LPL NEWSLETTER

SPRING 2025

THE UNIVERSITY OF ARIZONA
COLLEGE OF SCIENCE
LUNAR & PLANETARY LABORATORY

BENNU COMES FROM A LOST WORLD WITH INGREDIENTS FOR LIFE

By NASA and Daniel Stolte/UA Communications

Nature had the conditions to "cook up" the chemical precursor ingredients for life before Earth formed, according to two studies published by the sample analysis team of **NASA's OSIRIS-REx** mission, which is led by LPL **Regents Professor Dante Lauretta**.

The OSIRIS-REx spacecraft returned a sample from asteroid Bennu in 2023, and following a year of in-depth analyses in labs across the globe, researchers conclude that these conditions and ingredients may have been common across the solar system, increasing the odds of life forming on other planets and moons.

"These samples from Bennu are an incredible discovery, showing that the building blocks of life were widespread across the early solar system," said Lauretta, a co-author on both papers. "By studying how these ingredients interacted in environments like those on Bennu and in places inferred for the early Earth – such as salty ponds similar to those Darwin once imagined – we can better understand how life might emerge and where to search for it beyond our planet."

Bennu coalesced from a small portion of the leftover rubble resulting from a giant collision of asteroids. Preserved in the vacuum of space since the solar system's formation about 4.5 billion years ago, the samples have provided scientists with unparalleled insights into the conditions of that era.

Based on their findings researchers share several theories about the history of Bennu and the solar system.

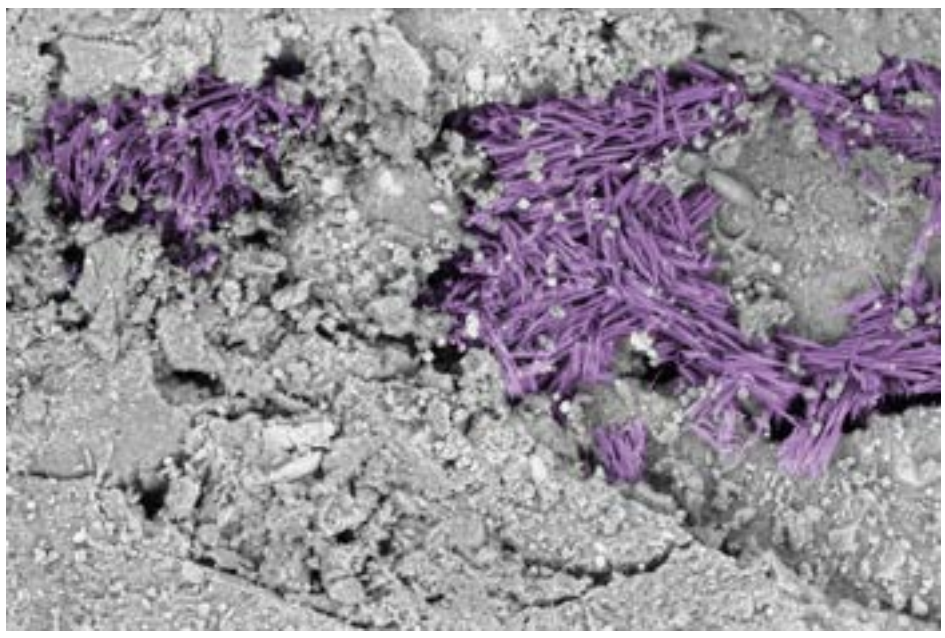
Bennu's molecular composition suggests the ice and organic compounds in its parent body originated in the extremely cold outermost disk of gas and dust that gave rise to the solar system.

Temperatures in the outer disk could dip to minus 400 degrees Fahrenheit, allowing volatile gases that easily evaporate in warmer conditions to accumulate and freeze – among them water vapor, carbon dioxide, methane and ammonia, which was detected in "exceptionally high" abundances in the Bennu samples.

Given the right environment, ammonia can react with formaldehyde, which was also detected in the samples, to form complex molecules such as amino acids – the building blocks of proteins. Fourteen of the 20 amino acids that life on Earth uses to make proteins are found in the Bennu sample. The research team also found all five nucleobases that life on Earth uses to encode structural information in more complex biomolecules like DNA and RNA.

"Besides pointing to the outer solar system origin of abundant ammonia in Bennu's ancestor, our work also supports the idea that objects that formed far from the sun could have been an important source of the raw ingredients for life throughout the solar system," said Danny Glavin, a senior sample scientist at **NASA's Goddard Space Flight Center** in Greenbelt, Maryland. Glavin, together with colleague Jason Dworkin, led the paper in **Nature Astronomy**.

With life's ingredients found in Bennu samples, the big question is: How did these building blocks turn into the chains of molecules needed to activate biology?



Microscope image of a Bennu sample, needles of hydrated sodium carbonate — one of the salts left behind by evaporating brine — are highlighted in purple false color. Courtesy: NASA.

"You can have all the ingredients for whatever you want to make, but you have to have the environment to make them do something," said Tim McCoy, curator of meteorites at the **Smithsonian's National Museum of Natural History** in Washington, D.C.

Along with Sara Russell of the **Natural History Museum** in London, McCoy co-led 66 scientists in a study of minerals in the Bennu samples. In the **Nature paper**, they describe evidence of an ancient environment well-suited to kickstart the chemistry of life.

Ranging from calcite to halite and sylvite, scientists identified 11 minerals that comprise a complete set of "evaporites" from a brine, or salt-saturated water. These evaporites form as water containing dissolved salts evaporates over long periods of time, leaving behind the salts as solid crystals. "We're seeing minerals in Bennu samples that we have never seen before in a meteorite or any extraterrestrial sample," McCoy said.

