THE UNIVERSITY OF ARIZONA
COLLEGE OF SCIENCE

LUNAR & PLANETARY LABORATORY

SPRING 2023

LPL NEWSLETTER

Artist's impression of a near-Earth object in space. NASA is on the lookout for near-Earth objects – neighboring asteroids and comets – that could possibly impact Earth.NASA/JPL-Caltech

LPL'S CSS WANTS YOUR HELP HUNTING FOR ASTEROIDS

Thanks to a new **online portal** launched by LPL's **Catalina Sky Survey (CSS)**, anyone can become an asteroid hunter. The portal opens the CSS mission – the discovery and identification of space rocks that regularly visit Earth's neighborhood – to the general public.

Through the new portal, named **The Daily Minor Planet**, CSS scientists will share potential asteroid and comet detections from their ground-based telescopes with anyone with an internet connection. Even amateurs can help scientists find unknown objects in the solar system as they click through and pore over high-resolution, telescope snapshots of the sky that scientists haven't been able to observe.

To begin asteroid hunting, participants create an account on **Zooniverse**, an online platform for people-powered research; a basic tutorial will teach participants to look at sets of images of the night sky taken by one of the CSS telescopes. Each image set contains four exposures taken six or seven minutes apart. The pictures are noteworthy because software spotted a moving speck of light from one image to the next, which may or may not represent the light reflected from a faraway comet or asteroid.

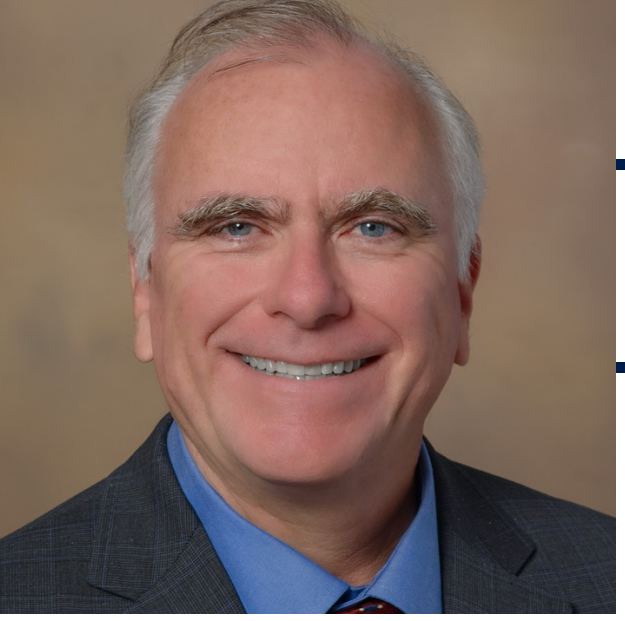
The task for the amateur asteroid hunter: decide if the identified speck of light in the images could be a genuine celestial body or, rather, a false detection resulting from inconveniently timed "twinkles" of the star-studded background, dust on the telescope mirror or other causes. After answering by clicking a "yes" or "no" button, the participant can either write a comment or move on to the next detection.

More than 14,400 NEOs in the past 30 years – almost half of the entire known population of nearly 32,000 – have been discovered by the Catalina Sky Survey. Of those, 1,200 were found just in the past year. The process of spotting a new NEO and reporting it is time sensitive, and astronomers can lose track of them if there is no immediate follow-up on their discovery. That's because NEOs have highly elliptical orbits that only bring them close to Earth every three or four years. Plus, some smaller NEOs can only be detected if they are passing near Earth.

That is where a Zooniverse account comes in handy, as citizen scientists peek through sky photos that the software flagged but weren't obvious enough to make the cut. For each set of images, a participant must decide: Did the software pick up on a never-before seen space object or did it just get confused by the flickering stars? Already, three citizen scientists have discovered 64 possible candidates for unknown asteroids during the testing phase of the web portal. CSS plans to release new data into the interface every day after their scheduled nighttime viewing session.

Read full story: news.arizona.edu/story/astronomers-want-your-help-hunting-asteroids

Join the hunt for asteroids: zooniverse.org/projects/fulsdavid/the-daily-minor-planet



WELCOME TO THE LPL NEWSLETTER

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

Welcome to the **Spring 2023 LPL Newsletter**! As traditional, we highlight in this issue the many awards our amazing faculty, students, and staff have been honored with over the past year. Some of our recent LPL Ph.D. recipients are also highlighted. In early May I had the pleasure of witnessing the hooding of six of our graduates—all women—at the College of Science commencement ceremony.

Also be sure to read about the epic LPL spring field trip to the **Big Island of Hawai'i**. Our field trips are generally expeditions to the diverse geology of Arizona and the Southwest. Fortunately, we can sometimes rely on the **Wilkening-Sill endowment** to head farther afield. The Hawai'i trip was enabled by a combination of the endowment and a generous donation, supplemented by funds from LPL. Reviews from the student participants were across the board excellent and we look forward to doing another trip before too long. Donations to the field trip endowment support these outstanding educational opportunities.

Finally be sure to read the cover story about the **citizen science opportunity** to support LPL's Catalina Sky Survey's asteroid search. This program was the brainchild of CSS' **Carson Fuls**. I look forward to giving it a try.

Of course, we are all looking forward to the return of the **OSIRIS-REx** sample container on **September 24**. NASA TV will be carrying the re-entry live and excitement is building as the Earth-spacecraft distance (currently 0.75 AU as I write this) decreases.

For more content and **expanded stories with links**, visit **LPL.Arizona.edu/news/2023/spring**.

ALUMNI UPDATES

Ali Bramson (2018), Assistant Professor, Purdue University
Received Purdue University's College of Science Faculty Award for Outstanding Contributions to Undergraduate Teaching by an Assistant Professor.

Barbara Cohen (2000), Planetary Scientist, NASA Goddard Space Flight Center
Named Project Scientist for Artemis IV.

Molly Simon (2019), Assistant Professor, Arizona State University
Recipient of Arizona State University College of Liberal Arts and Science Teaching Award

Maria Steinrueck (2021), ***see page 8 for full article***
Awarded 51 Pegasi b Fellowship from the Heising-Simons Foundation.

Michelle Thompson (2016)
Promoted to Associate Professor, Purdue University, Dept. of Earth, Atmospheric, and Planetary Sciences.

