, an astonishing combination of expertise widely admired by his colleagues.

Students and colleagues alike knew Dr. Showman as a fount of knowledge and ideas which he shared generously and widely. He was a friend to many who fondly remember his spirit of adventure and abiding curiosity. In his teenage years, after a family trip to China, he developed a fascination for Chinese culture; he travelled frequently to China and became proficient in the Mandarin language. Dr. Showman is survived by his daughter, Arwen, his brother, Ken, and his parents, Pete and Dinah Showman.

Renu Malhotra, Lunar and Planetary Laboratory, The University of Arizona, Tucson, AZ

Andrew P. Ingersoll, Division of Geological and Planetary Sciences, Caltech, Pasadena, CA

Welcome from the Director



Welcome to the latest edition of the semesterly *LPL Newsletter*.

The last two months have been trying times for the entire world because of the coronavirus, and it has been no different at LPL. We have closed down all three of our buildings, except for essential research, but have managed to keep teaching, conducting business, and writing proposals and papers, but all remotely and online. We have all become very familiar with the Zoom meeting technology. But moving to remote operation has not been the most difficult thing that we've dealt with. **Professor Adam Showman**, whose expertise was in fields as diverse as the atmospheres of extrasolar planets and the interiors of the moons of Jupiter, passed away suddenly in March. However, we have had good news, too, with students graduating, members of the LPL family winning awards, and an LPL-led mission, the **Io Volcano Observer**, being selected as one of the finalists for the next round of NASA's Discovery missions.

Please read through and see what has been happening at LPL, and please stay safe and healthy.

Timothy D. Swindle, Ph.D.

Department Head and Laboratory Director

Invest in LPL

Give to Adam P. Showman Distinguished Lectureship

We hope you will join us in remembering our friend and colleague **Adam Showman** with a gift of any size for the **Adam P. Showman Distinguished Visiting Lectureship**. With your generous support, we plan to establish an endowed fund that will allow LPL to bring guest lecturers to campus in Adam's memory in perpetuity. We can think of no better way to honor him than to bring exceptional planetary scientists with similarly broad interests to engage with and inspire our students, just as Adam did. Thirty donors have already pledged a total of more than \$10,000.

Go online to donate: <https://crowdfund.arizona.edu/project/20743> or contact us at UALPL@lpl.arizona.edu; 520-621-2828.



Faculty

Hamilton and Harris: Promotion and Tenure



Dr. Christopher Hamilton has been promoted to Associate Professor with tenure. Dr. Hamilton's research focuses on geological surface processes to better understand the evolution of the Earth and other planetary bodies. His specialty relates to volcanology and specifically to lava flows, magma-water interactions, and explosive eruptions using a combination of field observations, remote sensing, geospatial analysis, machine learning, and geophysical modeling.

Dr. Walter Harris has been promoted to Full Professor. Dr. Harris' research is focused on the structure of thin atmospheres and their transition to and interactions with the space environment. He is particularly interested in the information that comet atmospheres provide about basic photochemical processes, the formation of the solar system, and the characteristics of the solar wind. He is also engaged in an ongoing study of the plasma interface between the solar wind and interstellar medium via remote sensing of interstellar neutral material as it passes through the solar system.

Early Career Award for Barnes

Assistant Professor Jessica Barnes was selected to receive funding through the **NASA Planetary Science Early Career Program**. Dr. Barnes' research focuses on studying how the solar system formed and evolved, specifically by studying volatile species like hydrogen in the inner solar system. The funding will help Dr. Barnes further expand her research and will be used to purchase new equipment to aid in teaching students at the University of Arizona interested in planetary science.



McEwen Named Fellow of GSA



Regents' Professor Alfred McEwen has been elected a **Fellow of the Geological Society of America**. Fellows are named "in recognition of a sustained record of distinguished contributions to the geosciences and the Geological Society of America through such avenues as publications, applied research, teaching, administration of geological programs, contributing to the public awareness of geology, leadership of professional organizations." Professor McEwen is Principal Investigator (PI) for the **High Resolution Imaging Science Experiment (HiRISE)**, the most powerful camera ever sent to another planet, one of six instruments onboard the Mars Reconnaissance Orbiter. He is also PI for the **Io Volcano Observer, or IVO**, mission, which is among the four finalists for the next \$500 million **NASA Discovery mission**. If selected, IVO will orbit Jupiter and make 10 close flybys of its moon Io – the most volcanically active world in the solar system – to determine if the moon has a magma ocean hidden beneath its vibrant, pockmarked surface.

