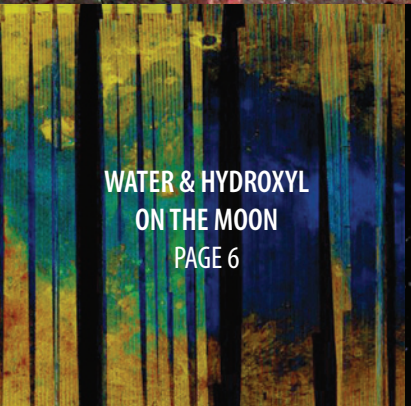
Planetary Science Institute

ANNUAL REPORT

2024



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Dedicated to Solar System exploration,
PSI scientists are involved in NASA and international missions,
fieldwork around the world, education, and public outreach.

PLANETARY SCIENCE INSTITUTE

The Planetary Science Institute is a private, nonprofit 501(c)(3) corporation dedicated to Solar System exploration. It is headquartered in Tucson, Arizona, where it was founded in 1972.

PSI scientists are involved in numerous NASA and international missions, the study of Mars and other planets, the Moon, asteroids, comets, interplanetary dust, impact physics, the origin of the Solar System, extra-solar planet formation, dynamics, the rise of life, and other areas of research. They conduct fieldwork on all continents around the world. They are also actively involved in science education and public outreach through school programs, children's books, popular science books, and art.

PSI scientists are based in over 30 states, the District of Columbia, and several international locations.

PSI BOARD OF TRUSTEES

ON THE COVER:
"Meteor Shower on Mars"

Painting by PSI Cofounder and Senior Scientist Emeritus William K. Hartmann

As Siding Spring Comet passed by Mars on Oct. 19, 2014, it broke up in the atmosphere, creating a luminescent shower in the pre-dawn hours. The depiction is based on reports by astronomer Nick Schneider et al. (2015), a paper published in Geophysical Research Letters. The breakup of cometary meteors is based on work by Olga Popova, a Russian meteor entry expert. The image uses acrylic paint and integrates soil from Tucson, Arizona to create visible gravel-like textures on the surface of Mars.

MESSAGE FROM THE DIRECTOR

I AM INSPIRED THIS YEAR TO FOCUS ON THE ACHIEVEMENTS OF MANY OF OUR EMPLOYEES AND THE RECOGNITIONS THEY HAVE RECEIVED.

Our Administrative Staff

PSI's accomplishments reflect the quality, imagination, and efforts of our scientists, but also the quality, imagination, and efforts of our dedicated administrative staff. We are very pleased to have some of these administrative staff honored this year with the naming by the International Astronomical Union of asteroids (14332) Brucebarnett, (14333) Alanfischer, and (14334) Lindarueger. Bruce Barnett was PSI's first Chief Financial Officer who provided the infrastructure that allowed for decades of PSI growth and continues as a valued advisor to the CEO. Alan Fischer was PSI's first Public Information Officer, generating over a thousand press releases and cover stories on the work of the Institute, strongly advocating for the engagement of scientists with the public, and continuing as Communications Advisor. Linda Rueger is PSI's first Human Resources Director, continuing to provide tireless support for PSI employees and keeping PSI compliant with state and federal regulations, while making a major ongoing contribution to keeping PSI a caring, stable workplace. All of these asteroids were discovered by Bobby Bus at Siding Spring Observatory in 1981. Bobby joined PSI as a Senior Scientist in 2024.

Our Research Scientists and Educators

We also have teams of scientists and science support staff doing important work. One such scientist is Jamie Molaro. She was honored with two major awards this year, receiving the 2024 Sagan Medal for outstanding public communication by the Division for Planetary Sciences of the American Astronomical Society and NASA's Susan Mahan Niebur Early Career Award. This is the first time both were awarded to the same person in a given year! Jamie is recognized for her research, including her work on space weathering by mechanical stresses brought about by thermal cycling. She is also recognized for her public communication, engagement of underserved communities, and making space exploration accessible to the disabled.

PSI scientists Than Putzig, Isaac Smith, Matt Siegler, Catherine Neish and Oded Oharonson won NASA Agency Honor Group Awards for their work on the International Mars Ice Mapper Measurement Definition Team. It was noted that their exceptional multidisciplinary science assessments strongly advanced NASA Moon-to-Mars objectives.

PSI scientists and educators were also honored this year when five of them were named 2024 American Astronomical Society Fellows: JA Grier, Amanda Hendrix, Larry Lebofsky, Robert M. Nelson, and Grace Wolf-Chase. This was almost a quarter of the 21 Fellows named this year! They were commended for their outstanding research and dedicated outreach efforts, including to religious communities.

We take pride in the work of many of our scientists and educators to bring our science knowledge to the broadest possible audiences, which helps to maximize the diversity of our profession and its achievements.

Our New CEO Amanda Hendrix!

The biggest news of the year is that PSI underwent an important transition in 2024! PSI Senior Scientist Amanda Hendrix was selected to be my replacement as CEO in 2025. I've served as CEO for more than 20 years, and during that time PSI has grown substantially, becoming perhaps the largest private employer of planetary scientists in the world, with employees in over 30 states, Washington, D.C., and a number of international locations. Our top four candidates were, interestingly, all women – because they were clearly the best! They spoke to and engaged our science staff (who bring in the money to the organization) and senior administration staff at our retreat in August, which was followed by a ranked choice vote for their ultimate recommendations to our Board of Trustees, which followed their recommendations. I am very pleased with the outcome and look forward to transitioning to a mild-mannered Senior Scientist!

— Mark V. Sykes

A NOTE FROM OUR NEXT CEO

I am very excited to be selected to serve as the new Director of PSI. Having been a PSI Senior Scientist for the last 12 years, it is a real honor for me to step into this role and to take the reins from Mark next year! PSI is such a fantastic organization of truly inspiring individuals. Since 1972, PSI has offered a collegial culture and stimulating environment for our scientists. We provide critical education and outreach opportunities in the local and broader arenas, and we advocate for the wider planetary science community. A primary goal of mine as Director is to continue these key functions and to strengthen them.

I look forward to working with our local partners in southern Arizona and those in Washington, D.C. and elsewhere to build and bolster the relationships that are so important in making our work happen. We are fortunate to have a fantastic, dedicated administrative staff. I am so pleased to be working with them, along with our superb Board of Trustees, to advance our Institute priorities.

— Amanda Hendrix

PSI SCIENTISTS HONORED WITH AWARDS IN 2024

Jamie Molaro Earns Two Major Awards

Research Scientist Jamie Molaro was honored for excellence in her research and her outreach efforts with two prestigious awards in 2024: The 2024 Susan Mahan Niebur Early Career Award and the 2024 Carl Sagan Medal for outstanding communication by an active planetary scientist to the public.

The early career award is given by NASA's Solar System Exploration Research Virtual Institute (SSERVI) to an investigator who is within 10 years of receiving their Ph.D. and has made significant contributions to the exploration science communities.

