LPL NEWSLETTER

SPRING 2024

THE UNIVERSITY OF ARIZONA
COLLEGE OF SCIENCE
LUNAR & PLANETARY LABORATORY

HUMANS ARE GOING BACK TO THE MOON WITH LPL SCIENCE IN TOW

By NASA and UA Communications

LPL researchers will play important roles in two of the three instruments NASA selected for deployment on the lunar surface by **Artemis III** astronauts.

Once installed near the Moon's South Pole, the instruments will collect valuable scientific data about the lunar environment, the lunar interior and how to sustain a long-duration human presence on the Moon, which will help prepare NASA to send astronauts to Mars.

The instruments were specifically chosen because of their unique installation requirements that necessitate deployment by humans during moonwalks. All three payloads were selected for further development towards flight on Artemis III, which is targeted to launch in 2026. Final decisions about the mission will be determined at a later date. Members of these payload teams will become members of NASA's Artemis III science team.

Artemis III, the first mission to return astronauts to the surface of the Moon in more than 50 years, will explore the south polar region of the Moon. Several proposed landing regions for the mission are located amid some of the oldest parts of the Moon. Together with the permanently shadowed regions, they provide the opportunity to learn about the history of the Moon through previously unstudied lunar materials.

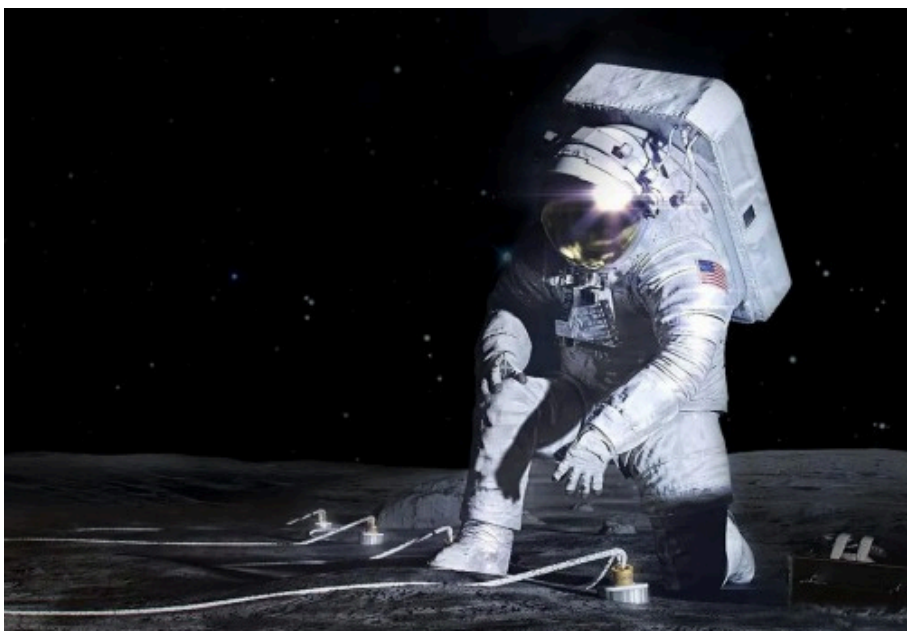
MAPPING MOONQUAKES

LPL Assistant Professor **Dani DellaGiustina** is working as part of the team to design and build two seismometers for the **Lunar Environment Monitoring Station (LEMS**). One will be tuned to detect deep moonquakes and the other to detect shallow moonquakes. "I am stoked because I have been working for years to develop seismic instruments not just for the Moon, but also for asteroids and other bodies like Europa," DellaGiustina said. "So, to see one of them make it to the next step, which is flight opportunity, is really exciting."

LEMS is led by **Mehdi Benna** from the University of Maryland, Baltimore County. **NASA Goddard** will build and operate LEMS. DellaGiustina is a co-investigator along with **Hop Bailey**, a **UArizona Space Institute** program manager, and **Angela Marusiak**, assistant research professor at LPL. **Veronica Bray**, LPL associate research professor, is assisting with science operations.

LEMS is a compact, autonomous seismometer suite designed to carry out continuous, long-term monitoring of ground motion from moonquakes in the lunar south polar region. The instrument will characterize the regional structure of the Moon's crust and mantle, which will add valuable information to lunar formation and evolution models. LEMS is intended to operate on the lunar surface from three months up to two years and may become a key station in a future global lunar geophysical network.

Moonquakes have a few sources, including the same gravitational tug between the Moon and Earth that causes ocean tides. Also, in the same way that houses creak as temperatures rise, the Moon trembles as it expands and contracts in response to dramatic temperature swings.



Artist's concept of an Artemis astronaut deploying an instrument on the lunar surface. Courtesy: NASA.

"The big difference between the Earth and the Moon is the Moon does not have plate tectonics. There is some evidence of faults on the Moon, however," Marusiak said. "One of our goals is to figure out if those faults are active and how active they are, and if they could cause a risk for the astronauts or their habitats." Lastly, the researchers also anticipate that LEMS will detect meteor impacts.

TREASURES BENEATH THE SURFACE

LPL Professor **Erik Asphaug** is a collaborator on the **Lunar Dielectric Analyzer (LDA)**, which will reveal what lies a meter deep in the Moon's regolith (airless soil). "As a child of the Apollo era, I find it amazing to be part of this adventure to put an instrument on the Moon," Asphaug said. "I've always been a big fan of radio and radar techniques to find out what's inside of things. I'm most excited to see if the regolith near the south pole has active frost."

LDA will measure how the Moon's regolith responds to an electric field, which depends on porosity and the presence of volatiles (substances that evaporate), especially ice. It will gather essential information about the structure of the Moon's subsurface and monitor whether volatiles migrate as the LDA goes in and out of shadow. University of Tokyo professor **Hideaki Miyamoto** leads the LDA, which is supported by the **Japan Aerospace Exploration Agency**.

"Different materials propagate radio signals at different speeds," Asphaug said, "so when you send a signal and measure its reflection, its speed tells you about composition and porosity. This will be important not only for lunar science, but for establishing a permanent human presence on the Moon."