Finding evaporites indicates that the interior of Bennu's ancestor was warm enough to support liquid water for a substantial amount of time. While several evaporites have been reported from meteorite samples, the Bennu sample represents the first time researchers have seen a complete set preserving an evaporation process that could have lasted thousands of years or more. This process happens in basins of water on Earth, including drying lakes and shallow seas. The researchers deem it possible that on Bennu's ancestor, water could have existed in underground pockets or veins, but not on the surface, as it would have quickly boiled away due to lack of atmospheric pressure.

Co-authors on the two publications include LPL faculty and staff **Jessica Barnes**, **Harold Connolly**, **Dani DellaGiustina**, **Pierre Haenecour**, **Dolores Hill**, **Tom Zega** and **Zoe Zeszut**, all of whom helped with sample analysis taking advantage of the advanced technological resources of **LPL Kuiper-Arizona Laboratory for Astromaterials Analysis**. The following LPL graduate students also were part of this work: **Maizey Benner**, **Kana Ishimaru**, **Nicole Kerrison**, **Iunn Ong**, **Beau Prince**, **Lucas Smith**.

Visit www.lpl.arizona.edu/news to read the complete article.

WELCOME TO THE LPL NEWSLETTER

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

Welcome to the **Spring 2025 LPL Newsletter** where we highlight the many recognitions and awards our faculty, staff, and students have received this past academic year. We are particularly proud of the many recognitions for the **OSIRIS-REx** team under the leadership of **Regents Professor Dante Lauretta** and the naming of **Professor Ilaria Pascucci** as winner of the University of Arizona **Koffler Prize** for her "groundbreaking and transformative contributions to the field of planetary science and observational astronomy."

This semester we've had a strong run of science results, starting off with exciting OSIRIS-REx results highlighted on the cover of ***Nature*** (see our story on page 1). Thanks to OREx, other missions, expansion of our exoplanets portfolio, and the hard work of our faculty, postdocs, staff, and students, our publication output has shown steady growth over the past decade, up 62% since 2015.

As always, we had a very strong pool of graduate applicants this year and we brought many of them to campus back in March. For the first time in the over fifty-year history of our grad program, all of our incoming students will be women. We are excited to welcome them as they pursue studies in planetary atmospheres, astrobiology, surface analog studies, and much more.

Of course, a concern for us is the changing federal funding landscape, including proposed changes to NASA and NSF research and mission budgets. NASA in particular has historically enjoyed bipartisan support in Congress and we are optimistic that with the help of advocacy from the engaged public, including contacts with congressional representatives, proposed changes will be minimally impactful. New University of Arizona president **Suresh Garimella** and Senior Vice President for Research and Innovation **Tomás Díaz De La Rubia** are both strong advocates for the University of Arizona's space science enterprise and we are hopeful that there will be new internal opportunities to help us sustain and grow in the coming year. More so than ever, our donor support is appreciated and will help us navigate through the changing federal landscape.

For more content and **expanded stories with links**, visit **LPL.Arizona.edu/news/2025/spring**.

PTYS ALUMNI

LPL alumni **Dr. Michelle Thompson** (2016) and **Dr. James Keane** (2017) were honored as **2024 Presidential Early Career Scientists** by former president **Joe Biden**. The **Presidential Early Career Award for Scientists and Engineers** is the highest honor bestowed by the United States government on outstanding early-career scientists and engineers.

Dr. Thompson *(left)* is an Associate Professor at **Purdue University**. Dr. Keane *(right)* is a Scientist at the NASA **Jet Propulsion Laboratory**.

Dwight Hoxie (1937-2024)

LPL alumnus **Dr. Dwight Hoxie** passed away on December 27, 2024.

Dwight earned his Ph.D. in Astronomy at the University of Arizona in 1969 with a dissertation titled *The Structure and Evolution of Stars of Very Low Mass*.

Dr. Hoxie worked as a groundwater hydrologist at the **United States Geological Survey**, Reston (VA) Water Resources Division.

LPL FACULTY

JESSICA BARNES
PROMOTION TO ASSOCIATE PROFESSOR

Jessica Barnes' research focuses on understanding the origin and evolution of volatiles in the Solar System. She utilizes a combination of nano- and microanalytical techniques in the **Kuiper-Arizona Laboratory For Astromaterials Analysis** to study mineralogy, geochemistry, isotopes and petrological histories of a wide range of extraterrestrial materials.

TYLER ROBINSON
AWARDED TENURE

Associate Professor Tyler Robinson uses sophisticated radiative transfer and climate tools to study the atmospheres of Solar System worlds, exoplanets, and brown dwarfs. He also develops instrument models for exoplanet direct imaging. Tyler combines these areas of expertise in his work on the **Habitable Exoplanet Observatory (HabEx) Science and Technology Definition Team**, and in his contributions to the **LUVOIR**, **WFIRST/Rendezvous**, and **Origins Space Telescope** mission concept studies.

JEFF ANDREWS-HANNA
PROMOTION TO FULL PROFESSOR

Dr. Andrews-Hanna's research focuses on understanding the processes acting on the surfaces and interiors of the solid-surface planets and moons in our Solar System. He is interested in geodynamic, tectonic, magmatic, hydrologic, and climatic processes, at scales ranging from local to global. To this end, he combines the analysis of gravity, topography, and other remote sensing datasets with numerical modeling.