The Sagan Medal recognizes Molaro's contributions to changing the way planetary science appears to the world, including efforts to connect art and science, and efforts to engage underserved communities. This is the first time both were awarded to the same person in a given year. Molaro studies weathering and landscape evolution on airless icy and rocky bodies.

PSI Scientists Honored for Work on Mars Ice Mapping

Than Putzig, Isaac Smith, Catherine Neish, Oded Aharonson, and Matt Siegler won a NASA Agency Honor Group Award for their work on the International Mars Ice Mapper Measurement (I-MIM) Definition Team.

The I-MIM mission is a Mars orbiter concept developed by NASA in collaboration with the Japan Aerospace Exploration Agency, the Canadian Space Agency, and the Italian Space Agency. The orbiter would measure the extent and volume of water ice in non-polar regions of Mars. The results are intended to support future Mars missions.

The project was cited for "exceptional multidisciplinary science assessments for the International Mars Ice Mapper mission concept that strongly advance NASA Moon-to-Mars objectives."

BUXNER ELECTED AGU EDUCATION SECTION PRESIDENT
The AGU Education Reception brought together the past, present and incoming section presidents. From left to right: Sanlyn Buxner, Laura Lukes, Kristen St. John, Tanya Furman and Mark Moldwin.
Credit: Pamela Gay

Jamie Molaro

Than Putzig

Isaac Smith

Catherine Neish

Oded Aharonson

Matt Siegler

Sanlyn Buxner Elected AGU Education Section President

At the December meeting of the American Geophysical Union, in Washington, D.C., PSI's Sanlyn Buxner became president-elect of the AGU's Education Section. At PSI, Buxner is a senior education and communication specialist and senior scientist with research and education activities spanning from K-16 science education research to teacher-training workshops to public outreach for major programs, as well as many years of professional leadership within professional societies.

American Astronomical Society Names Five PSI 2024 Fellows


JA Grier


Amanda Hendrix


Larry Lebofsky


Robert M. Nelson


Grace Wolf-Chase

Five Planetary Science Institute scientists and educators have been named 2024 American Astronomical Society Fellows: JA Grier, Amanda Hendrix, Larry Lebofsky, Robert M. Nelson, and Grace Wolf-Chase.

The AAS, a major international organization of professional astronomers, astronomy educators, and amateur astronomers, honored 21 new members for extraordinary achievement and service by naming them AAS Fellows – an honor bestowed on less than 0.5% of AAS's membership each year.

The AAS Fellows program was established in 2019 to recognize AAS members for their contributions toward the Society's mission of enhancing and sharing humanity's scientific understanding of the universe. Fellows may be cited for original research and publication, innovative contributions to astronomical techniques or instrumentation, significant contributions to education and public outreach, and noteworthy service to astronomy and to the Society itself.

PSI's Astronomy Cast Podcast Named Finalist for Sonic Bloom People's Choice Award

The Astronomy Cast podcast, produced at PSI in collaboration with Universe Today, has been recognized as a finalist in the Sonic Bloom People's Choice Awards. PSI's Pamela Gay is the director of CosmoQuest and co-host of Astronomy Cast. Astronomy Cast is engineered by PSI's Ally Pelphrey and Richard Drumm, with project management and promotion by Beth Johnson.

Outstanding Alumna

Elizabeth Jensen, class of 1993, was named an outstanding alumna by the Spring Independent School District Education Foundation in Houston. Foundation Executive Director Sandra Scott said those honored have demonstrated a commitment to excellence and a dedication to giving back that has long been a part of the district's spirit.

JENSEN NAMED OUTSTANDING ALUMNA
Elizabeth Jensen (second from left), Class of 1993, is honored as an outstanding alumna by the Spring Independent School District. Credit: Spring Independent School District

SOURCES OF WATER AND HYDROXYL ARE WIDESPREAD ON THE MOON

A PSI-LED ANALYSIS OF MAPS of the near and far sides of the Moon showed that there are multiple sources of water and hydroxyl – a functional chemical group with one hydrogen and one oxygen atom – in the sunlit rocks and soils, including water-rich rocks excavated by meteor impacts at all latitudes.

"Future astronauts may be able to find water even near the equator by exploiting these water-rich areas. Previously, it was thought that only the polar region, and in particular, the deeply shadowed craters at the poles were where water could be found in abundance. Knowing where water is located not only helps to understand lunar geologic history, but also where astronauts may find water in the future," said Senior Scientist Roger Clark, lead author of the paper published in the Planetary Science Journal.

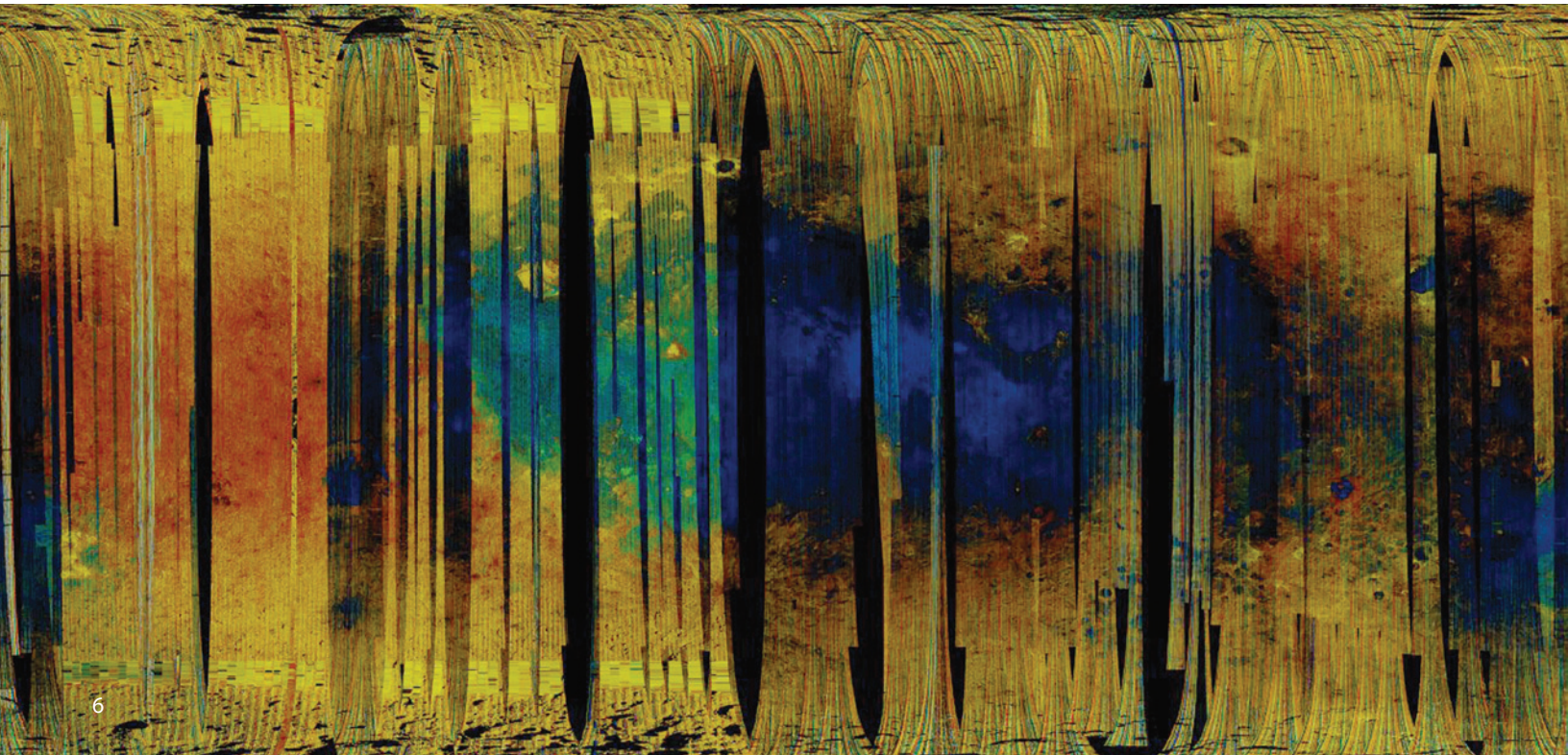
Clark and his research team, which includes PSI scientists Neil Pearson, Thomas McCord, Deborah Domingue, Amanda Hendrix, and Georgiana Kramer, studied data from the Moon Mineralogy Mapper (M3) imaging spectrometer on the Chandrayaan-1 spacecraft, which orbited the Moon from 2008 to 2009, mapping water and hydroxyl on the near and far sides of the Moon in greater detail than ever before. Locating water in the sunlit parts of the Moon uses spectroscopy to search for the fingerprints of water and hydroxyl in the infrared spectrum of reflected sunlight. While a digital camera records three colors in the visible part of the spectrum, the M3 instrument recorded 85 colors from the visible spectrum and into the infrared, making it a more powerful tool to determine surface composition.