PATRICK O'BRIEN
GERARD P. KUIPER MEMORIAL AWARD

PRESENTED TO STUDENTS WHO BEST EXEMPLIFY, THROUGH THE HIGH QUALITY OF THEIR RESEARCH AND THE EXCELLENCE OF THEIR SCHOLASTIC ACHIEVEMENTS, THE GOALS AND STANDARDS ESTABLISHED AND MAINTAINED BY GERARD P. KUIPER, FOUNDER OF THE LUNAR AND PLANETARY LABORATORY AND THE DEPARTMENT OF PLANETARY SCIENCES AT THE UNIVERSITY OF ARIZONA

Patrick O'Brien earned his Ph.D. from LPL in December 2022 with a dissertation on *The Rise and Fall of Lunar Topography,* research which combined theoretical models, high-performance parallel computing, and planetary topography data from Mercury, Ceres, and the Moon. As a student, Patrick developed and combined models of landscape evolution, remote-sensing data processing techniques, and high-performance computing to devise novel approaches for advancing lunar science. In 2020, he developed a landscape evolution model of the lunar surface that answered questions about the rate of space weathering on the lunar surface. Patrick's research as to the source of topographic diffusion of the lunar landscape led to discoveries that updated the canonical model with findings describing diffusivity as both anomalous and non-linear, and that the smallest impactors control the impact-driven diffusion rate. Finally, during his graduate career, Patrick produced the most detailed maps of permanent shadow on the Moon and for the first time cataloged the locations of doubly permanently shadowed regions.

While at LPL, Patrick became known to the planetary science community by participating in opportunities like a JPL Planetary Science Summer School and attending Dawn spacecraft mission team meetings. Patrick presented his work at many professional meetings and participated in outreach events and university service projects like Project POEM, which seeks to foster interest in STEM careers for visually impaired middle and high school students. He acted as a mentor within the UArizona TIMESTEP program, which engages minority students in STEM research. He is also interested in student governance and served as the College of Science representative to the Graduate and Professional Student Council and as the student representative on the committee to select the new Dean for the College of Science.

Patrick is currently a Research Scientist with the **Laboratory for Atmospheric and Space Physics**, University of Colorado, Boulder, and a member of the **Lunar Reconnaissance Orbiter Diviner** team.

Support LPL student endowments by donating to the Andersson and Kuiper Award endowments

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

ADAM BATTLE
ANDERSSON AWARD FOR SERVICE AND OUTREACH

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

Adam is a fourth-year graduate student who has demonstrated a commitment to service to his fellow graduate students and to the broader community since he joined LPL in 2019 and, in fact, even before beginning his graduate career.

As an undergraduate student, Adam supported his community as a volunteer at a food pantry and an ambassador for science, participating in activities like star parties and science fairs. As a graduate student, Adam has continued to encourage a passion for science and to support students in their career development.

In 2021, Adam worked with a Tucson Magnet High School student on a science fair project that collected data using the RAPTORS telescope on top of the Kuiper building. Adam wrote detailed manuals so that the student and their teacher could reduce the data on their own. The student won the Smithsonian Institution's Whipple Observatory Award at the Southern Arizona Research, Science and Engineering Foundation science fair and the student was invited to be the keynote speaker at the observatory's lecture series. And he has mentored two undergraduate students, one of which was accepted into a graduate planetary science program.

Adam's service to the department includes his work in organizing the annual **Lunar and Planetary Lab Conference** for 2020 and 2021. Adam was instrumental in pivoting the 2020 conference to a successful virtual meeting and returned in 2021 to support the in-person off-site conference. In his first semester at LPL, Adam volunteered as webmaster for **The Art of Planetary Science (TAPS)**, a position he continues to hold. In that role, Adam saved the 2020 TAPS exhibit by working with the department webmaster to implement an online web gallery that made the program available to a global audience during the COVID-19 pandemic. His work as TAPS webmaster continues to support improvements to registration and archiving.

In addition to receiving the Andersson Award, Adam was the LPL nominee for the **College of Science Graduate Excellence Award for Service**. Adam's dedication to a service impact outside of his academic responsibilities embodies the spirit of the **Andersson Award for Service**.

CONGRATULATIONS **LPL FACULTY**

Jessica Barnes

Awarded **Nier Prize** from the Meteoritical Society

Assistant Professor Jessica Barnes strives to understand the origin and evolution of volatiles in the inner Solar System utilizing a combination of nano and microanalytical techniques to study mineralogy, geochemistry, and petrological histories of a wide range of extraterrestrial materials. She was selected by NASA in 2019 to study the previously unopened **Apollo sample 71036** and received a **$1.5M gift** in support of the sample analysis. Also that year, Jess was named by ***Nature*** magazine as one of five young scientists who will shape the next 50 years of Moon research. In 2020, NASA named her to the **Early Career Award** program.

The Nier Prize is awarded to young scientists for outstanding research in meteoritics.

Kristopher Klein

Promotion to Associate Professor

Kris Klein's research focuses on studying fundamental plasma phenomena that governs the dynamics of systems within our heliosphere as well as more distant astrophysical bodies. He has particular interest in identifying heating and energization mechanisms in turbulent plasmas such as the solar wind.

Dr. Klein is serving the Deputy Principal Investigator for the **HelioSwarm** mission, a planned observatory to launch by the end of this decade nine spacecraft to measure the dynamics and evolution of turbulent plasmas at multiple points across multiple scales. In 2022, he received the **Landau-Spitzer Award** for Outstanding Contributions to Plasma Physics. He has been with LPL since 2017.

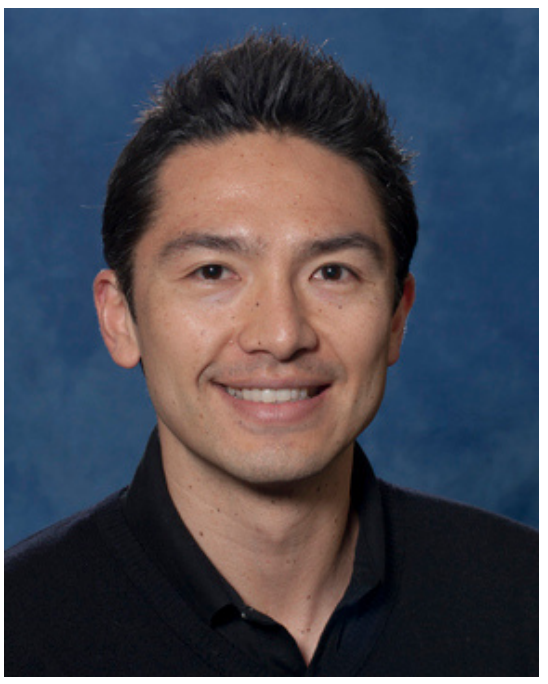
Tommi Koskinen

Promotion to Associate Professor

Dr. Koskinen’s research focuses on the **structure and evolution of planet and satellite atmospheres in the Solar System and extrasolar planetary systems**. He is particularly interested in the physics and chemistry of the middle and upper atmosphere that he studies with the analysis of observations and theoretical modeling. Tommi was a participating scientist on the **Cassini** mission and is still actively involved in researching the atmospheres of Saturn and Titan. He develops and maintains models of exoplanet atmospheres that are required to interpret current and planned observations as well as to simulate mass loss and address questions on long-term evolution. Dr. Koskinen was appointed as Assistant Professor at LPL in 2017.