With the Artemis campaign, NASA will land the first woman, first person of color and its first international partner astronaut on the moon, and establish long-term exploration for scientific discovery and preparation for human missions to Mars for the benefit of all. "It is exciting to see a new generation of Lunar and Planetary Laboratory scientists build on our legacy of lunar exploration, dating back to even before Apollo," said LPL director **Mark Marley**. "Our first major research program was to map the Moon. Now we are helping send instruments to detect what lies beneath that surface."

WELCOME TO THE LPL NEWSLETTER

Mark S. Marley, Ph.D.
Department Head and Laboratory Director

Welcome to the **Spring 2024 LPL Newsletter**! As traditional we highlight the many recognitions and awards our faculty, staff, and students have received this past academic year.

LPL faculty are coming off an impressive run of large NASA program successes these past few months. In March we learned that our planetary seismology team was selected to provide the seismometers for the **Artemis III Lunar Environment Monitoring Station** that will be deployed by the astronauts. The seismometers were developed as part of a multi-year effort led by co-investigator **Dr. Daniella DellaGiustina;** the LPL development will be led by co-investigator **Dr. Angela Marusiak** with missions operations help from co-investigator **Dr. Veronica Bray**. **Professor Erik Asphaug** is also a co-investigator on a separate instrument that will study the lunar regolith. All of the LPL faculty studying the Moon exemplify, as I like to say, that the first L in LPL stands for “lunar.”

A few weeks ago, we learned that the **Snow4Flow NASA Earth Ventures mission** led by Professor **Jack Holt** was selected for $30M in funding. The goal of the airborne program is to improve our ability to forecast mass balance and sea-level rise contributions from glaciers across the Northern Hemisphere.

You may have heard of the UArizona budget woes and are wondering how LPL might be impacted. All units in the College of Science are being asked to curtail spending in the 2025 fiscal year; LPL will participate to help improve the overall budget of the College. While we will curtail some types of spending, we do not foresee major impacts on operations at this time. This does mean that we will need to rely more than ever on charitable giving, particularly for our **Wilkening-Sill Fieldtrip Fund** to support the graduate student field trips. I view the trips as an indispensable component of our students’ journey to becoming planetary scientists and we universally appreciate the donor support that helps make them possible.

Our graduate student recruitment for the class entering Fall 2024 went exceptionally well and we have a very impressive group of nine students on their way to Tucson. They aim to study everything from icy satellites to habitable extrasolar planets. We look forward to their joining our ranks.

For more content and **expanded stories with links**, visit **LPL.Arizona.edu/news/2024/spring**.

LPL alumna **Dr. Kelly Miller** (2016) was selected as one of five NASA early-career scientists to be honored with a **2023 Planetary Science Early Career Award** based on their demonstrated leadership, involvement in the planetary science community, and potential for future impact.

Dr. Miller is a Research Scientist at **Southwest Research Institute** in San Antonio. Her project, *Carbon-Based Connections: From Earth to the Outer Solar System*, will establish carbon-based connections across the solar system and will include outreach efforts with middle schools in San Antonio.

Horton E. Newsom (1952 - 2024)

LPL alumnus Dr. Horton Newsom passed away on April 19, 2024.

Horton earned his Ph.D. in Geosciences at UArizona in 1982 with a dissertation titled *The Experimental Partitioning Behavior of Tungsten and Phosphorus: Implications for the Composition and Formation of the Earth, Moon and Eucrite Parent Body*. His dissertation committee was chaired by LPL Professor **Michael J. Drake** and included then LPL head and director **Laurel Wilkening** as a member.

Dr. Newsom worked as a senior research scientist and research professor within the **Institute of Meteoritics** and **Department of Earth and Planetary Sciences** at the **University of New Mexico**. He was a geologist and geochemist with expertise in the origin of the Earth and Moon, and the study of terrestrial impact craters around the world and their hydrothermal systems. He studied surface processes on Mars including impact craters, sedimentary deposits, and phyllosilicate (clay) bearing terrains. His research also included the origin and chemistry of Martian surficial materials using data from the **Mars Odyssey Gamma Ray Spectrometer.**

Horton was engaged with landing site selection for several Mars missions, including the **Mars Exploration Rover (MER)**, **Mars Science Laboratory (MSL)**, and future human landing sites. He was a co-investigator and science team member on the **ChemCam Laser Induced Breakdown Spectroscopy instrument** on the MSL Curiosity Rover, and was engaged with planning its science observations. Dr. Newsom was also a dedicated educator who mentored undergraduate and graduate students as well as postdoctoral scholars. He was active in NASA-funded educational outreach to K-12 teachers, and to local middle school and high school students, and Native American colleges.

LPL FACULTY

DANIEL APAI

DANTE LAURETTA

APAI AND LAURETTA NAMED 2023 AAAS FELLOWS

Professors Daniel Apai and Dante Lauretta were elected **Fellows of the American Association for the Advancement of Science**, the world's largest general scientific society.

Dante Lauretta is a Regents Professor of Planetary Sciences at LPL. He has been recognized as a AAAS Fellow for "distinguished contributions to the field of astrobiology, particularly for leadership and advancements through the OSIRIS-REx mission." Professor Lauretta is the director of the University of Arizona's **Arizona Astrobiology Center**, which focuses on astrobiological research on the origins, evolution and distribution of life in the universe.

Daniel Apai is a professor in both LPL and the Department of Astronomy and Steward Observatory. He is being honored for his "distinguished contributions to the field of astrobiology and astrophysics, particularly for advancements in understanding of habitable exoplanets and planetary systems." He is the principal investigator for the NASA-funded **Alien Earths project** that explores the potential of nearby planetary systems for supporting life. Apai also leads the **Nautilus Space Telescope project**, whose objective is to characterize 1,000 potentially Earth-like exoplanets to search for signatures of life.

The annual Fellows Forum will be held in Washington, D.C., on Sept. 21 in conjunction with the 150th anniversary celebration of the AAAS Fellows program.

KRISTOPHER KLEIN
2024 AAS HARVEY PRIZE

Associate Professor **Kristopher Klein** was named as the esteemed recipient of the **2024 Karen Harvey Prize**. The award is made by the Solar Physics Division of the **American Astronomical Society** and honors the memory of the late Karen Harvey, recognizing significant contributions in solar physics research made by an early career scientist. Dr. Klein was awarded for his outstanding contributions to the understanding of space plasma turbulence.