By studying the location and geologic context, Clark and his team were able to show that water in the lunar surface is metastable, meaning water is slowly destroyed over millions of years, but with hydroxyl remaining. Sub-surface water-rich rocks, exposed to the solar wind by a cratering event, will degrade with time, destroying water and creating a diffuse aura of hydroxyl, but the destruction is slow, taking thousands to millions of years. Elsewhere on the lunar surface, there appears a patina of hydroxyl, probably created from solar wind protons impacting the lunar surface, destroying silicate minerals where the protons combine with oxygen in the silicates to create hydroxyl, in a process called space weathering.

"Putting all the evidence together, we see a lunar surface with complex geology with significant water in the sub-surface and a surface layer of hydroxyl," Clark said. "Both cratering and volcanic activity can bring water-rich materials to the surface, and both are observed in the lunar data."

A MAP OF HYDROXYL ON THE MOON

Color correlates with hydroxyl spectral signature position, and the brightness of the color indicates the relative abundance of hydroxyl. Credit: NASA/ISRO/M3 Team/PSI/Roger Clark



CENTAURS GAIN COMET-LIKE CHARACTERISTICS THROUGH CLOSE ENCOUNTERS WITH JUPITER, SATURN

A TEAM LED BY PSI SENIOR SCIENTIST EVA LILLY discovered that close encounters with Jupiter and Saturn can rapidly reshape Centaurs' orbits and sometimes cause them to exhibit comet-like activity. Centaurs are small bodies similar to asteroids in size but to comets in composition, that orbit the Sun between Jupiter and Neptune.

"We have found some answers to the long-standing mystery of why some Centaurs became active like comets while the rest appear like regular quiet asteroids. Nobody knew why they behave this way. It did not make any sense. There was no correlation with size, color, or even the types of orbits," said Lilly. PSI Scientists Kat Volk, Jordan Steckloff, and Henry Hsieh are co-authors on the paper published in the Astrophysical Journal Letters.

To understand what active Centaurs had in common, the team studied the dynamical history of all known Centaurs, both active and inactive, and coupled their findings with thermal modeling.

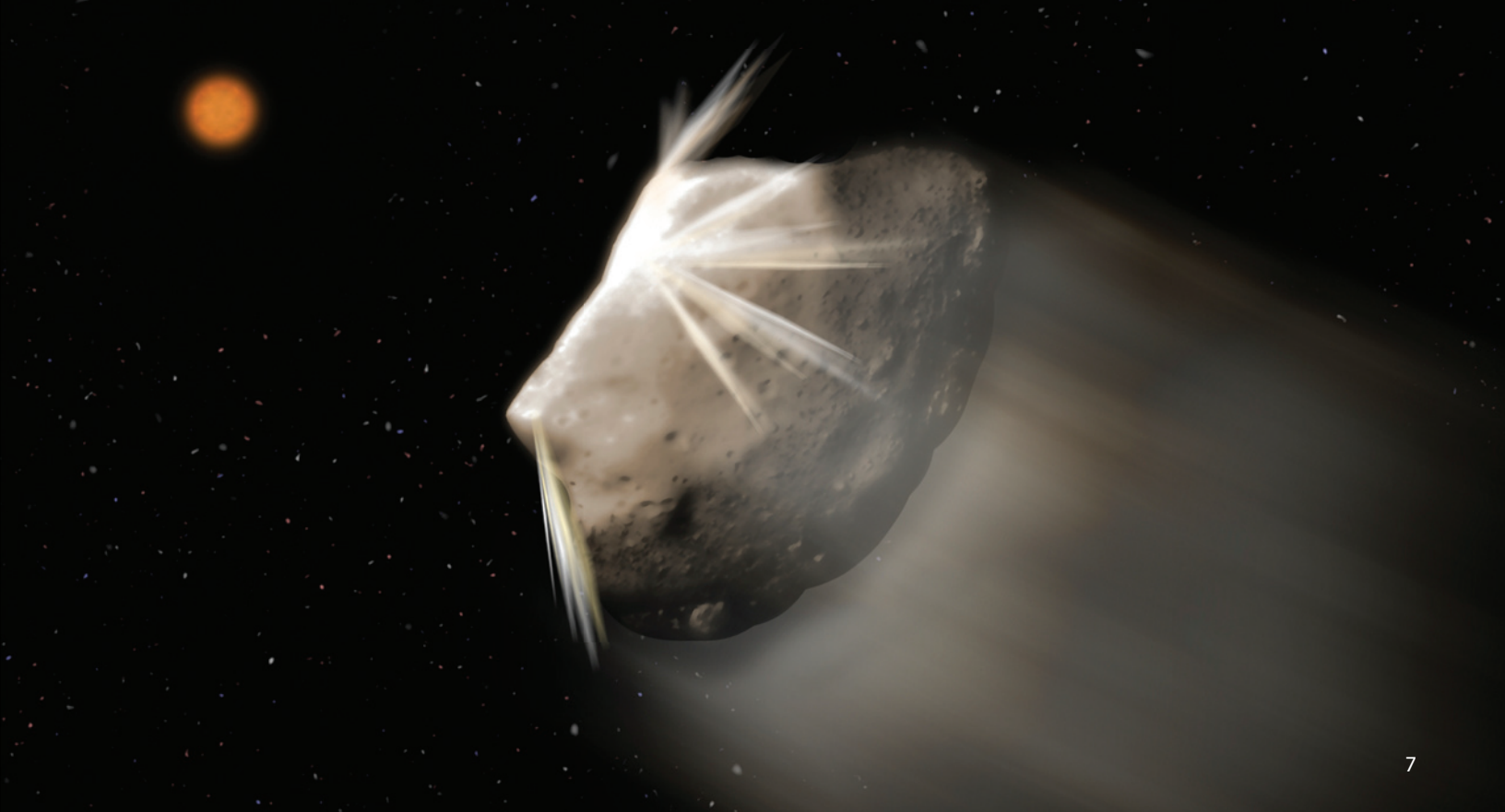
"Mapping the dynamical history of Centaurs is a tricky feat – they orbit in the realm of giant planets, and their orbital evolution is governed by the chaotic influence of the giants' gravitational pull," Lilly said. "We found out all active Centaurs underwent a close encounter with either Jupiter or Saturn and that this encounter caused a large orbital change we call the 'a-jump.' The a-jump is mostly a decrease in the semi-major axis of the Centaur's orbit, while at the same time reshaping it from elliptical to more circular and lower perihelion orbits. This change is very rapid, on the order of several months, and the semi-major axis can decrease by several astronomical units."