Isamu Matsuyama

Promotion to Full Professor



Dr. Matsuyama has been with LPL since 2011. His research is focused on understanding the **formation and evolution of solar system planets and planetary satellites**, with an emphasis on the connections between rotational dynamics, orbital dynamics, and interior structure. He develops theoretical models which are used to interpret spacecraft and ground-based observations.

Current research interests involve improving our understanding of (1) the formation and evolution of the Moon by analysis of the global lunar figure, which provides a record of prior orbital and rotational states; and (2) characterization of the thermal and orbital evolution of icy satellites, with particular emphasis on determining the long-term survivability of their subsurface oceans.

RETIREMENT FOR CAITLIN GRIFFITH

PROFESSOR GRIFFITH TRANSITIONS TO EMERITUS FACULTY

Caitlin joined LPL in 2002 after 8 years at Northern Arizona University, where she rose to the rank of Associate Professor. She was promoted to Professor at UArizona in 2009. A look at Caitlin's CV reveals her varied interests, from observational studies of the **atmosphere of Titan**, where she was the first to discover clouds, to studies of **giant planet, brown dwarf, and exoplanet atmospheres**. Caitlin had the idea to organize the first exoplanet-brown dwarf-Solar System synergy meeting in Flagstaff in 2000. She spearheaded and nurtured a multitude of international collaborations, including with researchers at the **Observatorio National in Brazil** and the **Observatiore de Paris in Meudon, France**. At LPL, she regularly taught the planetary atmospheres core class, educated numerous students on how to use a telescope, and shepherded a number of graduate students to a Ph.D. A reception in Caitlin's honor was held at LPL on May 16.

VERONICA BRAY JOINS RESEARCH FACULTY

DR. BRAY HAS BEEN A RESEARCH SCIENTIST WITH LPL SINCE 2011

Veronica has worked as a **Spacecraft Operations Engineer** with the **HiRISE** project, investigating central pit craters with the HiRISE and **Lunar Reconnaissance Orbiter Camera** teams. Her research focus is impact cratering, channel formation, fracturing and landscape evolution on a variety of planetary bodies. She uses observations at multiple wavelengths, computer modeling, terrestrial fieldwork and theoretical analysis to study the surface processes themselves and also the surface/sub-surface properties of planetary bodies.

Veronica earned her Ph.D. in planetary science from Imperial College London in 2008. In addition to her research with HiRISE and LROC imagery, Dr. Bray has conducted crater mapping and analysis studies on the Galilean satellites. In 2022, she co-authored a study detailing the discovery of an asteroid impact crater beneath the North Atlantic Ocean that could have implications for the dinosaur extinction.

WELCOME ANGELA MARUSIAK

DR. MARUSIAK JOINS LPL AS AN ASSISTANT RESEARCH PROFESSOR

Angela grew up in New Jersey and attended Boston University as an undergraduate, with a **Geophysics & Planetary Sciences** major and **Mechanical Engineering** minor. She worked at both **Columbia** and **Rutgers** universities before attending graduate school at the **University of Maryland**, where she joined the NASA **InSight** mission team, focusing on the use of terrestrial geophysical analog locations to prepare for future missions.

Angela completed her Ph.D. in 2020 and spent two years as a postdoctoral scholar at the **Jet Propulsion Laboratory**, where she joined the **Dragonfly** mission team and continued working on planetary seismology problems, especially the modeling of icy ocean worlds. At LPL, Angela looks forward to developing the next generation of seismometers to explore the Solar System.

SPRING 2023 PTYS 590 FIELD TRIP

HAWAI'I

BY SHANE BYRNE, BRETT CARR, AND CHRISTOPHER HAMILTON

LPL field trip in front of Mauna Kea. Photo courtesy Harry Tang

Thanks to the generosity of donors and support from LPL, the **PTYS 590 planetary geology field studies course** was able to venture further and longer than usual this semester. Arizona and its surroundings is gifted with exceptionally diverse geology, but there are some processes, such as active volcanism and new lava flows, that are best seen elsewhere. This March, thirty of us packed our bags for the **Big Island of Hawai'i** to explore at some of the freshest lava flows in the world. Led by **Professor Shane Byrne**, we spent eleven geology-filled days on the trip and we needed every one of them! We were especially fortunate to have the expertise of **Associate Professor Christopher Hamilton** and **Dr. Brett Carr**, who have researched many of these field sites.

Our group stayed in Kona one night before departing for **Volcano Village** and our base of operations at the **Holoholo In** (yes, there's only one 'n'). Volcano village is ideally located and we had the entire hostel reserved for our group, so it made an excellent headquarters. Although Hawai'i is made up of several large shield volcanoes, we spent most of the trip on the nearby **Kīlauea Volcano** on the south side of the island and its rift zones. Much of the recent volcanic activity has been concentrated there in an area that is largely covered by **Hawai'i Volcanoes National Park** and off to the east.

The summit area of Kīlauea in the national park has many interesting sites. We started at the old site of the **Hawaiian Volcano Observatory** (now derelict) at the **Uēkahuna Overlook**, where we heard from a living legend of volcanology, **Dr. Don Swanson**. Our group had the opportunity to walk through the **Kīlauea Iki caldera**, which hosted a lava lake during an eruption in 1959. There's still a lot of heat under the surface—fissures there continue to vent steam over 60 years after the eruption. The next day, we headed through the park to the coast, stopping at the devastation trail (devastated by tephra from the same 1959 Kīlauea Iki activity). We stopped at **Maunaulu**, a shield volcano that was built during an eruption in 1969–1974, and saw a perched lava pond on its flank. Our group got thoroughly drenched in the rain, but luckily that was the worst of the weather for the rest of the trip. We were able to dry out a little down on the coast looking at the **Hōlei Sea Arch**.