LYNN CARTER
PROMOTION TO FULL PROFESSOR

Professor Lynn Carter's research interests include volcanism and impact cratering on the terrestrial planets and the Moon, surface properties of asteroids and outer Solar System moons, planetary analog field studies, climate change, and the development of radar remote sensing techniques. Dr. Carter is currently the Science Team Lead for the NASA-provided **VenSAR** radar on the **ESA EnVision** mission to Venus.

STEVE KORTENKAMP
PROMOTION TO FULL PROFESSOR OF PRACTICE

Dr. Kortenkamp focuses on science education, with an emphasis on developing and exploring techniques, including development of 3D tactile resources, for teaching astronomy to students who are blind. He is also interested in planet formation and orbital dynamics of asteroids, dust particles, planetesimals. Steve has authored children's science books for struggling readers in grades K-8.

LPL FACULTY

University of Arizona
KOFFLER PRIZE
ILARIA PASCUCCI

Professor Pascucci won the **2025 Koffler Prize** in the category of Research and Scholarship for her transformative contributions to our understanding of the formation and evolution of planetary systems.

In 2023, Dr. Pascucci's teaching was recognized with receipt of the University of Arizona's Professor Leon and Pauline Blitzer Award for Excellence in the Teaching of Physics and Related Sciences.

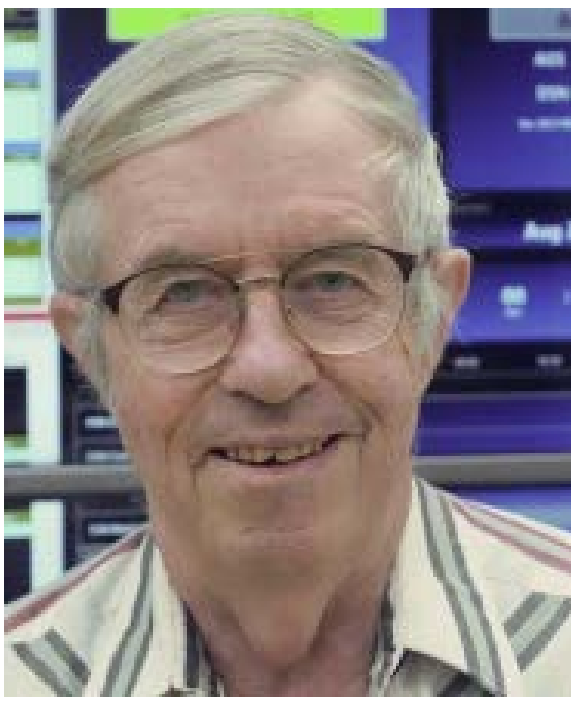
The U of A Koffler Prizes recognize outstanding accomplishment in the areas of teaching; research/scholarship/creative activity or public service/outreach with an emphasis on originality and international recognition.

University of Arizona
DISTINGUISHED SCHOLAR AWARD
KRISTOPHER KLEIN

Associate Professor Klein was named a University of Arizona **Distinguished Scholar** in recognition of his work in advancing space sciences through cutting-edge research in heliophysics. Dr. Klein is Deputy Principal Investigator for the **HelioSwarm** mission and a co-investigator on the **Parker Solar Probe** mission. He is the recipient of a **NASA Early Career Investigator Award**, the **Landau-Spitzer Award for Outstanding Contributions to Plasma Physics**, and the **Harvey Prize**, awarded by the American Astronomical Society Solar Physics Division.

University of Arizona Distinguished Scholar Awards are granted to recently tenured and mid-career faculty who are making transformative contributions to their disciplines and to the university's purpose, mission and values.

University of Arizona College of Science
GALILEO CIRCLE FELLOW
GEORGE RIEKE



Regents Professor Rieke is the Science Team Lead for the **Mid-Infrared Instrument** on the **James Webb Space Telescope**. He previously led the development of the **Multiband Imaging Photometer for SIRTF** instrument for the **Spitzer Space Telescope**. His current science is focused on the capabilities of these instruments.

Dr. Rieke is the recipient of many honors and awards, including a **NASA Public Service Medal**. He is a member of the **National Academy of Sciences**.

Galileo Circle Fellows are academic scholars who demonstrate a deep understanding over a broad range of science, a willingness to think in a truly interdisciplinary way, and an ability to inspire colleagues and students alike.

Congratulations
PARKER SOLAR PROBE

The **Parker Solar Probe** team was honored with the 2024 **Collier Trophy.** This annual award recognizes the most exceptional achievement in aeronautics and astronautics in America with respect to improving the performance, efficiency, and safety of air or space vehicles in the previous year. **Professor Joe Giacalone** and **Associate Professor Kris Klein** are both co-investigators on this mission.

LPL GRADUATE STUDENTS

GTA EXCELLENCE AWARD
CHAUCER LANGBERT

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

Chaucer Langbert won this year's Graduate Teaching Assistant Excellence Award for their support of **PTYS/ASTR 170A1 Alien Earths**, with instructor **Dr. Joe Schools**, during the Fall 2024 semester.

Chaucer was the sole teaching assistant for this writing-intensive class, providing accurate yet encouraging grading for 50+ essays on a weekly basis, in addition to a final project consisting of a 10-minute video. Chaucer made what was best for the student a priority, including providing for revisions of all rather than just a few of the essays.

Chaucer created their own course material and taught portions of the course based on their expertise in climate cycling and exoplanets. They attended all lectures and participated in both in-class and after-class discussions with students. Chaucer's efforts were acknowledged in the student evaluations, which were uniformly excellent.