The a-jump positions Centaurs in orbits where their surfaces can warm up for a longer time. The additional heat activates the Centaur, causing the ice to transition directly from ice to vapor. Activity has been observed in only about 10% of Centaurs, and it has not been clear why until now.

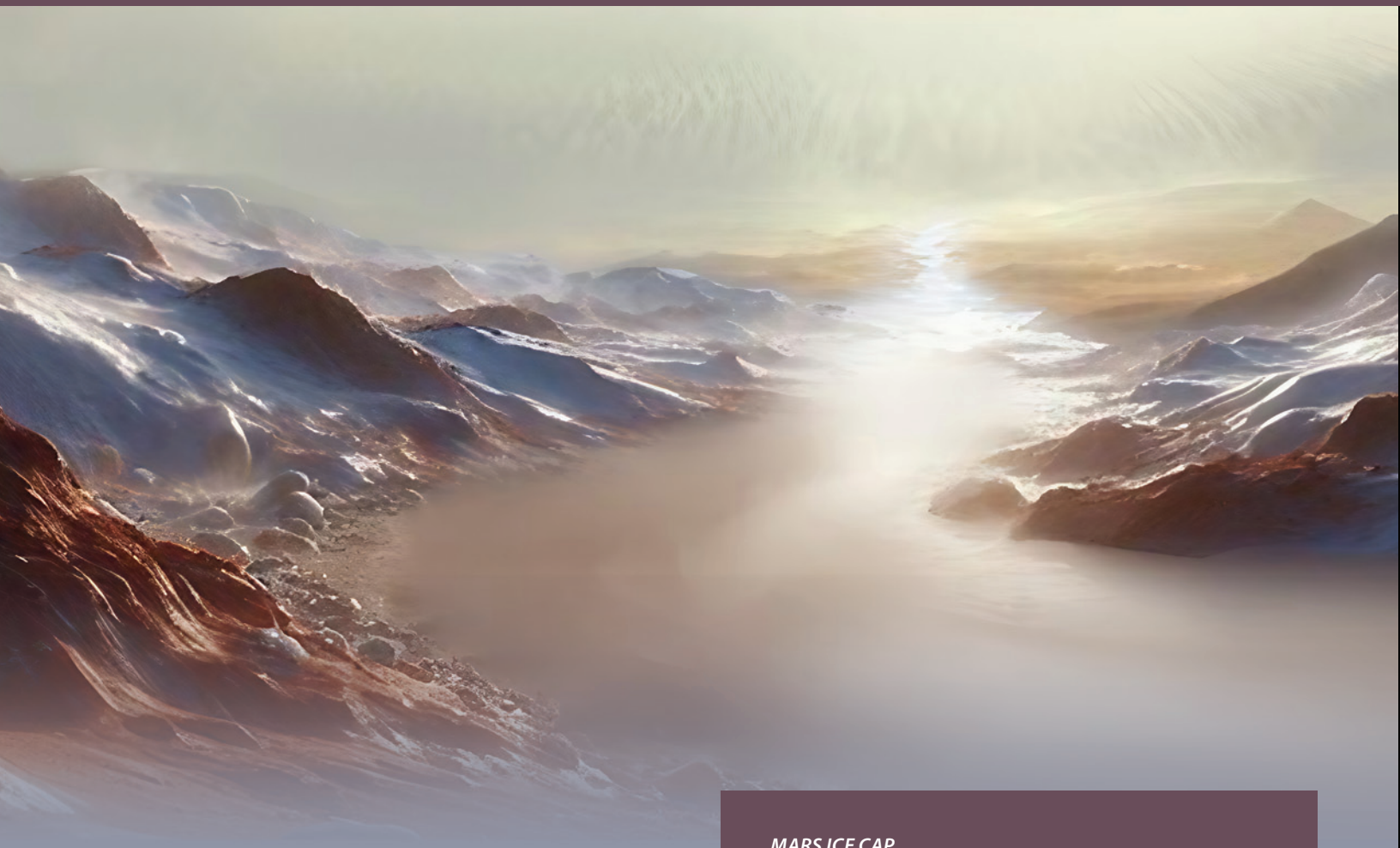
"We suggest the a-jumps could therefore be a major trigger of cometary activity on Centaurs," Lilly said. "Our results further imply that analyses of the recent dynamical histories could be used to identify objects that are currently active or may become active soon, where we have identified three such Centaurs with recent a-jumps that should be considered high-priority targets for observational monitoring to search for activity," Lilly said.

COMET-LIKE CENTAURS

An artist's representation of a Centaur, which is an object that looks like an asteroid but can become active and generate a tail for numerous reasons. Credit: Pamela Gay/PSI



CARBON DIOXIDE COLLAPSE: HOW WATER FLOWED ON AN ICY MARS



MARS ICE CAP
An artist's interpretation of an ice-covered river sourced from meltwater beneath Mars' south polar cap.
Credit: Peter Buhler/PSI

PSI RESEARCH SCIENTIST PETER BUHLER FOUND THAT ON A COLD, ANCIENT MARS, RIVERS FLOWED AND A LAKE THE SIZE OF THE MEDITERRANEAN SEA SWELLED UNDER THE PROTECTION OF THICK ICE CEILINGS.

3.6 billion years ago, carbon dioxide froze out of Mars' atmosphere and deposited on top of a water ice sheet at the poles, insulating heat emanating from Mars' interior and increasing the pressure on the ice. This caused roughly half of Mars' total water inventory to melt and flow across its surface without the need for climatic warming. These findings were published in the Journal of Geophysical Research: Planets.