Professor Klein's innovative research includes *in situ* observations of the solar wind, novel data analysis methods, theoretical frameworks, and simulations. The work has resulted in groundbreaking insights into the kinetics of solar wind evolution and the nature of plasma turbulence dissipation.

The award also recognizes Dr. Klein's leadership in the scientific community, including as Project Scientist for the **Solar Wind Electrons Alphas and Protons** instrument on **NASA's Parker Solar Probe**. Professor Klein is also Deputy Principal Investigator of the upcoming **NASA HelioSwarm mission**.

LPL GRADUATE STUDENTS

GTA EXCELLENCE AWARD
NICOLE KERRISON

TEACHING OR MENTORING THAT GOES ABOVE AND BEYOND WHAT IS REQUIRED; POSITIVE EVALUATIONS OR OTHER FEEDBACK FROM STUDENTS; WILLINGNESS TO HELP JUNIOR GRADUATE STUDENTS..

Nicole Kerrison won this year's Graduate Teaching Assistant Excellence Award for her support of **PTYS/ASTR 170A1 Alien Earths**, with instructor **Dr. Steve Kortenkamp**, during the Fall 2023 semester.

Nicole had a large number of students attend her office hours, which speaks to her willingness and ability to help students with revisions of their assignments but also to her ability to make students feel at ease with visiting a TA for help with the class.

The 170A1 section was taught in the **Flaundrau Science Center** theater (planetarium dome), so Nicole learned how to use the digital planetarium projection software and gave several full-dome presentations to the class related to concepts, including extrasolar planets, asteroids, and moons of giant planets. Nicole became so adept with the full-dome system that she volunteered to give a public planetarium talk for the solar eclipse that occurred on April 8.

Nicole also played a lead role in facilitating evening telescope observing sessions for the class on UArizona Mall. Thanks to her support, the course offered 18 consecutive nights of observing, with 60 students participating in each session. Nicole also helped to supervise the undergraduate TA/preceptor group involved with this class. Because Nicole herself had been an undergraduate preceptor, she was able to maintain a comfortable and professional atmosphere for the class teaching team.

The GTA Excellence awards provides $1,000 in support of conference and research travel.

2024 SHIRLEY D. CURSON TRAVEL AWARD

ESTABLISHED TO SUPPORT TRAVEL EXPENSES OUTSIDE THE STATE OF ARIZONA DURING SUMMER BREAK.

Roberto Aguilar Martinez
Mars Polar Conference
Whitehorse, Yukon

Studying the formation and evolution of glaciers on Mars and their potential as water resources for future human landing missions.

Namya Baijal
Psyche Collaboration Meetings
University of Bern

Seeking to understand how collisions have shaped the surface of asteroid (16) Psyche.

Melissa Kontogiannis
Summer School for
Sample Returns
Observatoire de Haute-Provence

Analyzing samples of asteroid Bennu, recently returned by the OSIRIS-REx mission.

Support LPL student endowments

https://give.uafoundation.org/science-lpl

ZARAH BROWN
GERARD P. KUIPER MEMORIAL AWARD

STUDENTS WHO 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.

Zarah graduated from LPL in December and is currently a postdoctoral research associate working with Associate Professor **Tyler Robinson**. She joined LPL as a grad student in 2017 from the University of Colorado, Boulder, where she had already co-authored two papers on Saturn's rings. As an LPL graduate student working with **Dr. Tommi Koskinen**, Zarah published 6 papers, including three as first author (one being a first-author paper in *Nature Astronomy*).

Zarah's dissertation research provides the first global view of a giant planet middle and upper atmosphere, which is based on her analysis of stellar occultations obtained during the Cassini Grand Finale tour. Zarah's observational results contradicted existing models and showed that auroral heating and global redistribution of energy is a viable solution to the giant planet "energy crisis" problem. These results had fundamental implications for the energy balance and circulation in the upper atmosphere and were published by *Nature Astronomy* (Brown et al. 2020).

Zarah's second paper (Brown et al. 2022) in *Geophysical Research Letters* describes the atmospheric gravity waves that she detected in the Cassini/UVIS dataset. She showed that the deposition of momentum by these waves enhances redistribution of energy from the aurora to lower latitudes, providing a mechanism to support her previous findings.

Zarah's thesis work culminated in a third *Icarus* paper (Brown et al. 2024) that extends the analysis of the stellar occultations from the highest altitudes in the atmosphere to the middle atmosphere. This paper provides the first global constraints on photochemistry and dynamics in Saturn's mesosphere where photochemical production peaks. The results have already supported a study that produced significant new constraints on the nature and flux of external material flowing in from the rings to Saturn's atmosphere and demonstrates the full power of multi-instrument observations in probing giant planet atmospheres for the purposes of future missions.

In addition to her academic accomplishments, Zarah had an exemplary record in service and outreach, including contributions to **The Art of Planetary Science** exhibition at LPL and leading the installation of the **Arizona Scale Model Solar System** on the UA campus as part of a **NASA Arizona Space Grant Graduate** Fellowship.

SAMUEL MYERS
ANDERSSON AWARD FOR SERVICE AND OUTREACH

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

Sam Myers is a fourth-year graduate student working with LPL Research Professor **Ellen Howell** to study near-Earth asteroids. His research includes modeling near-infrared spectra of these objects and is proficient at collecting data during remote observing sessions using the **NASA Infrared Telescope Facility** at the Mauna Kea Observatory, Hawaii.

Within the department, Sam's service commitments have included graduate student recruitment, organizing graduate student activities, and positions on various committees; he is currently graduate representative to the faculty.

Sam has been actively engaged with community science outreach, giving public talks about asteroids to various amateur astronomy groups, schools, and retirement communities. He has also supported efforts by the **Arecibo Observatory** staff to draw attention to the need for a replacement radar system to study and determine impact hazards for near-Earth asteroids.