Hamilton Named Scialog Fellow

Associate Professor Christopher Hamilton was appointed as a Scialog Fellow in the **Signatures of Life in the Universe** initiative, a three-year program co-sponsored by the **Research Corporation for Science Advancement** and the **Heising-Simons Foundation**, with support from the **Kavli Foundation**. **Signatures of Life in the Universe** will bring together scientists from many disciplines to initiate research on the topics of habitability of planets, detection of life beyond Earth, and life in extreme environments on Earth or in Earth's distant past.

Department

2020 Staff Excellence Awards

LPL presented two outstanding staff awards: **Amy Brenton** (administrative) and **Chris Schaller** (science/engineering staff)



Amy Brenton is academic advisor for the PTYS graduate program and for the undergraduate minor programs in Planetary Sciences and Astrobiology. She helps our students to navigate policies and procedures and to achieve their academic goals. Amy is dedicated to making the department a more welcoming and inclusive place for all students; her door (real or virtual) is always open, and she is known to invite students to visit for conversation and homemade cookies.



technical expertise and careful implementation are critical to project success. For HiRISE in particular, Chris has been responsible for software development and technical understanding of critical areas, including the complicated matter of precise timing of HiRISE instrument operation steps, which is key to targeting accuracy and analysis of instrument anomalies.

To better serve our students, Amy has developed relationships with other campus advisors as well as staff at the **Graduate College** and the **Graduate and Professional Student Center** and works closely with the advising community on campus, including the **University Professional Advising Council (UPAC)**. In addition to attending regular UPAC meetings, Amy makes a point of expanding her knowledge and experience by participating in professional development opportunities such as workshops geared toward improving student services and communication: e.g., trainings on having difficult conversations, how to address mental and emotional concerns, and regularly using her lunch hour to participate in advisor training sessions. She also volunteers to represent the department at university events like the Meet Your Major Fair—PTYS had previously never been represented at these types of events.

In addition to excelling at these fundamental advising roles, Amy goes “above and beyond” to serve the LPL community by supporting department functions such as coordinating the LPL social media posts, which includes regular meetings with UA Communications and other departments and groups within LPL to learn about the networking requirements; serving as LPL’s **CoSSAC** representative since 2015 (she was committee chairperson for 2018-2019); helping to produce the semesterly print newsletters; and participating in outreach events such as Summer Science Saturday. Amy also pitches in to assist with any and all tasks in the department, including co-hosting the LPL holiday party in recent years. Amy’s expertise and dedication to the success of our students and to the department as a whole are hallmarks of her outstanding work as a member of the LPL staff.

As lead Spacecraft Operations Software Engineer for the High Resolution Imaging Science Experiment (**HiRISE, Mars Reconnaissance Orbiter**) and the Colour and Stereo Surface Imaging System (**CaSSIS, ExoMars Trace Gas Orbiter**) instruments, **Chris Schaller** is primarily responsible for developing and maintaining the planning and targeting software for the two instruments. His

Chris has been described as a conscientious and inclusive developer who regularly solicits feedback from the team members using his software. Based on that feedback, Chris works to improve the usability of his software, proactively adding new features that aid the operations teams in streamlining their processes. The results of this work often reduce the time required to complete daily missing planning tasks by hours. And while his work saves time for others, it also means that Chris works holidays and weekends so that he is available to solve problems in real time; this is especially true of his work with CaSSIS, for which Chris has lead the development of Plan-C and adaptation of HiPlan for the TGO spacecraft and CaSSIS. This has been a continuing effort due to instrument anomalies and changing spacecraft constraints. CaSSIS has now acquired thousands of images of Mars via Plan-C. Chris has been recognized for the excellent work he has done to understand and respond to the needs of both the HiRISE and CaSSIS science teams.