Buhler's past work has focused on modeling the modern carbon dioxide cycle on Mars. Recently, he extended his model to investigate the exchange of carbon dioxide with the Martian regolith – or sand and rocks. By doing so, his model encapsulates the full carbon dioxide cycle from the regolith, to atmosphere, to frozen polar caps. For this study, he applied the model to a pivotal era in Mars' history.

"This model describes the origins of major landscape features on Mars – like the biggest lake, the biggest valleys, and the biggest esker system (remnants of rivers that once flowed beneath an ice sheet) – in a self-consistent way," Buhler said. "And it's only relying on a process that we see already today, which is just carbon dioxide collapsing from the atmosphere."

IMPACT CRATERS WERE HIDING IN PLAIN SIGHT, SAY RESEARCHERS WITH A NEW VIEW OF VENUS

THE MOON AND MARS ARE POCKED with giant impact craters acquired very long ago, while there appears to be a dearth of them on Earth and Venus. Time may have healed many of Earth's largest impact scars with its wind, water, life, and plate tectonics, but Venus lacks these destructive processes. What's more, Venus is home to some of the most pristine smaller impact craters in the Solar System. So why the lack of huge impact basins?

After geologically mapping a region on Venus called Haastte-baad Tessera and modeling how its unique features could have formed, a small group of researchers, including Planetary Science Institute Senior Scientist Vicki Hansen, think they have an answer.

Haastte-baad Tessera hosts one of the oldest surfaces on Venus, called tessera terrain, cut by a unique set of concentric rings over 900 miles at its widest. The team concluded that the tessera and its rings record two huge back-to-back impact events. The rings and its host tessera look nothing like traditional-looking craters on the Moon and Mars, and even Venus; this is because Venus' early conditions led to impact structures that significantly differ from classic impact craters.

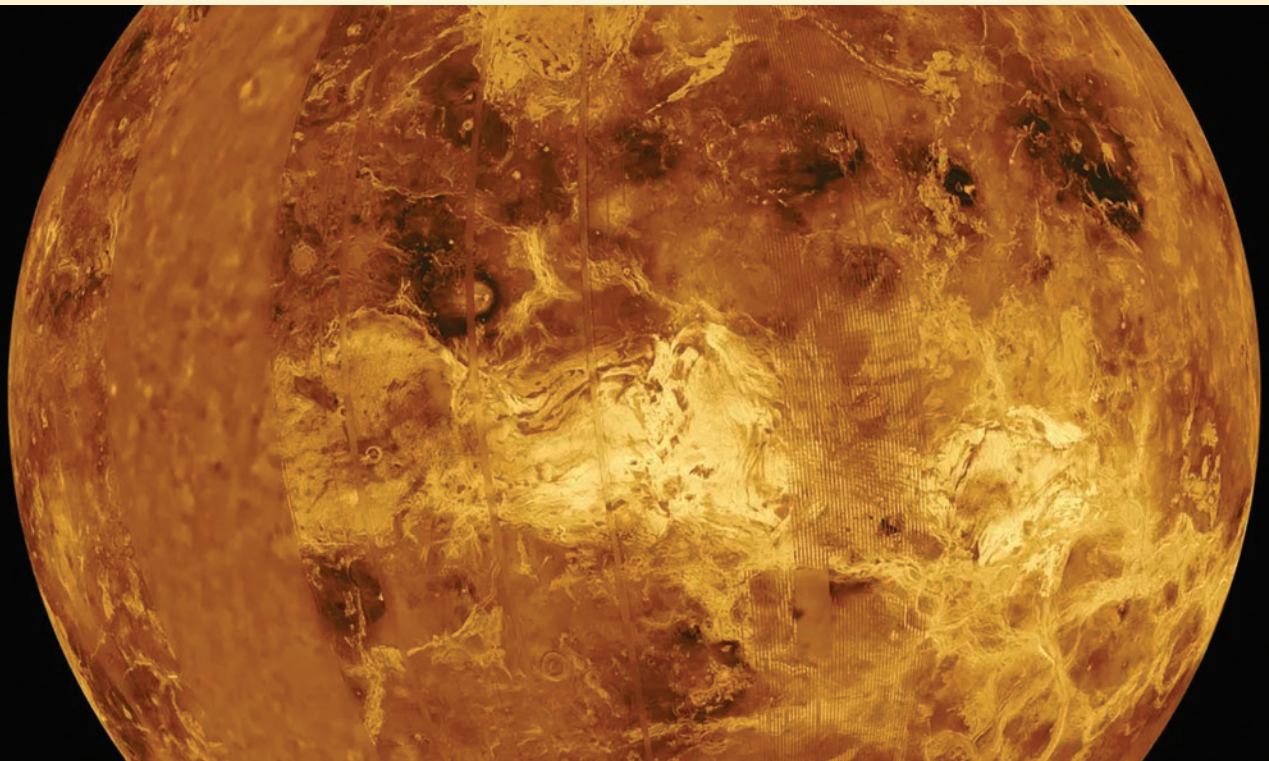
"If this is really an impact structure it would be Venus' oldest and largest, giving us a rare glimpse into Venus' past and informing early planet processes," Hansen said. "And perhaps even more important, it shows us that not all impact structures look alike. Impact structures result from a bolide – a body of unspecified composition – that collides with a target planet. The nature of the bolide is important, but so too is the nature of the target."

The paper was published in the Journal of Geophysical Research: Planets.

Ultimately, the research team found that the formation of the ringed structure on Venus would have required two large bolides hitting Venus back-to-back. The first created the lava pond to form tessera terrain and the second bolide impacted the lava pond, forming the unique ring structure.

Back-to-back bolides might seem too serendipitous, but there's evidence in ancient rocks preserved in South Africa that this occurred about 3.5 billion years ago on Earth, Hansen said. Even on the Moon and Mars, there's evidence of many of these enormous impacts. In those cases, the large bolides, not uncommon during the first 2.5 billion years of our Solar System history, struck planetary bodies with thick lithospheres, forming the huge impact basins we still see today.

HAASTTE-BAAD REGION ON VENUS
A false-color radar map of the hemisphere of Venus where Haastte-baad is located. Credit: NASA/JPL



PIERAZZO INTERNATIONAL STUDENT AWARD WINNERS

The Planetary Science Institute selected Namya Baijal and Mishal K T as the winners of the 2025 Pierazzo International Student Travel Award. PSI established the award in memory of Senior Scientist Betty Pierazzo to support and encourage graduate students to build international collaborations and relationships in planetary science. Each awardee will receive a certificate and check for $2,000 at their respective conferences.

Namya Baijal

Baijal (University of Arizona) will receive the award as a U.S.-based graduate student attending the Europlanet Science Congress – Division of Planetary Sciences Joint Meeting 2025 in Helsinki, Finland where she will present her research titled "Three-dimensional Modelling of the Major Impact Craters on (16) Psyche."