Throughout his time as a student, Sam has pursued an interest in science policy and has been actively involved in influencing lawmakers and government agencies to guide science research. He has visited Arizona representatives and senators to draw their attention to science-related issues. Sam enrolled in a **Science Policy and Diplomacy (SPD)** course three years ago and was a leader in that class. He has continued pursuing activities related to SPD that broaden the impacts of science and its influence in society.

As part of the SPD course, Sam participated in a **U.S. State Department Diplomacy Lab** project examining the potential impact of climate change on the water, energy, and agricultural systems of an identified region; the project yielded policy recommendations that could be implemented by the State Department. The team was selected to present their work at the annual **Diplomacy Lab Day** and eventually also developed a journal publication on linking science and diplomatic recommendations in the project. In 2023, the team was selected to develop a science and technology fellowship program to serve the Arizona Legislature.

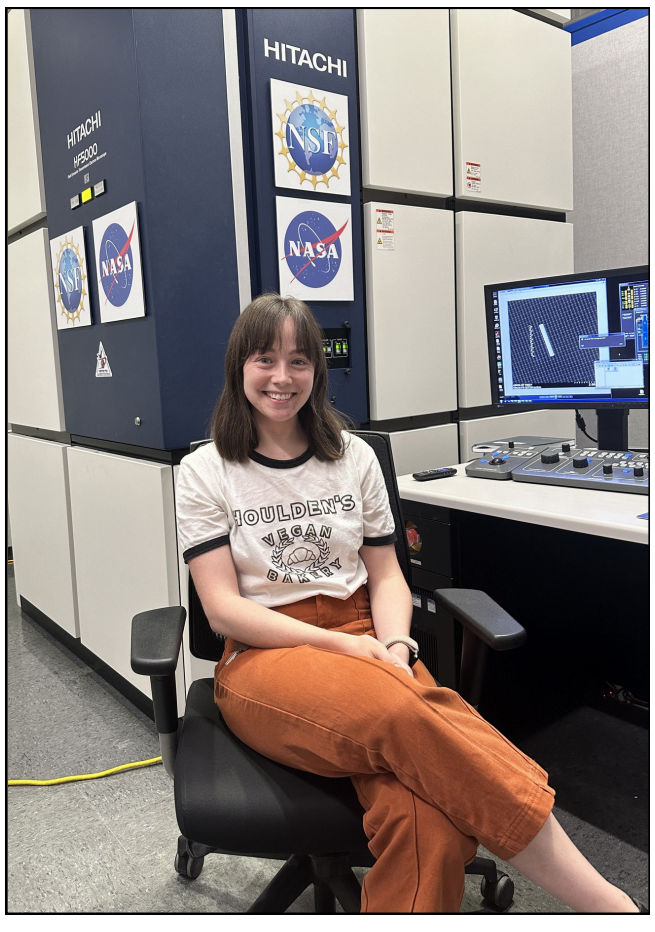
2024 HITACHI ELECTRON MICROSCOPY SCHOLARSHIP

The **Kuiper-Arizona Laboratory for Astromaterials Analysis** awards the **Hitachi Scholarship in Electron Microscopy** annually to two graduate students generating cutting-edge research and publications in the area of electron microscopy. The scholarship was established by **Hitachi High-Technologies** as part of their partnership with the **University of Arizona**.

HITACHI
Inspire the Next

COLLEGE OF SCIENCE
KUIPER-ARIZONA LABORATORY FOR ASTROMATERIALS ANALYSIS

MAIZEY BENNER AND LUCAS SMITH



Maizey Benner is a third-year Ph.D. student at the Lunar and Planetary Laboratory. Her research focuses on unraveling the thermodynamic history of phosphorus- and sulfur-bearing minerals in aqueously altered carbonaceous chondrites using coordinated electron microscopy techniques. Maizey uses the Hitachi HF5000 S/TEM and S-4800 SEM to characterize the structure and chemistry of these materials from the millimeter to atomic scale. About the award, Maizey says, “Receiving the Hitachi Electron Microscopy Scholarship has given me great confidence in my work, and encouragement to pursue further training in electron microscopy. I am honored to receive such an award and look forward to completing my Ph.D. research using the Hitachi microscopes.”

LPL graduate student **Lucas Smith** uses the Hitachi instruments in the **Kuiper-Arizona Laboratory for Astromaterials Analysis** to study presolar stardust grains in aqueously-altered meteorites. In particular, he says, “the Hitachi HF5000 TEM allows me to obtain critical information on the chemical composition, structure, and mineralogy of presolar grains in the context of their host meteorites. This information allows me to understand both the conditions under which the presolar grains formed in their parent star and how aqueous processing on asteroids affects presolar phases.“

2024 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.

Namya Baijal

Advisor: Erik Asphaug

Seeks *to* understand how impacts between planetary bodies shape their surface and interiors, with a focus on asteroids.

Maizey Benner

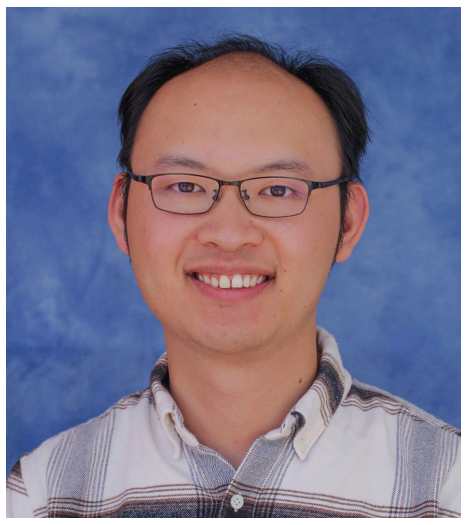
Advisor: Tom Zega

Investigating the thermodynamic origins and evolution of phosphorus- and sulfur- bearing minerals in aqueously altered carbonaceous chondrites.

Galen Bergsten

Advisor: Ilaria Pascucci

Uses large-scale survey data to study populations of extrasolar planets, including those analogous to Earth, to learn how planets form and evolve throughout the Galaxy.



Dingshan Deng

Advisor: Ilaria Pascucci

Studies star and planetary formation, including protoplanetary disks, which are the birthplaces of the planets around the young stars.