Occasionally, eruptions and lava flows wipe out neighborhoods in Hawai'i and that occurred near **Pāhoa** in 2018. Some enterprising landowners now provide tours of the area, giving us a chance to see a very young cone and lava field up close. We toured the Ahu'ailā'au cone (Fissure 8 of the eruption), which is one of many eruption sites powered by activity many miles away at the Kīlauea caldera.

Lava–seawater interactions lead to spectacular explosions and we observed the results of those in several locations. Fine-grained debris from these explosions piles up in littoral cones that later can be eroded away by the waves. One of these cones near Southpoint is so rich in the mineral olivine that the sand on the adjoining beach is green. Other beaches we visited had the more common black sand (one of which came from the 2018 eruption above), which is basically the volcanic rock basalt that has been mechanically pounded into small pieces. Although it is not widespread on the Earth, this black sand has a special planetary connection as it's quite similar to what we commonly see on Mars.

Hawai'i has a lot of other interesting sites to offer such as waterfalls, lava tubes, and incredible night-sky viewing. Fortunately, we were able to sample all these and more. The **West Hawaii Astronomy Club** met us with telescopes at the **Mauna Kea** visitors center one evening and wow'ed us with gorgeous views.

Hawai'i has a rich history that informs the modern culture. The many sites we visited provided an opportunity to learn about the history of Hawai'i. Footprints preserved in ash at **Ka'u desert** attest to the long history of human habitation. Contact with Europeans began at Kealakekua Bay and set in motion a chain of contentious events that made Hawaii a U.S. state 180 years later. As planetary scientists, an issue of great relevance to us is telescope building on Mauna Kea. A complex dispute about how best to balance the science, economics, and sensitivity to Hawaiian customs and beliefs there continues to this day. A solution is elusive, but one can hope that education and understanding can lead to respect and ultimately agreement on a path forward.

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

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

LPL ALUM AWARDED 51 PEGASI B FELLOWSHIP
MARIA STEINRUECK

Dr. Maria Steinrueck (2021) is the recipient of a **51 Pegasi b Fellowship** from the Heising-Simons Foundation. The 51 Pegasi b Fellowship provides postdoctoral scientists with the opportunity to conduct theoretical, observational, and experimental research in planetary astronomy. Dr. Steinrueck's research seeks to enable more accurate observational interpretations and predictions across a range of exoplanet types through three-dimensional climate modeling. "We knew that photochemical hazes exist on exoplanets, but nobody had examined what they do in three dimensions. We had only one-dimensional models, which cannot describe the weather of a planet fully."

As an undergraduate student majoring in physics with a focus on particle physics, Maria encountered a team studying exoplanet atmospheres and recalled her own excitement, years earlier, when exoplanet winds were first measured. It was enough to change her course as a scholar and professional. "I was drawn to climate models where you can actually simulate the winds and temperature distribution on an exoplanet and see what that looks like in three dimensions, through day and night differences in temperature and other conditions. 3D models are necessary to more fully understand what's happening on planets we cannot see directly."

Today, Maria examines how clouds and hazes impact a planet's atmospheric circulation, temperatures, and transmission and emission spectra. Photochemical hazes, born of UV reactions with molecules such as methane, can significantly distort or mute the chemical signatures observed and used to characterize a planet. In a first for her field, Maria developed a three-dimensional climate model that predicts the location of photochemical hazes in the atmospheres of Hot Jupiters, the largest and most extensively described exoplanets to date.

During her fellowship, Maria will model 3D atmospheric circulation for a wide variety of exoplanets, determining how haze particles mix and move across different planetary conditions. Included in this exploration will be cooler, smaller planets closer in size to Neptune and Earth, which are increasingly observable through next-generation telescopes. "With the new space telescope (**JWST**) we will get more data and details about smaller exoplanets. From the first measurements published, we can already see there is uneven cloud and haze coverage, with a lot of 3D effects that must be factored in to interpret observations of these planets correctly." Maria's modeling will improve the accuracy of interpreting these observations, for a clearer picture of distant planets more like our own.

Prior to starting her 51 Pegasi b Fellowship at the **University of Chicago**, Maria will continue in her position as the **Atmospheric Physics of Exoplanets Prize Postdoctoral Fellow** at the **Max Planck Institute for Astronomy** in Heidelberg, Germany.

2023 LPL STAFF EXCELLENCE AWARD
NANCY RAMOS

In her role as **Executive Assistant** for the **OSIRIS-REx** management team, Nancy provides administrative, technical, and logistical support for the mission team. Nancy excels in her high-pressure role, making the organization of meetings, calendars, and large team events seem effortless. She ensures efficient team communication and manages special projects such as the team's recent move from the Drake building to the Kuiper building. In addition to her many professional contributions, Nancy volunteers to support department activities of all types and to foster a sense of community with LPL as well as the OSIRIS-Rex team.

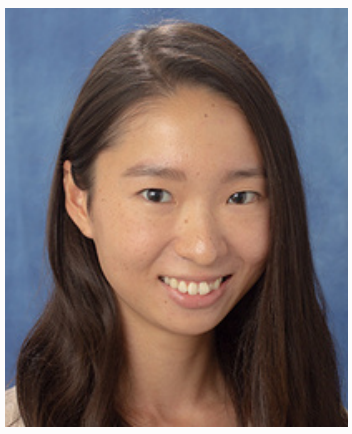
Prior to joining the OSIRIS-REx team, Nancy spent six years in similar administrative roles, first at Northern Arizona University and then at the University of Arizona. Nancy has a Bachelor's degree in English from Northern Arizona University.

In her free time, Nancy enjoys spending time with her husband and two cats. Nancy adores all things feline and was founding president of Northern Arizona University's student-run "trap, neuter, vaccinate, return, manage" organization, the **Feral Cat Alliance**.

Asteroid 47862 Nancyramos was named in her honor.

PTYS GTA EXCELLENCE AWARD

TEACHING OR MENTORING THAT GOES ABOVE AND BEYOND, BASED ON STUDENT EVALUATIONS AND RECOMMENDATIONS



Kana Ishimaru

Fall 2022
PTYS/ASTR 170A1, Alien Earths
Instructor: Jessica Barnes

2023 LPL nominee for College of Science Graduate Excellence Award for Teaching and Mentoring

Jada Walters

Fall 2022
PTYS 212, Science and Politics of Climate Change
Instructor: Tommi Koskinen

2023 LPL COLLEGE OF SCIENCE GRADUATE EXCELLENCE IN SCHOLARSHIP

Rachel Fernandes

Outstanding Research, Publications, and Presentations

ZOË WILBUR
P.E.O. SCHOLAR AWARD

Ph.D. candidate **Zoë Wilbur** is one of 110 doctoral students in the U. S. and Canada selected to receive a $20,000 Scholar Award from the **P.E.O. Sisterhood**. She was sponsored by **Chapter FF of Tucson, Arizona**.