Mishal K T

K T (Indian Institute of Technology Kanpur) will receive the award as a non-U.S.-based graduate student at the 56th Lunar and Planetary Science Conference in The Woodlands, TX where he will present his research titled "Characterization of Hydration at Compton Belkovich Volcanic Complex on the Moon.

Betty Pierazzo

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.

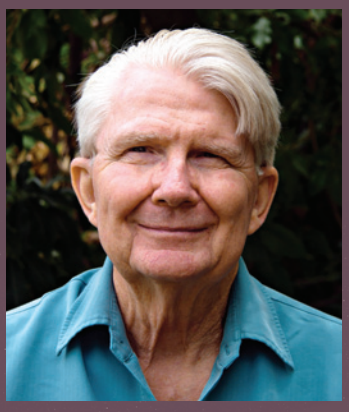
This award memorializes the scope of how she lived her life and the good she sought to bring to our profession and communities.

Namya Baijal

Mishal K T

Betty Pierazzo

A MESSAGE FROM OUR PSI BOARD CHAIRMAN



The members of the Board of Trustees are honored to serve PSI and take very seriously our responsibility to provide strategic governance to insure a sustainable future for PSI. In 2024, the primary focus of the Board was to select a successor to Mark Sykes, who has guided PSI for over 20 years, through a period of tremendous growth, and established a culture of scientific and operational excellence. This search process reached a critical point at the retreat in 2024, where we had the opportunity to interview four outstanding candidates. Using our insights from the interviews and invaluable inputs from both the Science and Administrative staff, we chose Amanda Hendrix as the next CEO. Our focus now will be to ensure a smooth leadership transition and to support Amanda as she brings her outstanding leadership skills to lead PSI into its next phase.

— Scott Fouse

PSI FINANCIAL REPORT

Maurizio Balistreri, CPA Chief Financial Officer

PSI's revenues totaled $18M for the fiscal year ended September 30, 2024. During the fiscal year, PSI was actively involved in 131 prime awards issued directly from federal agencies and 152 subawards/contracts issued through other institutions. 90% of PSI's Grants and Contracts revenues were derived from awards with NASA.

REVENUES

Grants and Contracts	$ 17,674,797
Contributions	127,528
Other	135,659
Total Revenues	**$ 17,937,984**

ACTIVE PROJECTS BY PRIME AWARDING AGENCY

NASA	117
NSF/Other	14
Subawards/Contracts	152
Total Projects	**283**

Salaries and related fringe benefits represented 74% of PSI's total expenses. Operating expenses included $2.3M from subawards issued to other institutions for collaborative efforts on PSI prime awards. Program Service expenses amounted to 90% of total expenses.

EXPENSES

Salaries and Benefits	$ 13,200,430
Operating	4,329,233
Depreciation	246,211
Interest	17,373
Total Expenses	**$ 17,793,247**

EXPENSES BY FUNCTION

Program Services	$ 16,019,376
Management & General	1,772,537
Fundraising	1,334
Total Expenses	**$ 17,793,247**

PSI's financial records are audited annually by independent auditors. A condensed Statement of Financial Position from PSI's audit report as of September 30, 2024 is reflected below.

Current Assets	$ 4,396,362
Property & Equipment, Net	1,264,372
Total Assets	**$ 5,660,734**

Current Liabilities	$ 2,101,731
Long-term Liabilities	128,708
Net Assets with Donor Restrictions	117,040
Net Assets without Donor Restrictions	3,313,255
Total Liabilities & Net Assets	**$ 5,660,734**

PSI EDUCATION AND PUBLIC OUTREACH

Education and public outreach are central to PSI's mission. Our scientists and education and communication specialists continue to engage people of all ages and backgrounds all over the country. The following is just a sampling of the exciting outreach PSI conducted throughout 2024, which included opportunities to work with teachers, students, community scientists, and learners of all ages.

2024 Eclipse Experience

Perhaps the biggest outreach opportunity of the year was the April 8 total solar eclipse, which swept across North America. In preparation, Sanlyn Buxner and Larry Lebofsky facilitated five workshops for local educators in Arizona and distributed thousands of solar safety glasses. Nathan Kaib presented eclipse information to faculty and staff of the Lorain County Community College in Elyria, Ohio, which was then disseminated to students in science courses in the days preceding the eclipse.

Buxner and Pamela Gay also edited a collection of 33 free articles to support eclipse activities. The collection included examples of past events and experiences and resources for future engagement activities that spanned a variety of topics including safe eclipse viewing to narratives about how the public has contributed to science. The collection was published as a special issue in the Bulletin of the American Astronomical Society.

On eclipse day, Gay co-hosted Weather Channel total eclipse coverage from the stadium at Southern Illinois University Carbondale where 15,000 people gathered. Emilie Royer organized an eclipse viewing party at California State University, Los Angeles for the local partial eclipse. Buxner and husband Rob Bovill were at the W.M. Brook Park in Lampasas, Texas with two telescopes, where they handed out pinhole projectors and Sun viewing glasses to safely celebrate over four minutes of totality. Lebofsky, just outside of Lampasas, set up two telescopes, several pairs of solar-safe binoculars and scale models of the Earth-Moon-Sun system. Other scientists and educators shared the eclipse with family, friends, and the public across the country.

Fun at the Tucson Festival of Books

In March, an estimated 1,000 visitors stopped to talk to our scientists and staff over the two-day book festival event held on the University of Arizona mall. PSI's exhibit, held in the event's Science City area, included hands-on activities featuring meteorites, pinhole solar projectors, discussions on how to prepare for the partial eclipse in Tucson, and UV bracelet making. PSI volunteers included Buxner, Lebofsky, Kat Volk, and Bea Mueller.

Workshops

In November, Jamie Molaro hosted 30 people for "Making Space: A Workshop on Space, SciArt, & Society" in Pasadena, California. The theme centered on time as a dynamic framework for understanding planetary bodies and our relationship to them. The workshop was designed to explore the way that planets evolve, how processes at both long and short timescales interact, how cultural perceptions of space have shifted over time, and how art and artists change through exploration.

In September, Buxner co-facilitated a Culturally Inclusive Planetary Engagement Workshop in partnership with the Boys and Girls Club in Burbank, California. The workshop brought together planetary scientists and informal educators to learn and plan an event together. The culmination of the three-day workshop was an event for more than 30 youth providing hands-on activities.

Buxner and JA Grier organized Disabled Science Writers Workshops, with several PSI scientists speaking at the sessions. Each workshop seeks to engage new voices in space science outreach, provides deeper understanding and trust of science and the scientific process, encourages informed and positive views of science as linked to and as a part of disability, as well as growing science literacy and critical thinking ability.




Supporting Educators

Over the summer, Buxner and Lebofsky facilitated a three-day institute for educators of young children and elementary school students. The 2024 STEMAZing Institute "The Moon," organized by Pima County Superintendent's Office, provided educators an opportunity to learn more about the Moon and other Solar System objects as well as engaging ways to teach young students.