In addition to the responsibilities of his critical role with two spacecraft instruments, Chris has recently played major roles in improving communication within LPL and advancing the interests of LPL across campus. Within LPL, he has facilitated the exchange of expertise across different research groups, culminating in the first “town hall” for technical staff, which helped to inform staff about development proposal and how technical staff could contribute expertise to current and future projects. He has represented LPL at meetings for the proposed Advanced Research Building, advocating for infrastructure to support future LPL instrumentation and science. He has also represented LPL at meetings related to the UArizona Space Institute and represents the science/engineering staff at LPL faculty meetings.

This award recognizes not only Chris’ consistent outstanding work with HiRISE and CaSSIS, but also his recent advocacy, leadership, and engagement with staff issues, which demonstrates a long-standing and deep commitment to LPL.

Department

LPL Postdoc Stefano Nerozzi



Dr. Stefano Nerozzi joined LPL in January as a Postdoctoral Research Associate working with **Professor Jack Holt**. He is leading a NASA-funded project to study the geological evolution of outflow channel systems in Utopia Planitia, Mars. This project integrates several remote sensing techniques to unravel the history of water in this region, and especially how it shaped the surface and interacted with volcanic and impact processes. Stefano is also interested in the study of Mars' cryosphere, analyzing gamma ray spectrometer elemental concentration data at boulder halo sites and continuing his doctoral work on ancient icy sedimentary deposits in Planum Boreum using radar sounding and visible imagery.

Stefano grew up near Bologna, Italy. He earned his B.S. in Geological Sciences in 2011 and his M.Sc. in Geology and Land Management in 2014 at the University of Bologna. During the second half of his M.Sc. program, Stefano participated in an exchange program at the University of Texas at Austin, where he also received a Ph.D. in Geological Sciences in 2019 with **Professor Jack Holt**. His dissertation focused on unraveling the morphological and stratigraphic signature of global climate events within the Planum Boreum of Mars.

Outside of work, Stefano enjoys a large number of hobbies and interests, including DIY electronics, amateur radio, outdoor activities, role-play games, and building ecospheres.

AAS Fellows

The American Astronomical Society (AAS) inaugurated its **Fellows Program** with a 2020 legacy class that included several LPL scientists:

- Professor Emeritus **Bill Hubbard**
- Regents' Professor **George Rieke**
- **Robert Seaman**, Senior Data Engineer
- Visiting Research Scholar **Mark Giampapa**
- Visiting Research Scholar **Jack Harvey**
- Visiting Research Scholar **John Leibacher**

Two LPL alumni were also named as AAS Fellows:

- **Dale Cruikshank** (NASA Ames Research Center)
- **Faith Vilas** (Planetary Science Institute)

Passing of Charles See

Charles "Chuck" See, a long-time member of the LPL family, passed away on January 8. Chuck was a native Tucsonan who earned a B.S. in Mechanical and Aerospace Engineering as well as an M.S. in Electrical Engineering from the University of Arizona. He spent ten years working as an aerospace engineer at firms like Sperry Space Systems (Phoenix), Allied Signal (Tucson), Westinghouse (Pittsburgh), Honeywell (Phoenix) & Westinghouse (Baltimore). In 1995, Chuck returned to the UA as a staff engineer working with **Professor Martin Tomasko** on the Cassini Descent Imager/Spectral Radiometer (DISR) and the Huygens probe.

Chuck was a consummate aerospace engineer, possessing multiple skills that covered a variety of sub-disciplines: mechanical, thermal, electronic, systems, testing and flight operations. Never one to sit back and relax, he also developed his considerable analytical skills and became a talented scientific data analyst. Chuck was famously extroverted and a natural leader, usually tasked with being the U.S.-based DISR team's instrument engineer during the Huygens probe's Europe-based testing. Very popular with the other (largely European) instrument team members, he gracefully acted as the public face of an American DISR camera suite. He retired in 2006 but was retained part-time in order to curate and analyze the rich DISR data set.



Department

IVO Selected as Finalist for NASA Discovery Program

by Mikayla Mace, University Communications



Professor Alfred McEwen's mission proposal to one of Jupiter's moons is among the four finalists for the next \$500 million Discovery mission. The Discovery Program funds midsize principal-investigator-led spacecraft missions designed to unlock the mysteries of the solar system and our origins.

The four finalists will now embark on a one-year study before NASA expects to make its final selection in 2021.

