

THE PLANETARY REPORT

DECEMBER
SOLSTICE **2024**

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THE YEAR IN PICTURES

EXPLORATION SNAPSHOTS
FROM ANOTHER ORBIT





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SEEING FOR OURSELVES

Cosmic sights on Earth and others waiting to be seen

by Bill Nye

FOR SO MANY of us who live in modern, brightly lit cities, opportunities to see the majesty of space are few and far between. We don't get to see the Milky Way spilling across the sky every night or the horizon-to-horizon starscape that our ancestors knew so well.

But on April 8 this year, tens of millions of people across North America were out in the open — in broad daylight — to see the sky go black during the awe-inspiring total solar eclipse. It was the highlight (or dark sky moment) of the year, and it's reflected in our choices of the images that captured this year in space.

Of course, the eclipse wasn't the only cosmic spectacle we got to witness. The Sun was particularly active this year, sending solar energy our way in the form of streams of charged particles that created aurorae much farther south and over a much greater area than is usual for our planet. People throughout the Northern Hemisphere got a rare glimpse of colors dancing across the sky as the solar wind interacted with Earth's magnetic field.

We got to see a little bit of asteroid Benu as well when the sample returned

from the asteroid by NASA's OSIRIS-REx mission arrived and was conveyed to earthly labs. In the same way that the Moon rocks brought to Earth over 50 years ago continue to yield discoveries, the material brought back from Benu will likely lead to decades of insights into the creation of our Solar System and perhaps the origin of life itself.

In July, we also got a tantalizing look at something we'd very much like to see in a lab on Earth: a sample the Perseverance rover collected from a Mars rock nicknamed "Cheyava Falls." It shows intriguing patterns often associated with microbial life. That sample has been collected and cached, but we still need to bring it here to study. NASA's internationally collaborative Mars Sample Return (MSR) program needs funding; it needs the support of organizations like The Planetary Society and advocates like you.

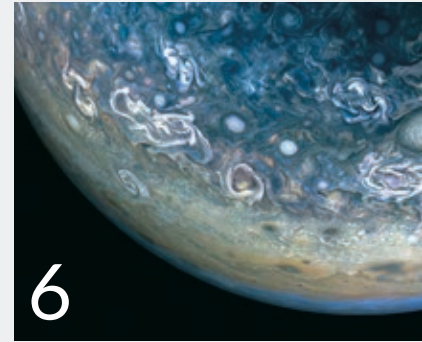
Speaking of people like you, it was thanks in part to your advocacy efforts that Europa Clipper launched this October. As I write, it's en route to Jupiter's intriguing, icy moon with all systems nominal. What we discover there could change the world(s).

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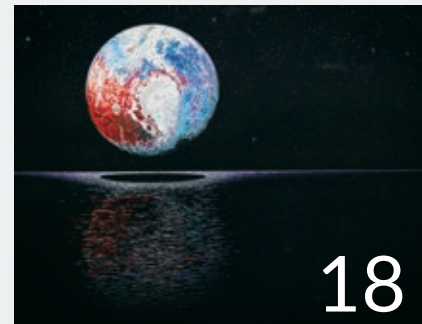
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OPPOSITE Planetary Society members see the splendor of the Cosmos for themselves during a total solar eclipse at the Eclipse-O-Rama 2024 event in Fredericksburg, Texas.

THE PLANETARY SOCIETY

ABOVE NASA's Europa Clipper spacecraft launches on a SpaceX Falcon Heavy rocket from Kennedy Space Center, Florida, on Oct. 13, 2024.

SPACEX

Right now, we're also calling on our members to help get our Beyond the Horizon comprehensive campaign over the finish line. This overarching effort to raise funds to support all of The Planetary Society's work is on track to meet our ambitious \$40 million goal. You've already contributed to this campaign just by being a member, and I thank you for that. You'll read more later in this issue about our goals for this final month of our five-year campaign.

Now, I hope you enjoy reviewing the highlights of 2024 in this issue of The Planetary Report's year-end

collection of space images. It's been a year of fantastic phenomena for everyone who loves space and for humankind. There's so much more to come. Thank you for being with us as we work to make it all happen. 🚀

Onward,

Bill Nye



BILL NYE is chief executive officer of The Planetary Society.