In May, Kirby Runyon attended the Space Tourism Conference in Los Angeles, California where he participated on the panel "Kids & the Future: Prepping the Next Generation for Working in Space." As part of this panel, he presented on the planetary analog field geology training he conducts.

Outreach for Kids

In April, Elisabeth Adams brought meteorites for kids at the Albert F. Argenziano School in Somerville, Massachusetts to hold and study. Later, she participated in the Family STEAM (Science, Technology, Engineering, the Arts, Math) night. The event, "Rocks from space – Touch a Meteorite" attracted 776 people.

During the American Geophysical Union conference in December, Buxner and Gay traveled to Washington, D.C. to bring science to foster kids in one of D.C. 's under-resourced communities in collaboration with the Let's Go program, short for Leadership Engineering Technology Science Generating Opportunities. This event was the first of an ongoing series of events that bring together scientists attending research conferences and children who might otherwise never meet a scientist in person.

Outreach for All Ages

Molaro also led an outreach project called the Skyhorse Carousel, an amusement ride, art installation, and science outreach project which celebrates human culture and cosmology from ancient to modern times. Each carousel animal is painted like a figure from a different myth or tradition relating to different celestial objects.

Photos from left to right:

SOLAR ECLIPSE EXPERIENCE
Elisabeth Adams, second from right, with her family and friends observed the 92% eclipse in Somerville, MA. Photo Courtesy of Elisabeth Adams

TUCSON FESTIVAL OF BOOKS
Visitors kept Larry Lebofsky, left, and Sanlyn Buxner busy at PSI's display of hands-on activities during the Tucson Festival of Books. Credit: Alan Fischer

MOLARO TIME WORKSHOP
PSI's Jamie Molaro hosted 30 people for her most recent workshop that blends science and art. Credit: Jamie Molaro

LET'S GO PROGRAM WORKSHOP
Kids learn about the phases of the Moon using Oreos. Credit: Let's Go Program

INSTITUTE FOR EDUCATORS
Larry Lebofsky asks teachers how far away they think the Moon is from the Earth. Credit: Sanlyn Buxner

SKYHORSE CAROUSEL
Jamie Molaro's Skyhorse Carousel, an amusement ride, art installation, and science outreach project. Credit: Jamie Molaro

Riders learn the story and science behind the horse they ride from a plaque. In August, Molaro brought the installation to the Burning Man art festival, providing over 5,000 rides.

Runyon and Buxner participated in the Virtual Trips to Extreme Environments (VIRTEX) project partnering scientists with Boys and Girls clubs across the country. Runyon mentored youth at the Boys and Girls Club in Allentown, Pennsylvania, and Buxner served as a project evaluator for the overall effort.

Numerous scientists engaged in other local outreach in the communities through talks, science nights, citizen science projects, star parties, newsletters, and festivals. These include Adams, Lebofsky, Gay, Runyon, Sarah Sonnet, Neil Pearson, Amanda Sickafoose, Hannah Sizemore, Laura Breitenfeld, Elizabeth Jensen, Darby Dyar, Candice Hansen-Koharcheck, Patricia Craig, David Vaniman, Rebecca Williams, Grace Wolf-Chase, and Aileen Yingst.

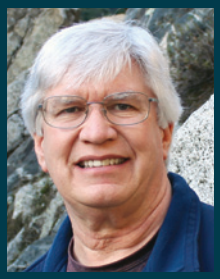
PSI CONTINUES TO EXPAND IN 2024

As it has been for more than 50 years, PSI's strength and advantage continues to be in its people. Our culture of openness and high level of mutual support distinguishes us as an organization. In 2024, PSI continued to grow, adding 25 new research and administrative staff members.

Zach Bain
Research Assistant

Meryem Berrada
Associate Research Scientist

Laura Breitenfeld
Associate Research Scientist



Bobby Bus
Senior Scientist

Augusto Carballido
Senior Scientist

Jack Conrad
Associate Research Scientist

Tamara Denny
Administrative Assistant - Proposal Support

Rodrigo Duran
Research Scientist

Megan Dwyer
Research Assistant

Matthew Huber
Associate Research Scientist

Mikayla Mace Kelley
Public Information Officer

Nandita Kumari
Associate Research Scientist

Jenny Larson
Associate Research Scientist

Katie Lester
Associate Research Scientist

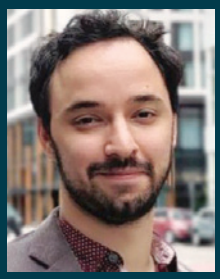
Alexis Lund
Artist

Benjamin McKeeby
Associate Research Scientist

Claire Mondro
Associate Research Scientist

Jeff Muzzy
Information Technology Director

Karly Pitman
Senior Scientist



Dani Sega
Associate Research Scientist

David Thomas
Network and Linux System Administrator

Ping Wang
Research Scientist

Not Pictured:

Mark Lewis, *Senior Research Associate* **Bella Mueller,** *Junior Research Assistant* **Amy Steele,** *Senior Research Associate*

ASTEROIDS NAMED AFTER PSI SCIENTISTS AND STAFF

The names of three PSI administrative staff and one scientist are forever commemorated among the asteroids. According to the Working Group of Small Body Nomenclature, volume 4, #4 and #7, our Sun is now orbited by (14332) Brucebarnett, (14333) Alanfischer, (14334) Lindarueger, and (216752) Kirbyrunyon. The citations for each of these newly named objects reflects the excellence these individuals brought to their careers. The citations for these objects read as follows:

(14332) Brucebarnett

Bruce Barnett (b. 1956) is an American Certified Public Accountant who was the first Chief Financial Officer of the Planetary Science Institute. He provided infrastructure that allowed decades of growth at PSI, and generously provided administrative support and advice to other astronomical organizations when they were in need.

(14333) Alanfischer

Alan Fischer (b. 1957) is an American journalist and the first Public Information Officer of the Planetary Science Institute. He has written about research results of more than 100 scientists, communicating the excitement of their work to the public and advancing science literacy. He is a strong advocate for the engagement of scientists with the public.

(14334) Lindarueger

Linda Rueger (b. 1955) is the first Human Resources Director of the Planetary Science Institute. Her patience, accessibility and empathy for all staff, her tireless support for scientists, and her rigor in maintaining state and federal regulatory compliance have contributed much to making PSI a caring, stable workplace.

(216752) Kirbyrunyon

Kirby D. Runyon (b. 1985) is an American planetary scientist. He served as a science team graduate student and postdoctoral researcher on NASA's New Horizons mission to Pluto and the Kuiper Belt.

New names are released each month by the International Astronomical Union's Working Group on Small Body Nomenclature. Learn more from the Minor Planet Center website.

NEW PSI RESEARCH GRANTS

Eddie Baron. Examining the heart of type Ia supernova 2021aefx with ultra-late time spectra. NASA James Webb Space Telescope Guest Observer Program-Cycle 2.

Eddie Baron. Probing early dust formation in the universe via stripped-envelope supernovae. NASA James Webb Space Telescope Guest Observer Program-Cycle 2.