If selected, the **Io Volcano Observer**, or IVO, mission will orbit Jupiter and make 10 close flybys of its moon Io – the most volcanically active world in the solar system – to determine if the moon has a magma ocean hidden beneath its vibrant, pockmarked surface.

"IVO will revolutionize our understanding of a truly spectacular, volcanically active world, with volcanic eruption scales seen on Earth only during mass extinctions," said **Alfred McEwen**, IVO principal investigator and Regents' Professor of planetary sciences.

"To become a finalist for the next phase of the NASA Discovery Program is a tremendous accomplishment," said University of Arizona **President Robert C. Robbins**. "If we are selected in the final round, IVO will become the second University of Arizona-led Discovery mission following the Phoenix Mars Lander, and the third University of Arizona-led NASA planetary mission, following the current OSIRIS-REx mission. The University of Arizona has a long history of space research that began with mapping the moon and has included most NASA planetary missions. This is a phenomenal step for our continuing leadership in space exploration."

The mission would carry a suite of science experiments to map Io's surface, measure its heat flow, monitor volcanic activity, measure the composition of surface lavas and gases erupting from Io, and measure the magnetic and gravitational fields near Io that inform us about the internal structure and distribution of magma.

"Magma oceans were common among the terrestrial planets – Mercury, Venus, Earth, Mars and the moon – soon after the planets formed," McEwen said, "and are an integral piece of planet formation and evolution. They are responsible for the formation of metal cores and degassing to produce the planet's oceans and atmosphere."

These magma oceans cooled and solidified billions of years ago, but great quantities of magma are currently produced in Io from tidal heating as it is stretched and squished by its gravitational dance with the giant Jupiter and sister moons, changing its shape every 42-hour orbit.

The tidal heating could be so great that it sustains an entire magma ocean. Or Io may lack a continuous liquid layer and instead resemble the terrestrial planets soon after their magma oceans solidified. Either way, Io can inform us about ancient volcanic and tectonic processes on Earth and other worlds, and about countless exoplanets that may resemble Io, according to McEwen.

"The NASA Discovery Program enables universities like ours to make exquisite use of our remarkable scientists to peer into the formations and workings of planetary bodies, comets and asteroids and truly discover new knowledge that illuminates our place in the universe," said Senior Vice President for Research and Innovation **Elizabeth "Betsy" Cantwell**. "The discoveries resulting from this program also advance our ability to innovate broadly around space technologies and new entrepreneurial opportunities, opening many more doors for advances that benefit life on Earth."

The IVO spacecraft and several science instruments would be built and managed by the Applied Physics Laboratory. UArizona would lead science operations and the potential development of a camera in collaboration with students. Other key partners are the Jet Propulsion Laboratory for gravity science and spacecraft navigation, the University of California, Los Angeles for magnetometers, the German Aerospace Center for an infrared instrument and the University of Bern in Switzerland for a mass spectrometer.



Department

Schuchardt Wins University Award for Excellence

Maria Schuchardt was named a recipient of a **2020 University Award for Excellence**, which recognizes outstanding service to the university community and visitors. As part of her duties as Data Manager for the **Space Imagery Center**, Maria offers and organizes tours of the facility, facilitates access to the collection for researchers as well as the public, and provides educational resources and kits to visitors and educators. However, she goes above and beyond these responsibilities by coordinating outreach activities for the entire department and working with other campus groups to support university projects and better serve local communities. She developed the idea of an annual public science event in the Kuiper building; this **Summer Science Saturday** program has become extremely popular in the community and draws several hundred visitors each year on a Saturday in July. She devotes many long hours to organizing the event, creating the displays, and inviting and communicating with local science groups who look forward to participating and working with Maria every year. When the **Tucson Festival of Books** came on the scene, Maria began coordinating the “Science City” section, in part because she knew the groups that could be counted on to provide activities. Another programmatic highlight is the very popular **LPL Evening Lecture Series**; Maria solicits the speakers and advertises the talks to the distribution list she maintains, in addition to the community at large.