Mackenzie Mills

Advisor: Alfred McEwen

Uses spacecraft data to derive scientific conclusions from planetary surfaces, characterizing Martian geomorphology and working for an understanding of influence of Martian subsurface features on spatial distributions of surface features.

Samantha Moruzzi

Advisor: Jeff Andrews-Hanna

Studying Pluto's interior through its fractures and impacts, and how Earth analogs and terrestrial methods can aid in our investigations.

Iunn Ong

Advisor: Jessica Barnes

Using microscopy techniques to analyze Bennu samples and understand the extent of aqueous and thermal alteration that takes place on asteroids.

Lucas Smith

Advisor: Pierre Haenecour

Identifying and investigating presolar stardust grains within meteorites that have experienced aqueous processing, which informs our understanding of conditions that existed during Solar System formation.

SPRING 2024

PTYS 590: PLANETARY GEOLOGY FIELD STUDIES

PROFESSOR JACK HOLT, INSTRUCTOR

Death Valley

In spite of a very windy first day and rain on the second, PTYS 590 had a successful trip to **Death Valley** and its vicinity. We visited and discussed a multitude of planetary-relevant sites including dunes, playas, alluvial fans, volcanics, a phreatomagmatic crater, paleo-shorelines, ventifacts, Snowball Earth glacial deposits, stromatolites, hot springs, and more. There was still a giant shallow lake at **Badwater Basin**, which was quite a sight. UArizona Regents Professor **Victor Baker** provided great insights at many stops and LPL Research Scientist **Dr. Joe Schools** supported the trip.

Perhaps the most amazing, unprecedented outcome is that we had zero flat tires on the road to **Racetrack Playa**!

Support the LPL Graduate Field Trip by donating to the Wilkening-Sill endowment

https://give.uafoundation.org/science-lpl

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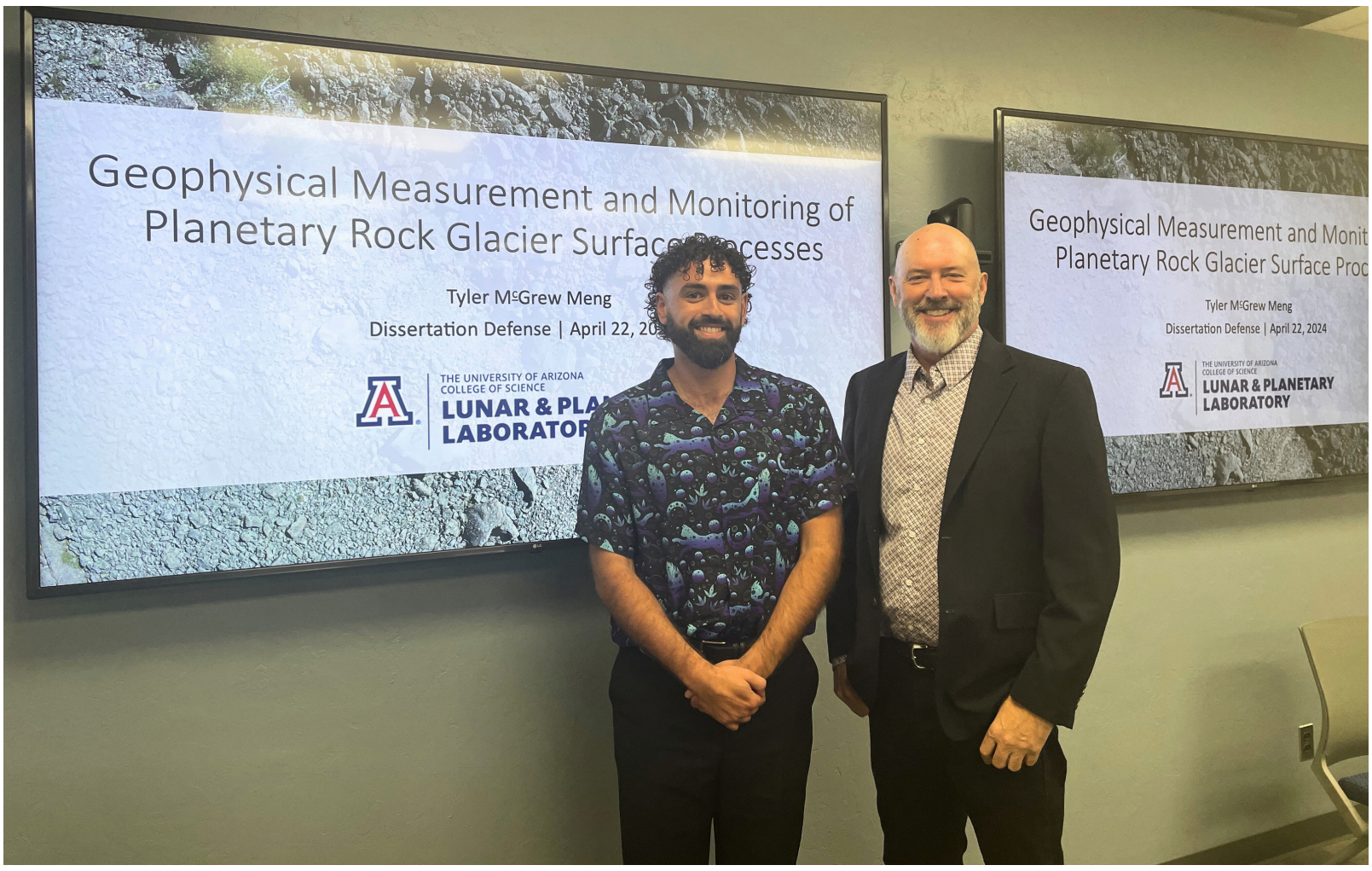
CONGRATULATIONS **PTYS GRADUATES**



TYLER MENG

April 22, 2024

Geophysical Measurement and Monitoring of Planetary Rock Glacier Surface Process

Advisor: **Professor Jack Holt**

New position: Postdoctoral Research Associate, Washington University, St. Louis

Theodore Broeren

(Applied Mathematics)

PTYS Graduate Minor
April 3, 2024

Multi-Spacecraft Observatory Data Analysis Techniques: Uncertainty Quantification & Comparison

Advisor: **Associate Professor Kristopher Klein**

New position: Raytheon (data science technologies)

UNDERGRADUATE MINORS

Astrobiology

Luisa Becerra
Fernando Jaime
Shae Henley
Grace Peek

Planetary Sciences

Severance Graham
Travis Matlock
Kaycee Ridenhour

LPL GRADUATE STUDENTS

Ruby Fulford

Ruby is a first-year graduate student advised by Associate Professor **Jeff Andrews-Hanna**. Her research interests include astrobiology and planetary geophysics.