ON THE COVER: SpaceX's Starship vehicle is seen above Earth from an onboard camera during its third test flight on March 14, 2024. Image: SpaceX * The Planetary Report (ISSN 0736-3680) is published quarterly at the editorial offices of The Planetary Society, 60 South Los Robles Avenue, Pasadena, CA 91101-2016, 626-793-5100. It is available to members of The Planetary Society. Annual dues are \$50 (U.S. dollars) for members in the United States as well as in Canada and other countries. Printed in the USA. Third-class postage at Pasadena, California, and at an additional mailing office. Canada Post Agreement Number 87424. * Viewpoints expressed in articles and editorials are those of the authors and do not necessarily represent the positions of The Planetary Society, its officers, or its advisers. © 2024 by The Planetary Society. All Rights Reserved. The Planetary Society and The Planetary Report: Registered Trademarks © The Planetary Society.

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RIGHT A close-up of the Mars rock nicknamed “Cheyava Falls,” showing its distinctive spots.

NASA/JPL-CALTECH/MSSS



MARS' ENDURING ROLE IN THE SEARCH FOR LIFE

New discoveries underscore why we must keep exploring the red planet

by Kate Howells

ON THE STAGE that is the search for life beyond Earth, Mars has spent a long time in the spotlight. The planet next door shows evidence of a more Earthlike past, with liquid water abundant on the surface. Many missions have visited Mars over the decades to study its potential for life, whether long ago in its watery past or somehow persisting today. In recent years, other worlds have started to creep closer to center stage: Europa and Enceladus with their huge subsurface oceans of liquid water and even Titan with its alien seas of liquid

hydrocarbons. Mars was never displaced as a promising world in the search for life, but it increasingly shared the limelight with these other worlds. This year, though, two discoveries proved that Mars would not be upstaged anytime soon.

The first big announcement came in July from NASA's Perseverance mission, along with a selfie. The Mars rover had found a rock, partially buried in a dry riverbed, with a smattering of black and white spots across its surface. On Earth, such “leopard spots” are mainly known to form in two ways: from



microbes or through chemical reactions that can provide fuel for life. This is far from conclusive evidence of past life on Mars, but it's the most intriguing hint of life we've found so far. And even if these spots weren't created by living processes, they at least suggest that the building blocks of life may be common on Mars. Only by bringing the rock back to Earth for further study can we know what caused those leopard spots. But no matter what, the picture of Mars as a habitable planet is getting clearer.

The red planet wasn't finished surprising us yet. In August, a team of scientists analyzing data from NASA's now-defunct InSight lander shared evidence of huge amounts of liquid water beneath Mars' surface. InSight's mission was to study Marsquakes, and the data it collected can tell us things about the rock those tremors travel

through. Through these insights, researchers can tell that the planet's midcrust, about 10-20 kilometers (6-12 miles) down, may be riddled with cracks and pores filled with water — enough to cover all of Mars with an ocean over a kilometer deep. If Mars does have liquid water hidden beneath its surface, it could be hiding life there as well. Yet again, we can't know for certain what's down there until we explore further.

With these tantalizing discoveries hinting at Mars' potential for life, one thing is clear: This planet will always have a role to play in humanity's search for our cosmic kin. 🪐

ABOVE *Jezero Crater is the landing site of NASA's Perseverance rover. In the center of this image captured by the European Space Agency's Mars Express orbiter, the remains of an ancient river delta are visible.*

ESA/DLR/FU-BERLIN



KATE HOWELLS is the public education specialist for *The Planetary Society* and editor of *The Planetary Report*.

The Year In Pictures

The sights of space from the past 12 months

by Asa Stahl



THIS YEAR, space was brought down to Earth. Our planet had front-row seats to dazzling cosmic events, spacecraft collected samples from other worlds, and new missions made the Moon feel closer than it has in decades.