Maria's efforts also support the work done by other groups at LPL. When the department's external advisory board decided to try to put together an outreach committee to bring together groups doing K-12 outreach in Tucson, she became the glue that bound them together, supporting their (evening) meetings, and participating in many events that they organized around town. Maria serves as a point of contact for outreach requests from the community, working to ensure that LPL faculty, staff, and students have the opportunity to share their work with schools and groups around Tucson. In addition, she is actively involved with other department activities and special events such as **The Art of Planetary Science**. Maria's reputation extends well beyond Tucson; for example, each year, Maria hosts a group of Norwegian students on a science tour of the U.S. She is always "in demand" in part because she infuses every interaction with joy, positivity, and enthusiasm for communicating science. LPL and the University of Arizona are fortunate to have a science ambassador as dedicated as Maria; she truly embodies the spirit of the University Award for Excellence.

Graduate

Space Grant Fellowship for Zarah Brown



Fourth-year student **Zarah Brown** has won a **UA/NASA Space Grant Graduate Fellowship** from the **Arizona Space Grant Consortium**. Zarah's winning proposal, **The Arizona Scale Model Solar System**, has as its objective the installation of a 1:5 billion scale model of the solar system on the UArizona campus. The model would stretch from the Kuiper building, site of the Sun and inner planets, to the western edge of campus (Park Avenue), where Neptune will be located. The project, in addition to highlighting the university's legacy of space exploration, supports objectives in math and critical thinking as it inspires enthusiasm and appreciation for science and math.

The scale model project facilitates an active learning environment, supporting visual and kinesthetic learners. A prominent objective is to engage undergraduate non-science majors who struggle with concepts such as astronomical scale, speed and distance, so the project will include course materials designed to support faculty who teach introductory astronomy and planetary science courses at the University of Arizona. Specifically, Zarah will develop a one-day lab exercise for use in conjunction with the model, partnering with one or more instructors to implement its use. The lab exercise and associated materials will be curated at LPL by Associate Professor of Practice Dr. Steve Kortenkamp, who will ensure the materials are kept current and available to instructors.

Zarah envisions the model becoming a favorite destination for local K-12 schools, perhaps in partnership with **Flandrau Science Center**. Installation is planned for the first half of 2022.

Graduate

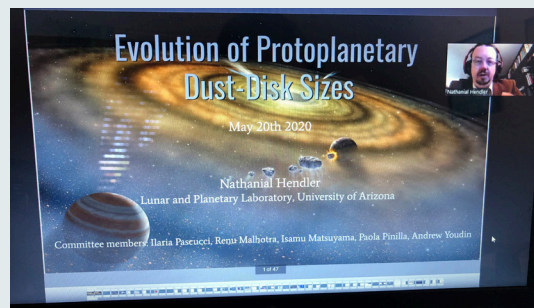
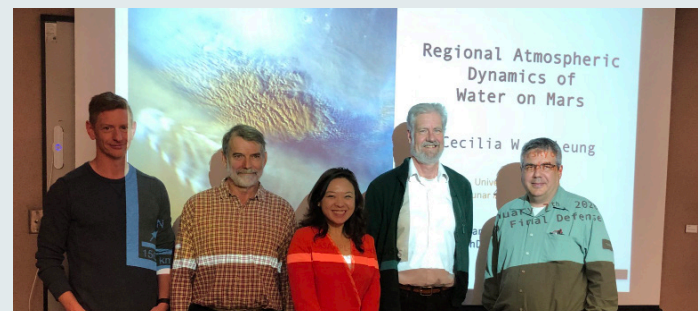
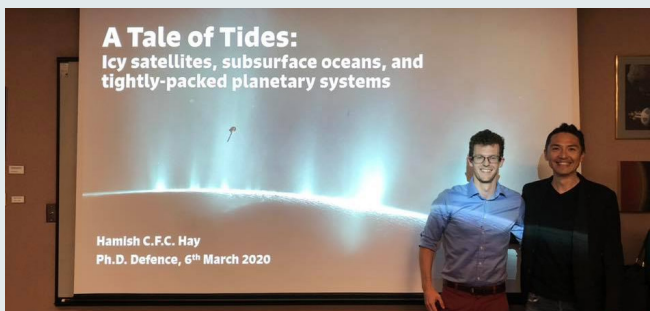
Recent PTYS Graduates

Congratulations to [Cecilia Leung](#), [Hamish Hay](#), and [Nathanial Hendler](#), LPL's newest alumni!