Ruby will spend Summer 2024 at the **National Air and Space Museum** in Washington, D.C., where she will work with Dr. Bob Craddock on MARSSIM, a complex Martian landscape evolution model, to explore fluvial activity on pre-Noachian and early Noachian Mars.

Jada Walters

Jada pursues solar and heliophysical research interests; she is advised by Associate Professor **Kristopher Klein**.

Jada was selected for the Department of Energy's SCGSR Program to pursue plasma science research at the **Princeton Plasma Physics Laboratory**. The DOE Science Graduate Student Research Program provides world-class training and access to state-of-the art facilities and resources at DOE National Laboratories.

SPACE IMAGERY CENTER

So far this year, LPL's **Space Imagery Center** has conducted three workshops that train planetary scientists in how to create topography from planetary images. Workshop attendees have spanned all career stages from undergraduates to senior scientists. These workshops introduce the fundamental principles of stereophotogrammetry and structure-from-motion techniques. Thanks to investment from the **Technology and Research Initiative Fund (TRIF)**, the Space Imagery Center possesses specialized hardware to see and edit these products in three dimensions.

These workshops were made possible by funding from **NASA's Topical Workshops, Symposia, and Conferences program**. As part of this proposal, organizers collaborate with colleagues at Arizona State University, the U.S. Geological Survey, and Cornell University in offering no-cost training in a wide range of topics related to Planetary Science data. We hope to continue offering these to the community next year – a follow-up proposal is currently under consideration at NASA.

Professor Shane Byrne is director of the Space Imagery Center and Research Scientist **Dr. Michael Phillips** is the Center's manager.

UNDERGRADUATE PROGRAMS

CHAD CANTIN
PTYS UNDERGRADUATE MINOR

Chad is an **Aerospace Engineering** major with minors in **Planetary Sciences** and **Astrobiology**. Chad chose Planetary Sciences as a minor because of his long-abiding and profound interest in space. He credits enrollment in **PTYS 206: Exploring our Solar System** with sparking an interest in pursuing further study of the field. Chad's favorite Planetary Sciences class has been **PTYS 407: Chemistry of the Solar System** taught by **Dr. Dante Lauretta**, principal investigator for the **OSIRIS-REx** mission**.** Chad reports the class was an incredible experience given the opportunity to learn first-hand about the OSIRIS-REx mission and its importance to the study of asteroid composition.

Chad plans to graduate in Spring 2025 with a Bachelor of Science in **Aerospace Engineering;** he will then pursue a Master's degree in Systems Engineering. His goal is to work as an aerospace/space systems engineer with NASA. Chad is getting a head start on his career goals this summer, when he will be working as an aeromechanics intern at **NASA Ames Research Center**.

Chad spent the past academic year as an **Arizona/NASA Space Grant** working with **Professor Shane Byrne** to digitize and archive lunar images from the **NASA Surveyor Program**. Chad also works with **Dr. Jekan Thanga** (Aerospace and Mechanical Engineering) in **SpaceTREx Laboratories'** NASA-funded projects relating to robotic space systems engineering for lunar base applications. More specifically, his work involves designing lunar robots using computer-aided drafting and 3D printing.

When he is not doing homework or working in the lab, Chad enjoys painting and spending time outdoors. He also pursues an interest in astrophotography, using his telescope to capture observable objects in the night sky.

IMANI RALPH
ASTROBIOLOGY UNDERGRADUATE MINOR

Imani is majoring in **Biochemistry** with minors in **Astrobiology** and **Statistics and Data Science.** She discovered the astrobiology option as a first-year student and was immediately eager to explore the opportunities the program offered in support of her research interests in planetary habitability.

Given Imani's interests, it's not surprising that her favorite minor course was **MCB 437: Life in Extreme Environments**, which was focused on extremophiles and the various conditions they can inhabit. Taught by **Dr. Solange Duhamel** (MCB), the class provided Imani with the opportunity to complete a project on a polyextremophile known as *Deinococcus radiodurans*. Known for surviving in multiple extreme environments such as those with intense infrared radiation, the bacterium provides insight into Mars' ability to sustain life.

Imani plans to attend medical school and pursue a career as a physician in a field related to pediatrics. As part of her pre-med program, she is supplementing her course work with practical experience. Currently, Imani is working in **Dr. M. Leandro Heien's** analytical chemistry laboratory to develop chronic electrodes for *in vivo* dopamine detection in mice under different stimuli. These types of studies can provide insight into certain conditions related to dopamine levels (e.g., Parkinson's disease).

When her schedule permits some free time, Imani enjoys spending time catching up with friends and her favorite Netflix programs.

STAFF EXCELLENCE AWARDS

Spring Awards and Recognition Reception
April 17, 2024
Celebrating the outstanding staff who go above and beyond in support of LPL!

ELIJAH GARCIA
SCIENCE/ENGINEERING STAFF

Eli Garcia is Manager of Professor Walt Harris' **Optical and Space Flight Instrumentation Development Laboratory**. He began his career at LPL as a student in 2016 and soon transitioned to being an essential member of the staff, maintaining a broad range of facilities including two vacuum test systems, a clean room, a darkroom, a mechanical shop, a compressed gas handling facility, chemical storage, and two electronics fabrication stations. He keeps facilities adequately supplied and maintained ensures that users are properly trained for safe use and have required certifications. Eli also serves as procurement lead for the funded research projects in the lab, including working with vendors to develop quotes for what are often highly customized components that will be incorporated into space flight hardware.