Eddie Baron. Observing molecule and dust formation in the nearby SN 2024ggi. NASA James Webb Space Telescope Guest Observer Program-Cycle 2.

Eddie Baron. The full picture: Determining the ultra-late time MIR flux redistribution in SN 2021aefx. NASA James Webb Space Telescope Guest Observer Program-Cycle 3.

Eddie Baron. Building the legacy of Supernova 2023ixf: How does molecule formation lead to dust? NASA James Webb Space Telescope Guest Observer Program-Cycle 3.

Eddie Baron. Late time spectroscopy of type Ia supernovae: Determining the explosion mechanism and elemental production. NASA James Webb Space Telescope Guest Observer Program-Cycle 3.

Eddie Baron. The UV future is now: Tapping Hubble's UV spectral archive to drive current and future type Ia supernova science. NASA Hubble Space Telescope Archival Research-Cycle 31.

Susan Benecchi. Are dark, red, small KBOs devoid of volatiles? NASA James Webb Space Telescope Guest Observer Program-Cycle 2.

Ben Boatwright. Simple crater morphometry and degradation processes on Mercury from MESSENGER stereo topography. NASA Discovery Data Analysis program.

Sanlyn Buxner. The Professional Advancement Workshop Series (PAWS) capstone event: Creating the rising tide. NASA Topical Workshops, Symposiums, and Conferences program.

Roger Clark. Mapping Imaging Spectrometer for Europa (MISE) phase E. NASA Europa Clipper program, Jet Propulsion Laboratory subcontract.

Jean-Philippe Combe. Testing alternative hypotheses to olivine on Vesta with multiple data from the Dawn Mission: Implications on its internal structure, origin and evolution. NASA Discovery Data Analysis program.

David Crown. Modeling the open-channel lava flows of Venus: Constraining emplacement conditions, cooling rates, and their implications for future orbital data. NASA Solar System Workings program, University of Pittsburgh subaward.

Robert Gaskell. Phobos and Deimos through time. NASA Martian Moons eXploration Mission Participating Scientist program, Johns Hopkins University Applied Physics Laboratory subaward.

John Goodge. Conference support for the 2nd RAID Science Planning Workshop. National Science Foundation Polar programs.

JA Grier. An innovative workshop on EDIA for leaders in planetary science. NASA Topical Workshops, Symposiums, and Conferences program, Cornell University subaward.

Amanda Hendrix. Europa-UVS: An ultraviolet spectrograph for the Europa

Mission. NASA Europa Clipper program, Southwest Research Institute subaward.

Carly Howett. Constraining Enceladus' between-stripe emission. NASA Cassini Data Analysis program.

Henry Hsieh. Subsurface thermal photometry of NEOs: Characterizing the regolith. NASA Yearly Opportunities for Research in Planetary Defense program, National Radio Astronomy Observatory subaward.

Henry Hsieh. Characterization of Water Outgassing in Main-Belt Comets 133P/Elst-Pizarro and 457P/Lemmon-PANSTARRS. NASA James Webb Space Telescope General Observer Program-Cycle 3. Space Telescope Science Institute.

Nate Kaib. Planetary systems as the bottom levels of hierarchies. NASA Exoplanets Research program.

Nate Kaib. Passing stars and the orbital evolution of our planets. NASA Solar System Workings program.

Jeffrey Kargel. Derivation of suspended sediment loads of glacier-fed Andean lakes, reservoirs, and rivers: Applications for hazards and water quality. NASA Understanding Changes in High Mountain Asia program.

Katie Lester. Spectroscopic orbits of exoplanet host binaries (WIYN). NASA Exoplanet Exploration program, Jet Propulsion Laboratory research support agreement.

Katie Lester. Spectroscopic orbits of exoplanet host binaries (Keck/WMKO). NASA Exoplanet Exploration program, Jet Propulsion Laboratory research support agreement.

Amy Mlinar. Europa Imaging System (EIS). NASA Europa Clipper program, Johns Hopkins University Applied Physics Laboratory subcontract.

Alexander Morgan. Investigating controls on Martian alluvial fan formation. NASA Mars Data Analysis program.

Alexander Morgan. Creating a Mars valley database using CTX data. NASA Planetary Data Archiving, Restoration, and Tools program.

Alexander Morgan. Composition of Martian fans, basin deposits, and watersheds using VNIR spectroscopy. NASA Mars Data Analysis program, Smithsonian Institution subaward.

Catherine Neish. Effects of methane clathrate on the depth of Titan's craters. NASA Cassini Data Analysis program, Massachusetts Institute of Technology subaward.

Alex Patthoff. Are Io's volcanoes controlled by tidal forces? NASA Solar System Workings program, Jet Propulsion Laboratory subcontract.

Alex Patthoff. The geology of Europa: Bridging the gap between the global and regional scales. NASA Administration Planetary Data Archiving, Restoration, and Tools program, Jet Propulsion Laboratory subcontract.

Bo Reipurth. HH24: A jet complex driven by a young multiple system. NASA James Webb Space Telescope General Observer Program-Cycle 2.

Kirby Runyon. A citizen scientist approach to high resolution geologic mapping of intracrater impact melt deposits as an input to numerical models. NASA Citizen Science Seed Funding program.

Kirby Runyon. Regolith beneficiation system for production of lunar calcium and aluminum. NASA Lunar Surface Technology Research program, Curators of the University of Missouri subaward.

Robert Skarbek. Tracking 3D ice shell evolution and material exchange at Europa. NASA Precursor Science Investigations for Europa program, Southwest Research Institute subaward.

Robert Skarbek. Investigating the origins and timing of shallow moonquakes. NASA Solar System Workings program.

Isaac Smith. North and south polar cap evolution from MY24 to MY36 using daily maps from MOC and MARCI. NASA Mars Data Analysis program, University of Nevada, Reno subaward.

Marissa Vogt. Relating Jupiter's auroral features to magnetospheric source processes: New insights from Juno. NASA New Frontier Data Analysis program.

Marissa Vogt. Structure and dynamics of Jupiter's duskside magnetosphere. NASA Juno Participating Scientist program.

Shawn Wright. Depositional contacts of loess-CRB as analogs for lunar regolith, Martian dust, and the matrix of impact ejecta breccia lobes: A field trip at the GSA Regional. NASA Topical Workshops, Symposiums, and Conferences program.

Naoyuki Yamashita. Advancing lunar geochemistry and prospecting with the KPLO gamma-ray spectrometer. NASA KPLO Participating Scientist Extended Mission program.

Bin Yang. Characterization and temporal evolution of the ejecta created by the DART impact on Dimorphos. NASA Hubble Space Telescope program, Space Telescope Science Institute General Observer Program-Cycle 29.

Bin Yang. Deep imaging of Dimorphos's dust tail. NASA Hubble Space Telescope program, Space Telescope Science Institute General Observer Program-Cycle 30.

Bin Yang. Long-term evolution of Dimorphos's dust tail created by the DART impact. NASA Hubble Space Telescope program, Space Telescope Science Institute General Observer Program-Cycle 30.

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