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

2025 SHIRLEY D. CURSON TRAVEL AWARD

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

Naman Bajaj
ESO RAVEYSO Conference
Garching, Germany

Presenting: *The role of accretion and ejection variability in the evolution of young stars and their disks.*

Maizey Benner
Canadian Center for Electron Microscopy Summer School
Hamilton, Ontario

Practical training and lectures in data processing and operation of telescopes

Lori Huseby
ExoSLAM Summer School and Exoclimes VII conference
Montreal, Quebec

Presenting research on exoplanet hazes

2025 NASA Arizona Space Grant Graduate Fellowships

Nathan Hadland
Research

Characterizing optimal locations for biosignature detection on Mars using geologic complexity

Melissa Kontogiannis
Outreach

Sample Return Mission Development Workshop

Cole Meyer
Outreach

Other Worlds: A STEM Pathway

LPL GRADUATE STUDENTS

MACKENZIE MILLS
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.

Mackenzie Mills defended her dissertation, ***Evolutionary Landscapes and Resurfacing Processes of Planetary Surfaces*** in Fall 2024. Her advisor was **Regents Professor Alfred McEwen**. She is currently a Physical Scientist working at the **U.S.G.S. Washington Water Science Center** in Tacoma, Washington.

Despite spending her first LPL year entirely remote due to COVID and having to relinquish a Fulbright Scholar project, Mackenzie completed her degree in just over four years. While at LPL, she won a **NASA FINESST** grant and two **Galileo Circle** awards and made substantial contributions to research about Mars and icy moons, pursing a broad range of techniques, including analysis of remote sensing data, modeling, and field work.

In her student career as a graduate student, Mackenzie made important contributions to research, teaching, and innovation. She collaborated successfully with multiple scientists at JPL, U of A, U.S.G.S., and the University of Bern. She demonstrated her leadership skills as President of the Alpha Kappa Chapter of **Sigma Gamma Epsilon**. Mackenzie also tutored students and mentored secondary school students in Baltimore and Tucson and has mentored visually-impaired middle and high school students through the U of A initiative, **Project POEM**. Also while a student, she participated in science outreach by giving talks to local astronomy groups.

Mackenzie published four first-author papers while a graduate student at LPL. In the first, she mapped a region around the Tianwen-1 landing site and Zhurong rover in Utopia Planitia, Mars. The mapping established extensive resurfacing by flows, most likely of igneous or sedimentary (mud flow) origin. Mackenzie presented results at the **Lunar and Planetary Science Conference** in 2023. The study of rift zones and resurfacing on Mars was an outgrowth of a summer internship at **NASA Jet Propulsion Laboratory**. The second paper topic also grew from her JPL research about moonquake-induced mass wasting of icy satellites and resulted in a NASA press release. The paper's hypothesis that seismically-induced mass wasting creates smooth (at the 100-m scale) plains will be tested by high-resolution (to 0.5 m/pixel) images and topography from **Europa Clipper**. For her third paper, Mackenzie manually mapped the distribution of pitted cones in **Utopia Planitia** (Mars). And in a fourth paper, Mackenzie used machine learning to map pitted cones over all of Mars, creating global maps of pitted cones and indicating that >90% are over the **Vastitas Borealis** formation. The result supports the case for lowland pitted cones as mud (not magmatic) volcanoes.

Support LPL student endowments
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ANNA TAYLOR
ANDERSSON AWARD FOR SERVICE AND OUTREACH

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

Anna Taylor is a second-year student working with **Associate Professor Tommi Koskinen**. Her research interests include exoplanets and planetary atmospheres.

Despite being an early-career student, Anna has a long list of science outreach to her credit. Early in her student career, Anna volunteered with the U of A College of Science **Brunch with Bennu** event and has gone on to represent LPL at many other events, including the "STEAM Night and Star Party" at Esmond Station K-8 school, Arizona Sands Club Eclipse Viewing Event, and the Mica Mountain High School Computer Science night.

Anna often participates in community science outreach programs. She has served on a graduate panel at the **Conference for Undergraduate Women in Physics** and gave research career talks to the **Women in Physics Club** at North Carolina State University, the **John T. Hoggard High School**, and **Tucson City High School**.

Anna also ran the **Exoplanet-James Webb Space Telescope** station at the University of Arizona Foundation special event for the **Old Main Society**. She facilitated a field trip for a science class from **Tucson City High School** to come to visit LPL and learn about research at the department. She is actively participating in **Arizona Science Center's Girls Who STEM** program where she mentors young girls through lab and science activities, helping them navigate uncertainties and self-doubt in STEM fields; she has mentored over 40 young women mentored to date. Anna also works with the **STAR Labs Mentorship** program, currently advising a high school student on a research project that focuses on the impact of possible planetary magnetic fields on the upper atmospheres of exoplanets.

2025 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.

Roberto Aguilar

Advisor: Jack Holt

Studying the interior of Martian mid-latitude glaciers with data from the SHARAD sounder and leading the development of a state-of-the-art drone-based ground penetrating radar to retrieve shallow subsurface structures in Mars-analog glaciers.

Arin Avsar

Advisor: Daniel Apai

Seeking to understand catastrophic collisions between planetesimals and developing a model that evolves the remnants of planetesimal collisions to determine the ideal disk orientation, stellar type, and observatory to detect such collisions.

Naman Bajaj

Advisor: Ilaria Pascucci

Using the James Webb Space Telescope to study the disks of dust and gas around distant stars where planets are just starting to form.