Eli is an active participant in the field component of the user groups' research, essentially extending his expertise beyond the lab. He handles logistics of remote test and flight operations of experiments developed in the lab and assists investigators with all phases of their effort to obtain a successful test or launch, often requiring him to travel to remote locations for up to weeks at a time, during which he has remotely attended to his regular duties.

Eli is adept at handling needs of multiple projects simultaneously, currently managing four projects with four principal investigators, diverse facility requirements, and a constantly changing set of students, postdocs, and engineers that he keeps certified and operating independently of each other. In addition, Eli takes an active role in mentoring undergraduate students in the lab, volunteering to train these students in lab best practices and routinely goes out of his way to research new and cost-effective solutions to problems that keep our project within budgetary and schedule bounds. Under Eli's leadership, the lab cleanroom was recommissioned to meet specific program requirements - a success that was described as a "heroic effort." Thanks, Eli, for your outstanding work in support of optical and spaceflight instrumentation development.

SUSAN ROBISON
ADMINISTRATIVE STAFF

Sue Robison was recognized for her outstanding work in supporting a multitude of projects to achieve their highest potential. Her nominators described the diversity of her responsibilities as enormous and her performance in meeting them as exceptional.

Sue has been a Senior Business Manager at LPL since 2012, starting her career with project support for the **High Resolution Imaging Science Experiment (HiRISE)** project. She currently manages finances for several spacecraft mission instrument teams at LPL, each with unique funding mechanisms and reporting requirements.

Sue creates complex proposal budgets, manages complicated subcontracts, and interfaces with business managers of several external institutions - all while doing the "routine" work of preparing required forms and reimbursements and overseeing travel reports and equipment purchases.

In addition to mission support, Sue plays a key role in proposal budget preparation for programs ranging from graduate-student support programs (e.g., NASA FINESST) to medium-sized data analysis proposals, to large-scale mission proposals. Sue recently took on the role of building manager for LPL's Sonett Building; this job grew in complexity with the moves and renovations that came with the installation of the **Arizona Astrobiology Center** and the anticipated arrival of the **APEX** mission. Sue obtained required renovation quotes, oversaw the reorganization of staff offices, and cataloged and surplussed unused equipment. All these changes involved not only a great deal of planning and logistical effort, but also the ability to work with an entirely new set of building occupants. Sue has handled all these transitions and duties with great competence, regularly going above-and-beyond to keep projects large and small, planned and unplanned, moving forward. Sue is an incredible asset to LPL and to the missions projects and researchers she supports.

SPRING 2024

LPL OUTREACH

JOIN THE FUN

Staff, faculty, and students from LPL are always delighted to share highlights of their research throughout the year with hands-on experiences and exhibits. This spring semester was an active one, with outreach opportunities at large, world-renown events like the Tucson Gem & Mineral Show and the Tucson Festival of Books (TFoB), as well as at smaller, local venues. Below is a sampling of what we were up to for spring 2024.

Students, faculty, and staff at LPL put in a lot of miles this spring bringing LPL research to Arizona science enthusiasts.

We start our semester re-cap with the **LPL Gem Show** booth, another great success this year thanks to the efforts of volunteers like graduate students **Nathalia Vega Santiago**, **Christina Singh**, **Melissa Kontogiannis**, **Gabe Gowman**, and **Orion Hon**, as well as undergraduate PTYS minor **Reed Spurling**, and longtime volunteer **Hector Swidzinski**. Over four full days, the LPL booth featured two sample glove boxes for guests to try their hand at moving precious particles using real lab tools. And we we had a lot of fun with the ever-popular **meteorites-meteorwrongs** test tray.

At TFoB, LPL volunteers including **Denise Blum**, **Joe Schools**, **Ruby Fulford**, **Orion Hon**, **Gabe Gowman**, and others participated in **Science City's Tent of Tomorrow**. In addition to working in the sample glove boxes, visitors attempted to land a 3D printed OSIRIS-REx Sample Return Capsule on a map of the Utah Test and Training Range. And visitors appreciated seeing pictures of the returned Bennu sample.

LPL Assistant Professor **Pierre Haenecour** had an especially busy season of public talks about OSIRIS-REx and the Bennu sample. He gave a much anticipated and well received presentation about the OSIRIS-REx Bennu sample to the International Meteorite Collectors Association for their annual Gem Show gathering. Pierre also spoke to students at Tucson's **Mansfeld Magnet Middle School**, sharing meteorite samples and describing the sample science related to OSIRIS-REx.

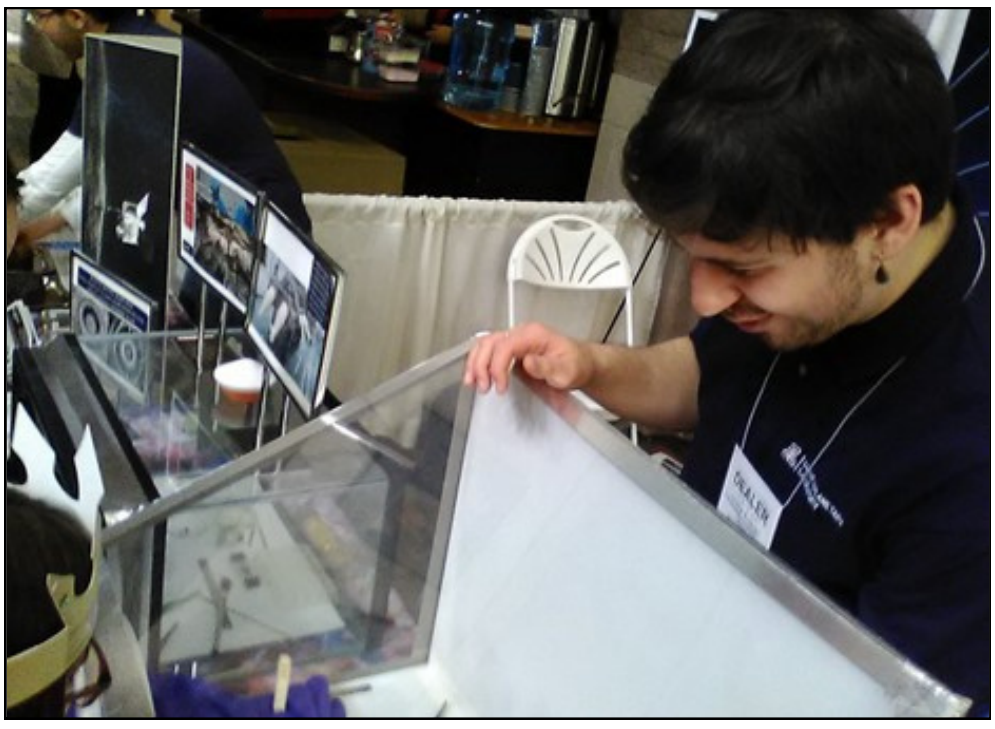
A bit farther afield, Dr. Haenecour gave two special talks about OSIRIS-REx and the Bennu sample for the **North Carolina Museum of Natural Sciences** (Raleigh) Astronomy Days event.