Cecilia defended her dissertation, *Regional Atmospheric Dynamics of Water on Mars*, on January 7. [Regents' Professor Alfred McEwen](#) served as her advisor. Cecilia is currently a NASA Postdoctoral Program Fellow at JPL, working with Dr. Leslie Tamppari.

On March 6, Hamish defended his dissertation, *A Tale of Tides: Icy Satellites, Subsurface Oceans, and Tightly-Packed Planetary Systems*. Hamish' advisor was [Associate Professor Isamu Matsuyama](#). Hamish will begin a postdoctoral appointment at JPL with Dr. Bob Pappalardo.

[Nathanial Hendler](#) will go down in history as the first LPL student to defend a dissertation via remote on May 20. His dissertation was titled *Evolution of Protoplanetary Dust-Disk Sizes*. Nathanial was advised by [Associate Professor Iliaria Pascucci](#).



Graduate Student Honors and Kudos

[Claire Cook](#) was awarded a **National Science Foundation Graduate Research Fellowship (GRFP)** for her proposal Modeling Martian Ice Sheets and Characterizing the Banded Terrain of Hellas Planitia, Mars. GRFP Fellows receive three years of stipend and tuition support. Claire is advised by [Professor Shane Byrne](#).

[Maria Steinrück](#) was named a recipient of the **Likins Inclusive Excellence Award for 2019-2020**. The award is presented by the **University of Arizona's Initiatives for Organizational Inclusion**, and honors students who have significantly contributed to creating a more diverse and inclusive campus community. The award provides a professional development stipend. For her committed efforts to equity and diversity, Maria was awarded LPL's **Andersson Award for Service and Outreach in 2018**.

[Zoe Wilbur](#) won an **LPI Career Development Award** for her first-author abstract submitted for presentation at the 51st Lunar and Planetary Science Conference (LPSC). The award provides for a travel stipend to LPSC. Zoe's abstract was titled, *Investigating the Magmatic History of Volatiles in Apollo 17 Basalts, Apollo Next Generation Sample Analysis*. [Assistant Professor Jessica Barnes](#) is Zoe's advisor.

Graduate

Kuiper Award to Sarah Peacock



Sarah Peacock is the 2020 recipient of the **Gerard P. Kuiper Memorial Award**, the department's highest award for graduate student scholarship. Sarah defended her dissertation, *Predicting the Extreme Ultraviolet Radiation Environment Around Low-Mass Stars*, on November 22, 2019; Professor Travis Barman served as her advisor.

Sarah's research interests include studies of stellar upper atmospheres and ultraviolet emission from low mass stars. She uses the PHOENIX atmosphere code to compute synthetic stellar spectra for exoplanet host stars that span extreme ultraviolet to infrared wavelengths. Sarah is a science team member for the **Star-Planet Activity Research CubeSat (SPARCS)**.

This summer (2020), Sarah will begin an appointment as a NASA Postdoctoral Program Fellow at NASA Goddard Space Flight Center.

Outstanding Scholarship Award to Shane Stone



Shane Stone earned the 2020 LPL College of Science Graduate Student Scholarship award for his accomplishments throughout an extraordinarily productive and successful graduate career. Shane will complete his degree with at least twelve peer-reviewed publications, including a first-author publication in *JGR Planets* (doi:10.1029/2018JE005559) and another submitted to *Science*. Shane is entering his sixth year as a graduate student; his advisor, Professor Roger Yelle, notes that the JGR paper is an example of Shane's consistently comprehensive and rigorous analysis as well as his superb communication skills. Although still a student, Shane has established himself in the community of Mars upper atmospheric researchers.

Amanda Stadermann Wins Fall 2019 GTA Award

Amanda Stadermann is the recipient of the PTYS Outstanding Graduate Teaching Assistant Award for Fall 2019. Amanda worked with students in Assistant Professor Kristopher Klein's section of PTYS/ASTR 170A1, Planet Earth: Evolution of the Habitable World. In support of the award, Professor Klein wrote, "This was the first class I have taught at the University of Arizona, and Amanda was an excellent GTA to provide support while I learned many of the pedagogical ropes of teaching a large enrollment course. Amanda provided advice on how to effectively keep track of the administrative elements she had learned from her previous GTA experiences. This assistance was invaluable. In addition to executing assigned TA duties like grading, Amanda gave two course lectures (and created the presentation for one of those lectures).