As a student at LPL, Zoë analyzes volatiles in meteorites and also in Apollo surface samples as part of the **NASA ANGSA project**. She is the recipient of a **NASA Future Investigators in Earth and Space Science and Technology Award**.

The P.E.O. Scholar Awards were established in 1991 to provide substantial merit-based awards for women of the U.S. and Canada who are pursuing a doctoral-level degree at an accredited college or university. Scholar Awards recipients are a select group of women chosen for their high level of academic achievement and their potential for having a positive impact on society.

The P.E.O. Sisterhood, founded January 21, 1869, at **Iowa Wesleyan College**, Mount Pleasant, Iowa, is a philanthropic educational organization dedicated to supporting higher education for women. There are approximately 6,000 local chapters in the U.S. and Canada with nearly a quarter of a million active members.

2023 CHAMBLISS ASTRONOMY ACHIEVEMENT STUDENT AWARD
LORI HUSEBY

Exemplary research by students who present a poster at **American Astronomical Society** meetings.

The Great Escape!
Extreme-UV Grids for K-Type Stars

2023 LPL CURSON TRAVEL AWARD
FUDA NGUYEN

Support for summer travel and study outside of the state of Arizona.

Travel to the Sagan Exoplanet Summer Workshop at CalTech

CONGRATULATIONS **PTYS GRADUATES**

Rachel Fernandes
April 20, 2023

Exoplanet Demographics Beyond Kepler: Giant Planets with Radial Velocity & Young Planets with TESS

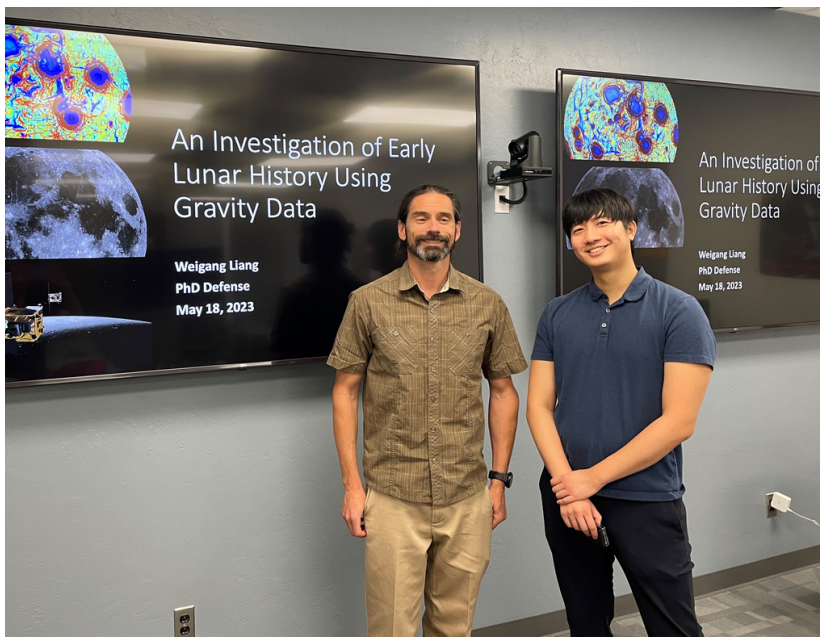
Advisor: **Professor Ilaria Pascucci**

New position: Penn State, President's Postdoctoral Fellow and Center for Exoplanets and Habitable Worlds Fellow

Weigang Liang
May 18, 2023

An Investigation of Early Lunar History Using Gravity Data

Advisor: **Associate Professor Jeff Andrews-Hanna**



Allison McGraw
April 14, 2023

Asteroid-Meteorite Linkages through Infrared Spectroscopy

Advisor: **Professor Vishnu Reddy**

New position: Physics Laboratory Manager, Texas A&M (Physics & Astronomy)

Laura Seifert
April 12, 2023

Dust Condensation in Circumstellar Environments: Insight from Chemical and Microstructural Analyses of Presolar Grains

Advisor: **Professor Tom Zega**

New position: NASA Postdoctoral Program Fellow, Johnson Space Center

Amanda Stadermann
February 6, 2023

From Earth to Neptune: The Mineralogical Properties of Small Planetary Satellites and Co-orbital Objects

Advisor: **Assistant Professor Jessica Barnes**

New position: NASA Postdoctoral Program Fellow, Johnson Space Center

Tarunika Ramprasad
Dept. of Materials Science and Engineering
Minor in Planetary Science

April 10, 2023

Reverse Engineering the Thermochemistry of the Early Solar Nebula through Transmission Electron Microscopy and Thermodynamic Modelling of Refractory Planetary Materials

Advisor: **Professor Tom Zega**

Brandon Tober
Dept. of Geosciences
Minor in Planetary Science

April 24, 2023

Radar Sounding Analysis of Mountain Glaciers in Alaska: Revealing Ice Thickness, Subglacial Topography, and Geologic Structure

Advisor: **Professor Jack Holt**

Support LPL students by donating to the

LPL Carson Graduate Fellowship

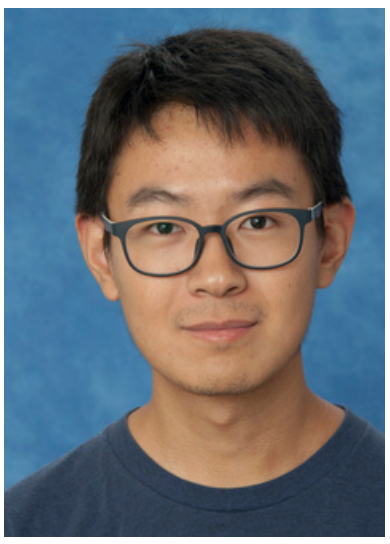
https://give.uafoundation.org/science-lpl

2023 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.

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.



Xiaohang Chen
Advisor: Joe Giacalone

Seeks to understand the acceleration and transport of solar energetic particles (SEP) associated with fast and wide coronal mass ejections to better predict dangerous SEPs.

Nathan Hadland
Advisor: Solange Duhamel & Christopher Hamilton

Studies planetary analogs in Iceland and elsewhere to evaluate the nature of life and their resulting biosignatures in extreme environments that have similar characteristics as Mars.