Orion Hon

Advisor: Lynn Carter

Investigating volcanic environments on Earth that are analogous to lunar volcanic terrains using geophysical instruments that can be employed by future robotic or human explorers on the Moon.

Devin Hoover

Advisor: Tommi Koskinen

Pursuing a comprehensive investigation of the atmosphere of Saturn's moon, Titan, using an unexplored dataset from the Cassini Ultraviolet Imaging Spectrograph instrument.

Lori Huseby

Advisor: Mark Marley

Conducting laboratory studies in exoplanet haze chemistry to better understand how laboratory work can shape and constrain current modeling efforts and future telescopic observations of exoplanets.

Beau Prince

Advisor: Tom Zega

Using transmission electron microscopy to study the mineralogy of **OSIRIS-REx** sample returns at the nanometer scale, to learn about the interior of asteroid Bennu's parent body.

Anna Taylor

Advisor: Tommi Koskinen

Studying the evolution of exoplanetary atmospheres and their interactions with the host stars, with a focus on atmospheric escape. Integration of theoretical hydrodynamic models with observational data aims to refine our understanding of how escaping atmospheres are detected through spectral features.

Chengyan Xie

Advisor: Ilaria Pascucci

Using JWST to investigate the chemical composition of the inner regions of protoplanetary disks. Mining older data sets to characterize the chemical compositions of aging disks to compare with younger samples and map evolutionary trends to advance our understanding of how planetary systems emerge over time.

SPRING 2025

PTYS 590: PLANETARY GEOLOGY FIELD STUDIES

PROFESSOR SHANE BYRNE, INSTRUCTOR

Salton Sea

By Shane Byrne. Photos courtesy of Robin VanAuken, Joe Schools, and Reed Spurling.

This semester, the LPL field trip traveled to the **Salton Sea** in southern California. The Salton Sea is just the latest incarnation of large lakes that have existed there since the end of the last ice age and we were able to see all parts of the lake lifecycle.

We have lakes so often in this area due to the low-lying terrain of the Salton Trough. The famous San Andreas Fault splits into many minor branches in this area; kinks in these minor branches can cause pull-apart basins where the topography is low and the crust is thin. We saw plenty of evidence of this faulting in beheaded alluvial fans and steep mountain fronts. The thin crust also leads to copious geothermal activity (there are plenty of power plants there taking advantage of that). We visited recent volcanic domes and active mud volcanoes that indicate the shallowness of hot subsurface material.

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

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

Because it’s a closed basin, the most-recent historic lake, Lake Cahuilla, dried up a few centuries ago. Tufa deposits that formed in the quiescent lakeshore environment on the hills surrounding the Salton Trough show the former shoreline and old lake sediment is blowing around in the form of sand dunes that we visited in the **Algodones Dunefield** among others. It’s still possible to dig up freshwater shells in the desert in this area.

There’s a much smaller (and shrinking) lake within the trough that is now called the Salton Sea. It was created in the early twentieth century when some careless canal construction accidently diverted the Colorado River (undammed at the time) into the Salton Trough. It took over a year to bring the fiasco under control and get the Colorado flowing back into the Gulf of California again. Eventually, the Southern Pacific Railroad stepped in to stem the flood by dedicating a significant fraction of all its rail traffic to dumping rocks into the breach. Although initially a wonderful resort location, the Salton Sea has become saline and extremely polluted from evaporation and agricultural runoff. Melancholy remnants of the Sea’s golden age are scattered around the shore, along with dead fish and an unwholesome smell. Many plans have been floated to keep the lake levels high and avoid exposing the toxic sediments on its bed, but a solution remains elusive.

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

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

CONGRATULATIONS **PTYS GRADUATES**

RICARDO MACIEL

M.S. in Planetary Sciences
January 13, 2025

Characterization of a Tunable All-Reflective Spatial Heterodyne Spectrometer

Advisor: **Professor Walt Harris**

New position: Researcher/Scientist, Lunar and Planetary Laboratory

UNDERGRADUATE

Astrobiology
Minors

Aleksandar Antonic
Andrew Dull
Noah Fleisher
Ciara Himes
Dylan Kmiec
Calista Madej
Imani Ralph

Planetary Sciences
Minors

Chad Cantin
Korbin Hansen
Ellen Jesina
Reed Spurling

Planetary Geosciences
Majors

Karla Paredes Aguilar
Scott Petersen

LPL GRADUATE STUDENTS

NAMYA BAIJAL

The **Planetary Science Institute** has selected LPL graduate student **Namya Baijal** as one of two winners of the **2025 Pierazzo International Student Travel Award**. Baijal will attend the **Europlanet Science Congress – Division of Planetary Sciences Joint Meeting 2025** (Helsinki, Finland) to present her research titled *Three-dimensional Modelling of the Major Impact Craters on (16) Psyche*.

Namya's research seeks to understand how collisions have shaped the surface of **asteroid (16) Psyche**, a unique metal-rich asteroid in the main belt and the target of NASA's **Psyche Mission**, set to arrive at the asteroid in 2029. Through impact modeling, she and her colleagues aim to help answer the mission's central question: "Is Psyche the leftover core of a differentiated planetesimal, and if so, how did it form?"

PSI established the award in memory of Senior Scientist and LPL alumna **Dr. Elisabetta (Betty) Pierazzo** to support and encourage graduate students to build international collaborations and relationships in planetary science. Awardees receive a certificate and check for $2,000 for conference expenses.