LPL's active outreach to local schools included several visits to classrooms, participation in STEM/STEAM festivals, star parties, and on-site tours for students visiting the Kuiper Space Sciences building. Topics included activities and exhibits about the solar eclipse (April 8), comet making, creating clay planets, and building safe egg-landing parachutes. Tours of the **Kuiper-Arizona Astromaterials Laboratory for Astromaterials Analysis** to learn about advanced materials analysis were popular.

If you would be interested in contacting the department about a visit, tour, or lecture, use the form at the URL below to tell us about your audience and your interests.

Request a speaker from LPL

https://lpl.arizona.edu/outreach/request-speaker



Spring 2024 semester highlights also include:

- Operations Specialist **Tracie Beuden** represented the **Catalina Sky Survey** at the **Paiute Neighborhood Center Sci-Tech Family Festival** in Scottsdale.
- **Dolores Hill** gave a "meet me under the Moon Tree" talk for the **Saddlebrook Hiking Club**.
- **Zoë Wilbur** and **Maizey Benner** spoke to community groups about meteorites, always a popular topic, and grad student **Sam Myers** is looking forward to a summer talk for the **Prescott Astronomy Club**.
- **Carson Fuls** and **Dolores Hill** gave presentations for the ***Stars Over Sabino Canyon*** event hosted by the **Mount Lemmon SkyCenter** and the **U.S. Forest Service**. The event was a combination of daytime solar viewing, presentations, and an evening star party. Presentations were well attended despite the rain!
- In celebration of this year's solar eclipse, first-year graduate student **Nicole Kerrison** gave a special presentation about the Sun at **Flandrau Science Center**.
- Assistant Professor **Jessica Barnes** spoke on science careers at the **Women in Physics** event at **Biosphere2**.

We look forward to seeing you soon!

SPACE SCIENCE SERIES NOW OPEN ACCESS
FORMERLY OUT-OF-PRINT VOLUMES AVAILABLE FOR DOWNLOAD

The **University of Arizona Press** has added 14 formerly out-of-print volumes of the **Space Science Series** to its open access platform **Open Arizona**. The collection makes available again the work of leaders in the field, including **Richard P. Binzel**, **Tom Gehrels**, **Mildred Shapley Matthews**, and many others. These works provide an important archive of a pivotal time in several emerging fields connected to astronomy and the space sciences.

The series brings together the world's top experts, who lay out their foundational research on current understandings, while also building frameworks for the highest-priority questions for the future. The books were originally published between 1976 and 2000. Since 2000, books in the Space Science Series have been produced in collaboration with the Lunar and Planetary Institute in Houston, Texas.

Download books here:

https://bit.ly/UASpaceScienceSeries

LPL IN THE NEWS

Complete list of LPL headlines and linked stories available at: **LPL.Arizona.edu/news**

Near-Earth Asteroid Was Blasted From a Crater on the Moon, Study Finds. For the first time, scientists at LPL have traced an asteroid to its exact place of origin – a particular crater on the moon. (Asphaug, Malhotra)

How Pluto Got Its 'Heart'. Scientists from LPL and the University of Bern in Switzerland used numerical simulations to investigate the origins of Sputnik Planitia, the western teardrop-shaped part of Pluto's heart surface feature. (Denton, Asphaug)

Humans Will Again Set Foot on the Moon; This Time, They'll Have LPL Science in Tow . LPL researchers will have a hand in two of the three instruments NASA selected for deployment on the lunar surface by Artemis III astronauts. (DellaGiustina, Bailey, Marusiak, Bray, Asphaug)

How the Moon Turned Itself Inside Out. LPL researchers have found physical evidence showing us what was happening in the moon's interior during a critical stage in its evolution. (Liang, Andrews-Hanna, Broquet)

Teams Behind OSIRIS-REx Win Prestigious Aviation Award. The team behind the LPL-led NASA mission to sample the asteroid Bennu joins the ranks of the Apollo 11 crew and Orville Wright to earn the Robert J. Collier Trophy. (Lauretta)

Loathed By Scientists, Loved by Nature: Sulfur and the Origin of Life. A LPL-led study by Assistant Professor Sukrit Ranjan shines a spotlight on sulfur, a chemical element that, while all familiar, has proved surprisingly resistant to scientific efforts in probing its role in the origin of life. (Ranjan)

A Pebble Scooped From an Asteroid is Now on Display at UArizona Museum. The Alfie Norville Gem & Mineral Museum is now one of only three places in the world where the public can see a piece of the asteroid Bennu, collected during NASA's University of Arizona-led OSIRIS-REx mission. (Lauretta)

James Webb Space Telescope Captures the End of Planet Formation. How much time do planets have to form from a swirling disk of gas and dust around a star? A new University of LPL-led study gives scientists a better idea of how our own solar system came to be. (Bajaj, Pascucci, Xie, Deng)

The Science of Leap Day – How It Works and Why We Do It. Accurate timekeeping has always been a human necessity, from early civilizations knowing when to plant crops to today's employees knowing when to hold a meeting (or not). (Malhotra)

NASA's OSIRIS-REx Curation Team Clears Hurdle to Access Remaining Bennu Sample. NASA's curation team has opened the treasure chest from Asteroid Bennu! Before the milestone, the team had already removed more than the 60 grams required to declare the mission a success. (Lauretta)