Mackenzie Mills
Advisor: Alfred McEwen

Using 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.

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.

Jada Walters
Advisor: Kris Klein

Investigating and identifying instabilities in solar wind plasma, modeling plasma instabilities in one and two dimensions to more accurately model the solar wind in three dimensions in advance of upcoming mission to explore near-Earth plasmas.

Zoë Wilbur
Advisor: Jessica Barnes

Investigating the volcanic and magmatic histories of Apollo 15 and 17 basalts using sample analysis, with a focus on a previously unopened Apollo 17 basalt sample. Measurements will help to answer key questions about how volcanism works on the Moon and potentially on other airless Solar System bodies. The sample analysis is particularly timely as the future NASA Artemis missions will include sample returns.

The Department of Planetary Sciences wrapped up the academic year with a count of 23 undergraduate minors in **Planetary Sciences** and 29 in **Astrobiology**. On April 28, LPL hosted a lunch for graduating seniors.

Congratulations to graduating ASB minors **Michelle Burr** and **Brooke Carruthers** and to PTYS minors: **Jared Bartunek, Morgan Cryder, Charlie Goldberg, Nicole Kerrison, Melissa Kontogiannis, Kevin May, and Bennett Skinner**.

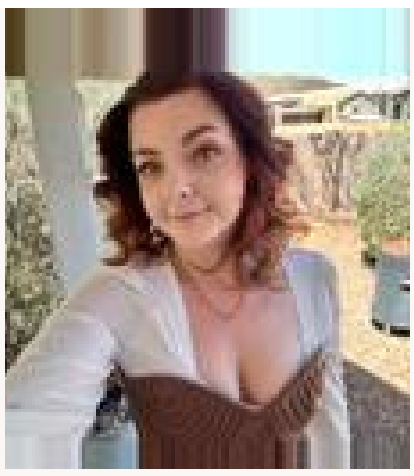
BENNETT NEIL SKINNER
PTYS UNDERGRADUATE MINOR

Bennett graduated with a major in **Astronomy and Physics** and minors in **Computer Science and Mathematics** in addition to Planetary Science. He will pursue an M.Sc. in Physics and Astronomy with collaborative work in Astrobiology at **McMaster University** beginning this fall and hopes to move into a Ph.D. program and an academic career in astronomy.

As an undergraduate, Bennett's favorite course was **PTYS 450** (Origin of the Solar System and aOther Planetary Systems), taught by **Professor Ilaria Pascucci**. The course inspired him to push his knowledge beyond the classroom, resulting in an honors thesis that looked at CI emission from protoplanetary disks using the Atacama Compact Array as a check on previous studies reporting CO depletion. Bennett writes, "We detected CI in half our sample, the highest rate of any protoplanetary disk CI survey thus far, nearly doubling the total number of CI detections. We found that CI fluxes are consistent with protoplanetary disk models assuming an ISM-like gas:dust ratio of 100, implying that CO is not depleted in the disk. We also found that CI flux correlates with CO isotopologue fluxes that trace the upper layers of the disk, showing that CI traces the upper layers of the disk where CO dissociates but CI has not yet ionized. " Results of the project have been submitted to *The Astrophysical Journal* with Bennett as one of three authors. Before starting graduate school, Bennett will work on a project using disk wind data from the **James Webb Space Telescope**.

Bennett has wide-ranging hobbies, with particular interests in history, politics, geopolitics, and biology. He tries to track every major election in the world, make predictions, and watch the results as they roll in. He enjoys museums, hiking, and documentaries and is a fan of the sci-fi and fantasy genres, as well as video games.

MICHELLE BURR
ASB UNDERGRADUATE MINOR



Michelle majored in **Cellular and Molecular Biology**, minoring in Astrobiology for the opportunity to work with LPL scientists with HiRISE, OSIRIS-REx and NIRCam. She has been accepted into the **Arizona Biological Biomedical** doctoral program for fall 2023 and plans to earn a Ph.D. in **Cellular Molecular Medicine**. Her career goals include working for NASA on radiation and nucleic acid research.

Michelle cites two courses from the ASB program as particular favorites. She says that being able to learn from **Regents Professor Alfred McEwen**, Principal Investigator for HiRISE and instructor for **PTYS 442** (Mars) was a "once in a lifetime experience." One of the assignments required her to provide a scientific rational for the Mars Reconnaissance Orbiter to use HiRISE to take a high-resolution image of her assigned Martian surface coordinates. The result was a one-of-a-kind framed high-resolution image of the Martian surface that hangs now in her room.

Professor Ilaria Pascucci's ASTR 450 (Origin of the Solar System and Other Planetary Systems) class was also a favorite. Michelle says, "This class was one of the most difficult classes I took in the minor, but...it made everything finally click for the formation of our solar system....I was able to link birth sites of planets and their formation with our solar system, and that was extraordinary."

Michelle is currently studying the effects of ionizing radiation on a species of the common house mosquito, a project she began at **Pima Community College** while in their ASCEND program. After transferring to UArizona, Michelle joined **SEDS/ASCEND** team and continued perfecting a model that allows mosquitos to enter near space and become introduced to ionizing radiation; she then analyzes their post-orbit DNA anomalies and protein disparities. In the course of this research, Michelle began volunteering with **Dr. Julie Ledford (Cellular and Molecular Medicine)** on research with asthma and airway diseases, specifically on a novel menopausal asthmatic model to understand the molecular pathways involved in onset of uncontrolled asthma post-menopausally.

Michelle enjoys hiking and rock climbing and takes advantage of Arizona dark skies for stargazing.

PTYS STUDENT SPOTLIGHT
SEARRA FOOTE

Searra is beginning her second year as a graduate student at LPL. She studies **exoplanets** to determine potential suitability for life, drawing from the fields of astrobiology and exoplanet science.

Searra develops and uses models to understand exoplanet atmospheres, which helps researchers learn not only more about the behavior of these planets, but also about other planets similar to Earth. Searra hopes that expanding research in the fields of astrobiology and exoplanets promotes public interest in science and inspires young people, especially girls, to pursue research in space science. Searra's faculty advisor is **Associate Professor Ty Robinson**.

2023 HITACHI ELECTRON MICROSCOPY SCHOLARSHIP

The **Kuiper Materials Imaging and Characterization Facility** 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**.