Pierazzo, after whom the prize is named, was an expert in the area of impact modeling throughout the Solar System, as well as an expert on the astrobiological and environmental effects of impacts on Earth and Mars. In addition to her research, she was passionate about education, teaching and public outreach, developing planetary-related classroom materials, professional development workshops for teachers, and teaching college-level classes herself. Betty believed in the strength of broad collaborations in all of her research and education activities.

NATHAN HADLAND

Nathan Hadland has been named an **Achievement Rewards for College Scientists (ARCS) Scholar** for the 2025-2026 academic year. The ARCS Foundation advances science and technology in the United States by providing financial awards to academically outstanding students who are U.S. citizens studying to complete degrees in science, engineering, math, technology, and medical research. Scholars receive a cash stipend, full tuition, and a travel grant.

Nathan's research focuses on microbial life in volcanic environments as an analog for life on Mars. Nathan is a fifth-year graduate student advised by **Associate Professor Solange Duhamel** (MCB) and **Associate Professor Christopher Hamilton**.

MADISON TUOHY

Madison is a third-year Ph.D. student in Geosciences, completing a graduate minor in Planetary Sciences. She is advised by Associate Professor **Christopher Hamilton**. Madison is interested in the active eruptions in Fagradalsfjall, Iceland, and how these eruptions can be used for hazard mitigation and planetary analogs.

Madison recently won four awards from the Dept. of Geosciences:

- **Montgomery Associated Best Overall Talk:** *Observing the effects of complex topography on fissure-fed facies in the 2021-2023 Fagradalsfjall (Iceland) eruption series*
- **Bert S. Butler Scholarship**
- **Spencer R. Titley Graduate Scholarship**
- **John and Nancy Sumner Scholarship** which Madison will use to travel to Italy to participate in a workshop focused on observing active volcanism at Mt. Etna and Stromboli and then to Geneva, Switzerland, to present her work at the **IAVCEI (International Association of Volcanology and Chemistry of the Earth's Interior) General Assembly**.

UNDERGRADUATE PROGRAMS

SARAH NIELSEN
PTYS UNDERGRADUATE MINOR

Sarah Nielsen is a **Biology** and **Biochemistry** major with minors in **Planetary Sciences, Astrobiology, and Emergency Medical Services**. Sarah chose Planetary Sciences as a minor because she has been interested in space since she was a child and the PTYS and ASTRB minors allow her to take advantage of the University of Arizona's great space related curriculum while continuing her love of exploration and discovery.

Sarah's favorite Planetary Sciences class has been **PTYS 214: Life in the Cosmos** taught by **Dr. Dante Lauretta.** She took this as her first planetary science class during her first semester at the U of A. Sarah wanted to take a class that captured her combined interdisciplinary interests in the Earth and life sciences. She enjoyed learning how a few of the "simple" elements (carbon, hydrogen, nitrogen, oxygen, phosphorus, and sulfur) on the periodic table can form complex planetary systems that potentially sustain an environment to harbor life. This class also showed her how planetary science can contribute to other fields, like astrobiology, in answering some of the biggest questions about the universe, including how the planets of our Solar System originated and evolved, and how planetary conditions can impact life.

Sarah is currently working with Dr. Lauretta through the **NASA Arizona Space Grant** internship program on a project studying how deep-sea samples near the Lost City Hydrothermal Field at the Atlantis Massif can be used as an analog for hydrothermal processes on asteroid Bennu. Sarah is using the electron microprobe in the **Kuiper-Arizona Laboratory of Astromaterials Analysis** to do this work.

Sarah plans on applying to M.D. or M.D./Ph.D. programs when she graduates. She wants to stay connected with space missions and make advancements in planetary sciences and astrobiology while also pursuing medicine as a physician.

When she is not working on schoolwork or research, Sarah enjoys practicing archery with the Wildcat Archery team and also enjoys drawing and painting. She is an ambassador for the **Arizona Astrobiology Center**, an activity that allows her to communicate her passion for astrobiology to the Tucson community through outreach events and other center projects.

DORA ELALAOUI-PINEDO
ASTROBIOLOGY UNDERGRADUATE MINOR

Dora is majoring in **Planetary Geosciences** with minors in **Astrobiology, Statistics and Data Science, and Leadership Studies and Practice.** She chose the Astrobiology minor because of it's interdisciplinary nature. She feels that this minor will give her the opportunity for a unique understanding about the the origins of life and the possibility of extraterrestrial life.

Dora especially enjoyed topics studied in **MCB 437: Life in Extreme Environments**, which covered extremophiles, planetary analogs, and biological concepts. She was encouraged by instructor **Dr. Solange Duhamel** to explore these topics through a final project about extremophiles that could live on Europa.

Dora plans to attend graduate school to pursue research related to Europa or Mars. She also wants to participate in fieldwork on planetary analog sites and intends to use her skills in data science when the **Europa Clipper** mission sends data back to Earth. Currently, Dora works as a **NASA Arizona Space Grant** intern advised by **Dr. Sarah Sutton** (LPL). Using **HiRISE** images and spatial visualization software (QGIS), she has located over 2,000 meter-sized, deeply shadowed pits that appear in the layered deposits of Mars' north polar region. Dora is conducting a time series analysis of pits in specific areas to understand their possible formation mechanisms and seasonal changes. In addition to her internship, Dora also works as a student research technician making digital terrain models in the **HiRISE Digital Terrain Model** lab.

When Dora has some free time, she likes to play guitar, read history books, spend time with her family and friends, and participate in science outreach at local schools in Tucson.

STAFF EXCELLENCE AWARDS

Spring Awards and Recognition Reception

April 16, 2025

Celebrating the outstanding staff who go above and beyond in support of LPL!