Amanda's objective as a TA is to "encourage science-inclined students to consider planetary science, and encourage science literacy among the students with inclination toward other subjects." To this end, she served as an exemplary ambassador to the students in the class; each of the half-dozen students who regularly attended her weekly office hours received an "A" grade. According to Professor Klein, Amanda "is an unceasing advocate for the students, and her work in my class demonstrates her aptitude for scientific education and outreach." Recipients of the Outstanding GTA Award receive funds of up to \$1,000 to support travel to a professional meeting of their choice. Amanda also received the 2020 College of Science Outstanding Teaching and Mentoring award for LPL.

Invest in LPL

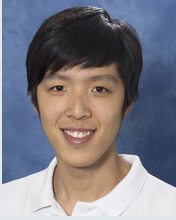
Galileo Circle Scholarships are awarded to the University of Arizona's finest science students and represent the tremendous breadth of research interests in the College of Science. Scholarships are supported through the generous donations of **Galileo Circle** members. Scholars receive \$1,000 each and the opportunity to introduce themselves and their research to the Galileo Circle



Saverio Cambioni: My vision is that Artificial Intelligence (AI) could allow for overcoming the limitations that humans bring to data analysis. AI can review large volumes of data and discover specific trends and patterns that would not be apparent to humans. This makes AI a natural tool to look at missing links, such as those connecting to the formation of planetary systems and the origin of life on Earth, or to signals of advanced civilizations elsewhere.



Indujaa Ganesh: I study the physical processes that drive volcanic eruptions and use numerical techniques to model these processes. I also use radar data to complement and constrain my modeling work. I enjoy implementing mathematical models to carry out quantitative geological investigations. I'm a firm proponent of using radar instruments for planetary exploration and I'm keen on expanding my expertise in different radar techniques like ground penetrating radars, imaging synthetic aperture radars, and radar polarimetric imaging.



Weipeng Ben Lew: Clouds affect how much energy is being absorbed and reflected in an atmosphere. By regulating the heating and cooling rate of an atmosphere, clouds play a key role in shaping the weather and climate of a planet. Observations of planets beyond the Solar System, which are called exoplanets, suggest that clouds are prevalent in planetary atmospheres. My long-term research goal is to understand the chemical and physical processes in cloud formation, and to answer the question "How do clouds impact the evolution of planetary atmospheres?"



Patrick O'Brien: So far in my scientific career I have developed skills and experiences in multiple fields of research on scales ranging from nanometer-sized particles to massive stars the size of Earth. This journey has instilled in me an invaluable perspective on a complex, interconnected Universe and led me to a career in planetary science, a field interdisciplinary by its very nature. My ultimate goal is to work on challenging problems using tools and technologies from many different fields and to connect people to the excitement of space exploration and solar system science.



Maria Steinrück: My research focuses on hot Jupiters. Hazes obscure the spectral signatures of gases present in the atmospheres of many hot Jupiters, making it hard to determine what the atmosphere is made of. I investigate if these hazes are formed through photochemical processes. Previous research has used 1D models that cannot fully capture the effects of the strong winds on hot Jupiters. My goal is therefore to adapt the 3D Global Climate Model that my research group uses to include photochemical hazes.



Sarah Sutton: My dissertation focuses on fissure-fed eruptions on Mars and Earth, analyzing morphology using high resolution topography from optical imaging and laser scanning data. My research connects the evolution of volcanic features on Earth to those on Mars and other planets to further our ability to interpret their morphology and more accurately model the fundamental physical processes that led to their creation.



Joana Voigt: The surface of a planet is an expression of the interior dynamics of the body. I am interested in establishing fundamental links between both to learn more about the inner working principles and evolution of planets. Linking the volcanic deposits to the controlling mechanisms is the research topic that I am inspired by and thus my Ph.D. is dedicated to better understanding these relationships. It is fundamental to combine terrestrial with planetary volcanism, so I study eruption products of the 2014–2015 Holuhraun lava flow-field in Iceland and the Elysium volcanic province on Mars.