KUIPER IMAGING FACILITY

HITACHI
Inspire the Next

Kelsey E. Hanson is a Ph.D. candidate in the **School of Anthropology**, specializing in the **archaeology of the U.S. Southwest**. She is particularly interested in how specialized knowledge is cultivated and circulated in communities and how this is encoded in material culture. In contemporary Pueblo communities, paint recipes are often maintained and passed down by ritual sodalities, making paint an ideal medium to understand **sociopolitical organization through time**. Drawing from anthropological archaeology, Indigenous philosophy, and conservation science, Hanson's dissertation research problematizes paint technology to understand the **circulation of specialized knowledge** in the rise and fall of the Chaco World of northern New Mexico (A.D. 850–1300). To characterize paint recipes, Hanson is currently analyzing particulate samples collected from archaeological pigments, paint production tools, and painted media using a combination of polarized light, microscopy, X-ray fluorescence, Fourier transform infrared spectroscopy, Raman spectroscopy, and scanning electron microscopy. Thus far, these analyses are revealing new mineral colorants, specialized processing techniques, and previously unrecognized traditions of paint production.

By treating paint technology as a material proxy for specialized knowledge, Hanson is using the circulation of paint technology to **understand changing power relations through time**, offering a new perspective on the sociopolitical history of the Chaco World.

Anton A. Samoylov is a third-year year **Chemical Engineering** Ph.D. student advised by **Dr. Adam D. Printz** in the **Dept. of Chemical and Environmental Engineering**. Anton's research interests are motivated by a vision for a sustainable future, sparked by undergraduate research in sustainable plastics. His research currently focuses on engineering the mechanical stability of **perovskite** for applications in **thin film photovoltaics through nano-compositing**.

Advanced electron microscopy is crucial in guiding the development of composite perovskite thin films in Anton's experiments. "The **Hitachi Electron Microscopy Scholarship** is of great help when it comes to providing financial support to help me focus on my research as I prepare to submit my results for publication within the upcoming months. I hope my work will also help highlight the role **Hitachi** and the the **Kuiper Imaging Facility** play in advancing quality research at the University of Arizona for a diverse set of departments."

WEBB TELESCOPE DISCOVERS WATER IN MAIN-BELT COMET

COMET 238P/READ DISCOVERED BY LPL SPACEWATCH® PROGRAM

On Oct. 24, 2005, **SPACEWATCH®** observer **Mike Read** discovered a main-belt comet using the SPACEWATCH® 0.9m telescope on Kitt Peak mountain. Now, astronomers using the **James Webb Space Telescope's Near-Infrared Spectrograph** instrument, have discovered water vapor around that very object, **Comet 238P/Read**. This observation marks the first time that a gas – specifically water vapor – has been found around a comet in the main asteroid belt, indicating that water ice from the primordial solar system can be preserved there. However, the successful detection of water comes with a new puzzle: unlike other comets, Comet 238P/Read had no detectable carbon dioxide.