DATHON GOLISH
SCIENCE/ENGINEERING STAFF

Since joining LPL in 2013, **Dathon Golish** has been an indispensable member of multiple high-profile planetary science mission projects.

Dathon is the Mission Instrument and Observation Scientist for **OSIRIS-APEX**. His leadership with observation planning and calibration and development of detailed observation plans has been essential to the success of OSIRIS-APEX concept of operations development. Dathon is also the Systems and Integration & Test Lead for the **SeisLEMS** payload development on Artemis III's **Lunar Environment Monitoring Station (LEMS)**. He has stepped up to fill key gaps in system design, performance and environmental testing, and validation. Dathon's expertise has been instrumental in keeping the program on track, ensuring that this complex spaceflight instrument meets mission requirements while strengthening LPL's capacity to build cutting-edge planetary seismic instrumentation now and in the future.

Dathon embodies the spirit of mentorship and professional development, guiding numerous undergraduate students in spaceflight hardware development, contributing to both LPL's research excellence and the growth of the next generation of planetary scientists and engineers. His role as Deputy PI of **CatSat**, a student-led CubeSat mission, is just one example of how he has fostered hands-on learning opportunities.

We recognize Dathon for his leadership in spaceflight instrumentation, his technical expertise, deep institutional knowledge, and ability to work seamlessly across engineering and science teams that make it possible for LPL to execute complex, multi-year spaceflight missions. Moreover, we thank Dathon for stepping into additional roles when projects are short-staffed, mentoring early-career scientists, and developing methods that enhance mission capabilities.

DENISE BLUM
ADMINISTRATIVE STAFF

In her role as Research Program Administration Officer, **Denise Blum** does an exceptional job in managing the complex budgets for U of A flagship spacecraft missions, **OSIRIS-REx** and **OSIRIS-APEX**. She brings to her role an unparalleled attention to detail, commitment to teamwork, and a proactive view to improving processes and workflows.

Denise is the subject matter expert for the required financial tracking and reporting required by NASA; she takes the initiative to identify opportunities for cost-savings while considering the needs and perspectives of mission partners and other key stakeholders and considerations. Mission operations run more smoothly because mission partners know they can rely on the precise detail and accuracy of her work.

Denise takes her role as a supervisor seriously and is committed to developing talent within the team. And she is also a team player in every sense, regularly volunteering to take on additional tasks and going "above and beyond," often taking on responsibilities outside of her job description to ensure the success of the OSIRIS-REx and OSIRIS-APEX missions and the cohesion of the mission teams.

Denise Blum's work is indispensable to the OSIRIS-REx and OSIRIS-APEX teams. She is a true professional and a valued colleague who consistently demonstrates excellence in all that she does.

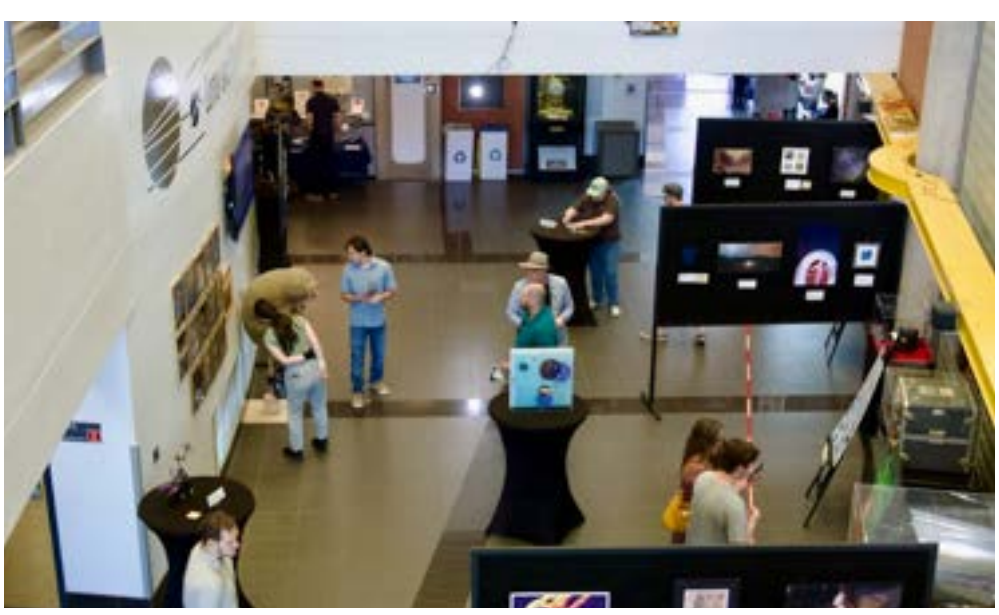
THE ART OF PLANETARY SCIENCE

BY LORI HUSEBY AND SEARRA FOOTE

After a hiatus in 2024, the Kuiper Space Science building and the Lunar and Planetary Laboratory hosted the graduate student-led art show, **The Art of Planetary Science (TAPS)**, over the weekend of February 21-23rd. Over 400 artists, scientists, and community members participated and visited the exhibit, where over 150 pieces of fine art, data art, theme art, and a special exhibit were displayed. This year's theme was "50 Years of Mystery and Discovery on Mars."