Invest in LPL

Andersson Award to Allison McGraw



This year’s **Leif Andersson Award for Service and Outreach** was presented to **Allison McGraw**. Allison was also the recipient of the **2020 LPL College of Science Service Award**.

Allison is a third-year graduate student at LPL. She has been active in public outreach since her days as an undergraduate at the University of Arizona, when she worked at **Kitt Peak National Observatory** as a public program specialist, conducting nightly telescopic observing programs and teaching visitors about Earth’s atmosphere, planets, telescopes and the many astronomical objects in the night sky to the public. As a graduate student, Allison has continued to grow her service portfolio. She was selected to be a **Lloyd V. Berkner Space Policy Graduate Intern** with the Space Studies Board, The National Academies of Sciences, in Washington, D.C. This experience provided Allison with a unique, policy-informed perspective that she applies as she engages larger communities, and also demonstrates her willingness to communicate science to public audiences.

Allison regularly leads and participates with LPL outreach activities, including outreach to local schools and support for events like **Tucson Festival of Books**. She is also an OSIRIS-REx Ambassador, communicating the science of the sample return mission to varied audiences. Allison has brought OSIRIS-REx outreach activities, including meteorites and cratering kits, to venues like libraries as well as more traditional events like Spacefest. In 2019, Allison won a **UA NASA Space Grant Graduate Fellowship** with her proposal for developing a full-dome planetarium show about meteorites.

Some of Allison’s most impressive and creative efforts and service to outreach are evidenced in her recent role as coordinator for the graduate-student-run art show, **The Art of Planetary Science (TAPS)**. Allison not only took on the formidable task of event logistics but also expanded the program’s scope and vision by including family friendly activities such as hosting telescopes for night time stargazing and the “Physics is Fun” bus on the UA Mall; the event also featured a local rock band beneath the Kuiper “Moon Tree” and digital submissions displayed on the planetarium dome at the **Flandrau Planetarium and Science Center**, with an introduction by a local space artist. The result was a festival feeling with something for everyone to enjoy.

Allison’s long-standing commitment and enthusiasm on behalf of public education and outreach truly represent the spirit and intent of the Andersson Award.



The LPL Andersson Award for Service and Outreach is awarded annually to a PTYS graduate student in recognition for attention to broader impacts and involvement in activities outside of academic responsibilities that benefit the department, university, and the larger community. The award is named for Dr. Leif Andersson, a scientist who worked at LPL in the 1970s.

LPL in the News

Links to the news stories below and others are available at: lpl.arizona.edu/news/2020/spring

OSIRIS-REx Asteroid Sample Collection Set for Oct. 20 - The new date allows the team more time to assess Bennu's unexpectedly rugged terrain. The event will mark NASA's first-ever asteroid sample collection.

What Makes Saturn's Upper Atmosphere So Hot - New mapping of the giant planet's upper atmosphere reveals a likely reason why it's so hot.

A Martian Mash Up: Meteorites Tell Story of Mars' Water History - LPL researchers probed Martian meteorites to reconstruct Mars' chaotic history. Their findings suggest that Mars might not have had a global magma ocean.

Meet the Pair of Astronomers Who Discovered Earth's 'Mini-Moon' - While scanning the universe for space rocks that may at some point pose a hazard of impacting Earth, astronomers with the Catalina Sky Survey made an unexpected and exciting discovery.

First Official Names Given to Features on Asteroid Bennu - The approved Bennu surface feature names will be named after birds and bird-like creatures in mythology, and the places associated with them.

How Engineers Are Operating Deep-Space Probes, Martian Rovers, and Satellites from Their Homes - Driving NASA's OSIRIS-REx mission from a living room.

New Mexico Badlands Help Researchers Understand Past Martian Lava Flows - Planetary scientists are using a volcanic flow field in New Mexico to puzzle out how long past volcanic eruptions on Mars might have lasted.

Surveying for Near-Earth Objects - LPL researcher provides leadership for asteroid-hunting space mission.

LPL Cameras Capture Asteroid Close-Up During OSIRIS-REx Rehearsal - The spacecraft of the Lunar and Planetary Lab-led OSIRIS-REx asteroid sample return mission executed a series of maneuvers that brought it within a mere 200 feet of its designated sampling location on the surface of Bennu.