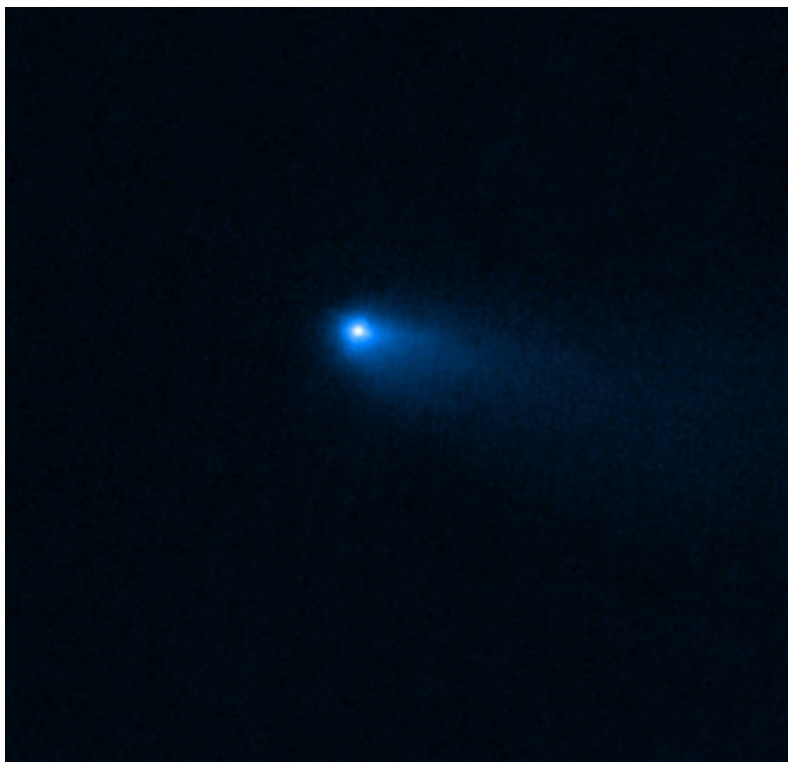


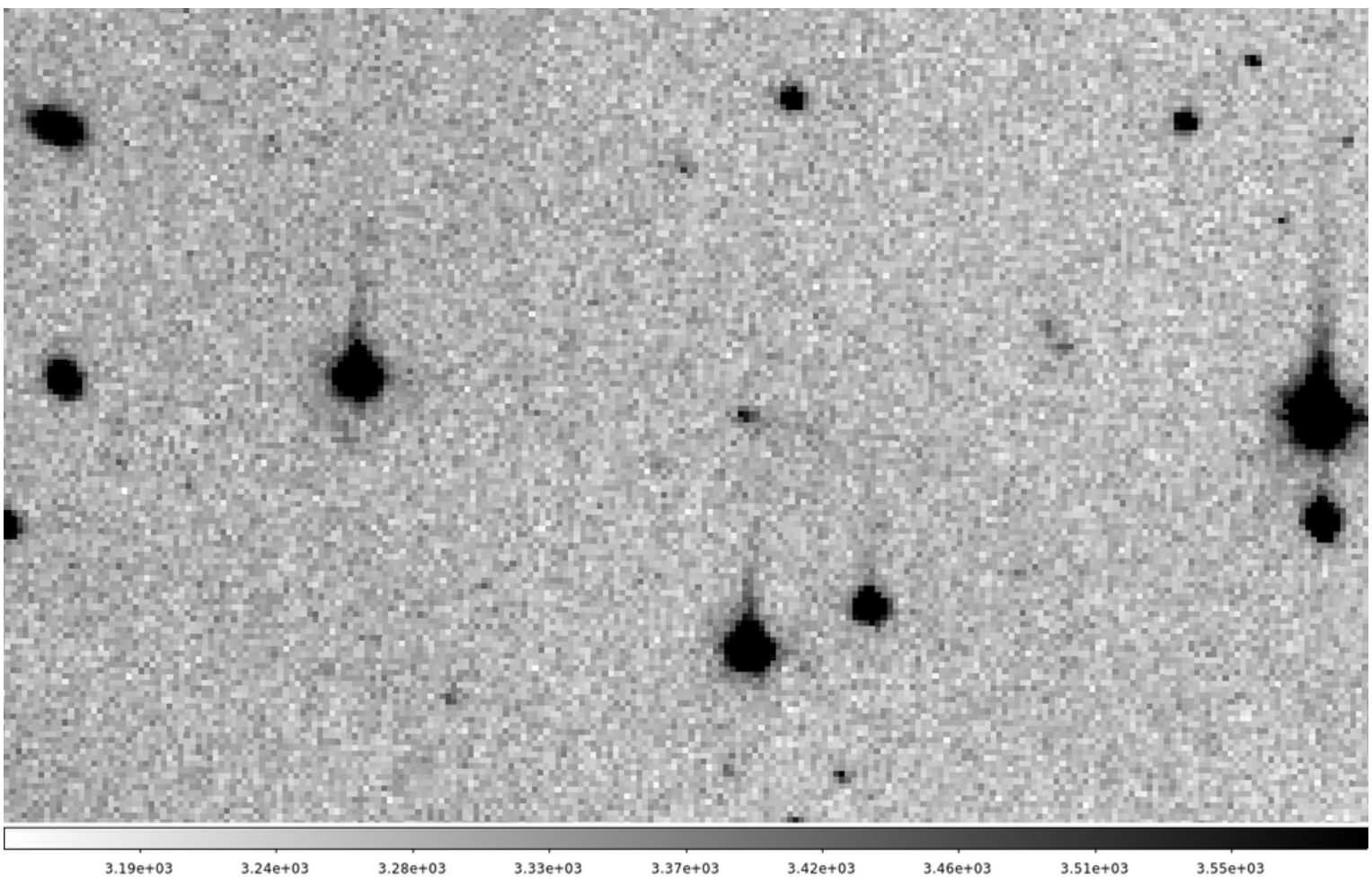
Image of 238P/Read captured by the NIRCam (Near-Infrared Camera) instrument on NASA's James Webb Space Telescope on September 8, 2022. It displays the hazy halo, called the coma, and tail that are characteristic of comets, as opposed to asteroids. The dusty coma and tail result from the vaporization of ices as the Sun warms the main body of the comet. Credits: NASA, ESA, CSA, M. Kelley (Univ. of Maryland). Image processing: H. Hsieh (Planetary Science Inst.), A. Pagan (STScI)

Comet Read is a main belt comet – an object that resides in the main asteroid belt but which periodically displays a halo, or coma, and tail like a comet. Main belt comets are a fairly new classification, and Comet Read was one of the original three comets used to establish the category. Before that, comets were understood to reside in the **Kuiper Belt** and **Oort Cloud**, beyond the orbit of Neptune, where their ices could be preserved farther from the Sun. Frozen material that vaporizes as they approach the Sun is what gives comets their distinctive coma and streaming tail, differentiating them from asteroids.

Scientists have long speculated that water ice could be preserved in the warmer asteroid belt, inside the orbit of Jupiter, but definitive proof was elusive – until Webb. But the missing carbon dioxide was a bigger surprise. Carbon dioxide generally makes up about 10% of the volatile material in a comet that can be easily vaporized by the Sun's heat. The science team presents two possible explanations for the lack of carbon dioxide. One possibility is that Comet Read had carbon dioxide when it formed but has lost that because of warm temperatures. Another is that Comet Read may have formed in a particularly warm pocket of the solar system, where no carbon dioxide was available.

The next step is taking the research beyond **Comet Read** to see how other main belt comets compare.

The research is published in the journal ***Nature*** (Kelley et al., May 15, 2023): https://rdcu.be/dcBbV.



Discovery image of Comet 238P/Read taken with the SPACEWATCH®.0.9m telescope.

LPL IN THE NEWS

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

Solar System 'Detectives' Search for Clues in 'Crumbs' Left Over From Early Solar System. NASA awarded nearly $3 million to the LPL Kuiper Materials Imaging and Characterization Facility to support OSIRIS-REx sample science and much more. (Zega, Barnes, Haenecour, Lauretta)

Economic Impact of UArizona Space Sciences Rivals That of Super Bowl. A new report spotlights the significant impact of University of Arizona space sciences activities, which generate $560.5 million every year for the local economy. (Marley)

Student-built Satellite Uses 'Beach Ball' for an Antenna. CatSat is a small satellite carrying a new communications concept – an inflatable antenna – into space. The project provides a rare opportunity for students at the University of Arizona to get hands-on experience with spaceflight technology. (Golish)

3D Radar Scan Provides Clues About Threats to Iconic Alaskan Glacier. Mapping a large coastal glacier in Alaska revealed that its bulk sits below sea level and is undercut by channels, making it vulnerable to accelerated melting in an already deteriorating coastal habitat. (Holt, Tober)

6 Months to go Until Historic Asteroid Sample Delivery. March 24 marks 6 months until the University of Arizona-led OSIRIS-REx mission is scheduled to return material from the dawn of the solar system to Earth for study. (Lauretta)

LPL Students Observe and Track "Near Miss" Asteroid. As a sizable asteroid makes a close pass by Earth, a team of University of Arizona students is ready to observe the action to practice and test procedures that could be useful in mitigating an impending asteroid impact in the future. (Reddy, Battle, Cantillo, Sharkey)

Icy Moonquakes: Surface Shaking Could Trigger Landslides. Quakes could be the source of the mysteriously smooth terrain on the moons circling Jupiter and Saturn, according to a new study led by a LPL graduate student. (Mills, McEwen)

Webb Finds Water Vapor, But From a Rocky Planet or Its Star? More observations will be needed to determine if exoplanet GJ 486 b has an atmosphere. (Moran)

James Webb Telescope Gives UArizona Astronomers Unprecedented Glimpses into Stellar Nurseries. As part of the largest survey of nearby galaxies, University of Arizona astronomers have obtained never-before-seen details of how young, newly forming stars influence the structure of the gas and dust in their host galaxies. (Rieke)

Construction Begins on NASA's Next-Generation Asteroid Hunter. A space telescope designed to search for the hardest-to-find asteroids and comets that stray into Earth's orbital neighborhood, NASA's Near-Earth Object Surveyor (NEO Surveyor) recently passed a rigorous technical and programmatic review. (Mainzer)