One special exhibit involved **Imagination 1**, a mission that took place at the **Space Analog for the Moon and Mars**, a high-fidelity center located at the University of Arizona's **Biosphere 2**. An all-artist crew of four University of Arizona professional artists (a non-fiction writer, a dancer/choreographer, a poet and a textile artist) undertook a six-day simulated Moon mission, generating creative work shaped by the limitations and possibilities of life and culture beyond Earth. We were honored to provide them a space to showcase and present their work. In addition to this special exhibit, there were special events each day, including local bands **Rubee** and **Daytrails**, night and day telescopes provided by **Professor of Practice Steve Kortenkamp** and the **Tucson Amateur Astronomy Association**, respectively, and a burlesque show titled "*Chiasm Cabaret*" at **Hotel Congress** in downtown Tucson.

Visit the TAPS website (https://www.lpl.arizona.edu/art/) for more information on the art show, including art show winners, photo gallery, and information about our upcoming 2026 show. Thank you to everyone who participated and visited the exhibit this year. We cannot wait to see you all again in February 2026 for the next TAPS art show!



Request a speaker from LPL

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

PLANETARY DEFENDERS

LPL ASTEROID HUNTERS ARE FEATURED IN NASA DOCUMENTARY

By NASA Communications

How would humanity respond if we discovered an asteroid headed for Earth?

NASA's ***Planetary Defenders*** is a gripping documentary that delves into the high-stakes world of asteroid detection and planetary defense. Journey alongside a dedicated team of astronomers and scientists working tirelessly to track and monitor near-Earth asteroids, aiming to protect our planet from potential impacts. This documentary captures the intricate and collaborative efforts of these unsung heroes, blending cutting-edge science with personal stories to reveal the human spirit behind this critical global endeavor. Witness the drama, the challenges and the triumphs of those on the front lines of planetary defense.

"I really like that I am protecting the planet. And yes, I'm not the one that's with a cape pushing the asteroid away, that's not what I do. In some ways, my little contribution might not help just myself, but someone in the future, and I think it's very important to do that."

Dr. Cassandra Lejoly
RESEARCHER, SPACEWATCH®
and LPL ALUMNA

*Planetary Defenders focuses on the LPL **Catalina Sky Survey** and **Spacewatch** programs, both part of NASA's Planetary Defense Coordination Office, which has a mission to find, track, and better understand asteroids and comets that could pose an impact hazard to Earth.*

Planetary Defenders debuted on **NASA+** and **YouTube** Wednesday, April 16, 2025.

Watch *Planetary Defenders* at

https://bit.ly/PlanetaryDefenders

CONGRATULATIONS ARIZONA ASTROBIOLOGY CENTER SEED GRANT RECIPIENTS

Eleanor Cornish, Undergraduate Student (Astrobiology minor)
Kayla Smith, Graduate Student (Planetary Sciences/LPL)
Dr. Pierre Haenecour, Assistant Professor (LPL)

The AABC Seed Grant program is an opportunity to foster creative, ambitious, and interdisciplinary scholarship and engagement in the expansive field of astrobiology. This initiative is uniquely inclusive, extending beyond the traditional confines of biological and space sciences. Researchers from the social sciences, arts, science education, and other diverse fields are invited to contribute their perspectives and expertise. The Center aims to nurture innovative, interdisciplinary research endeavors that deepen our understanding of life's origins, evolution, distribution, and future in the universe. This seed grant is a call to thinkers and explorers across all disciplines.

astrobiology.arizona.edu

LPL IN THE NEWS

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

Interstellar Visitor May Have Scrambled Our Solar System. The orbits of Jupiter, Saturn, Uranus and Neptune may have been altered by the fly-by of an enormous object from deep space, billions of years ago. (Malhotra)

An Asteroid Could Hit Earth in 7 years. Here's How Astronomers Are Tracking It. Over the next several weeks, astronomers will be looking closely at an asteroid that could be as big as a football field as they try to determine just how likely it is to strike Earth in 2032. (Fuls)

Hubble Space Telescope has Been Tracking Methane at Uranus for 20 years. This is What it Found . Astronomers have fresh insight into the planet’s atmosphere. (Karkoschka)

From Glacial Preservation to Local Conservation: U of A Experts Discuss Research Ahead of World Water Day. World Water Day was March 22, but at the University of Arizona, water is at the center of rigorous research year-round. (Holt)

Combination of Cosmic Processes Shapes the Size and Location of Sub-Neptunes . A combination of cosmic processes shapes the formation of one of the most common types of planets outside of our solar system. (Fernandes, Bergsten, Pascucci)

James Webb Telescope Reveals Planet-forming Disks Can Last Longer Than Previously Thought. LPL researchers have discovered that disks can grace their host stars much longer than previously thought, provided the stars are small – one-tenth of the Sun's mass or less. (Long, Xie)

Asteroid Bennu Comes From a Long-lost Salty World with Ingredients for Life. Nature had the conditions to "cook up" the chemical precursor ingredients for life before Earth formed, according to two studies published by the sample analysis team of NASA's OSIRIS-REx mission. (Lauretta)

NASA's Pandora Mission One Step Closer to Probing Alien Atmospheres, with Mission Operations Based at U of A. Pandora's exoplanet science working group is led by the University of Arizona, and Pandora will be the first mission to have its operations center at the U of A Space Institute. (Apai, Harshman)

Newly Discovered 'Kiss and Capture' Mechanism Explains the Formation of Pluto and its Largest Moon. A study led by LPL scientists has revealed this unexpected "kiss and capture" mechanism, which could help scientists better understand how planetary bodies form and evolve . (Denton, Asphaug)

Study Sheds Light on Origin of Genetic Code. Despite awe-inspiring diversity, nearly every lifeform – from bacteria to blue whales – shares the same genetic code. How and when this code came about has been the subject of much scientific controversy. (Wehbi, Lauretta)