The Sun put on two shows in 2024. In April, a total solar eclipse wowed stargazers across North America, including all those at The Planetary Society's Eclipse-O-Rama event in Fredericksburg, Texas. Because the Sun is near the peak of its 11-year activity cycle, this year gave a particularly dramatic view.

Peak solar activity also means more frequent solar storms. Only one month after the eclipse, the Sun unleashed multiple flares and gigantic waves of plasma toward Earth. Bright aurorae treated many people to exceptional light shows.

Elsewhere on Earth, the OSIRIS-REx mission team opened the capsule containing samples from the asteroid Bennu. They found rocks containing water, organic molecules, and phosphate, which might hint that Bennu could have originally been part of a watery protoplanet.

SpaceX's Starship rocket successfully completed its fifth flight test and was scheduled for a sixth as this issue went to press. The launch vehicle, which will bring astronauts back to the surface of the Moon during the Artemis 3 mission, still has a lot left to prove — but every test brings it closer.

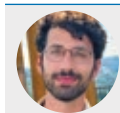
NASA is not the only one with the Moon in its sights. A fleet of diverse spacecraft made Moon landing milestones this year: China's Chang'e-6 became the first ever to bring back samples from the far side of the Moon, JAXA's SLIM made the first

ultra-precise landing (though upside down), and Intuitive Machines' Odysseus became the first private spacecraft on the Moon.

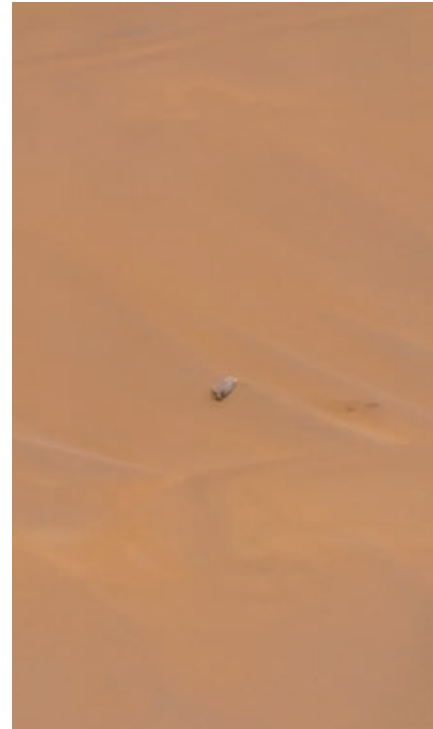
Mars was also full of drama in 2024. NASA's Ingenuity helicopter broke one of its blades — and many space-lovers' hearts — as its mission finally came to an end. The aircraft made the first controlled flight on another world and scouted for the Perseverance rover over 72 different times. Perseverance itself continued to collect samples for the future Mars Sample Return mission, including an intriguing rock that shows signs of having hosted all the main ingredients for life.

Farther from Earth, Juno entered the 13th year of its mission, having now orbited Jupiter for around six years longer than originally planned. It still sends back beautiful images and valuable data.

Two telescopes celebrated very different birthdays. Just before reaching its two-year anniversary, the James Webb Space Telescope made its first directly imaged discovery of an exoplanet. The Chandra X-ray Observatory, on the other hand, passed its 25th birthday under less happy circumstances. Under financial strain, NASA has proposed cutting Chandra's budget to a level that would effectively lead to the mission's cancellation in the near future. As this issue went to press, the fate of the observatory remained uncertain — but its scientific value and the incredible window it has given us on the Universe remain as clear as ever. 🚀



ASA STAHL is the science editor for *The Planetary Society*.



ABOVE One of the helicopter blades from NASA's Ingenuity lying in the Martian sand about 15 meters (49 feet) away from the aircraft's final resting place. This image was captured by the Perseverance rover.

NASA/JPL-CALTECH/LANL/CNES/
IRAP/SIMEON SCHMAUB

OPPOSITE NASA's Perseverance rover took this selfie on July 23, 2024, alongside a particularly intriguing Mars rock. Nicknamed "Cheyava Falls," the rock shows interesting patterns often associated with microbial life on Earth. Perseverance has collected a sample that now awaits return to Earth.

NASA/JPL-CALTECH/MSSS



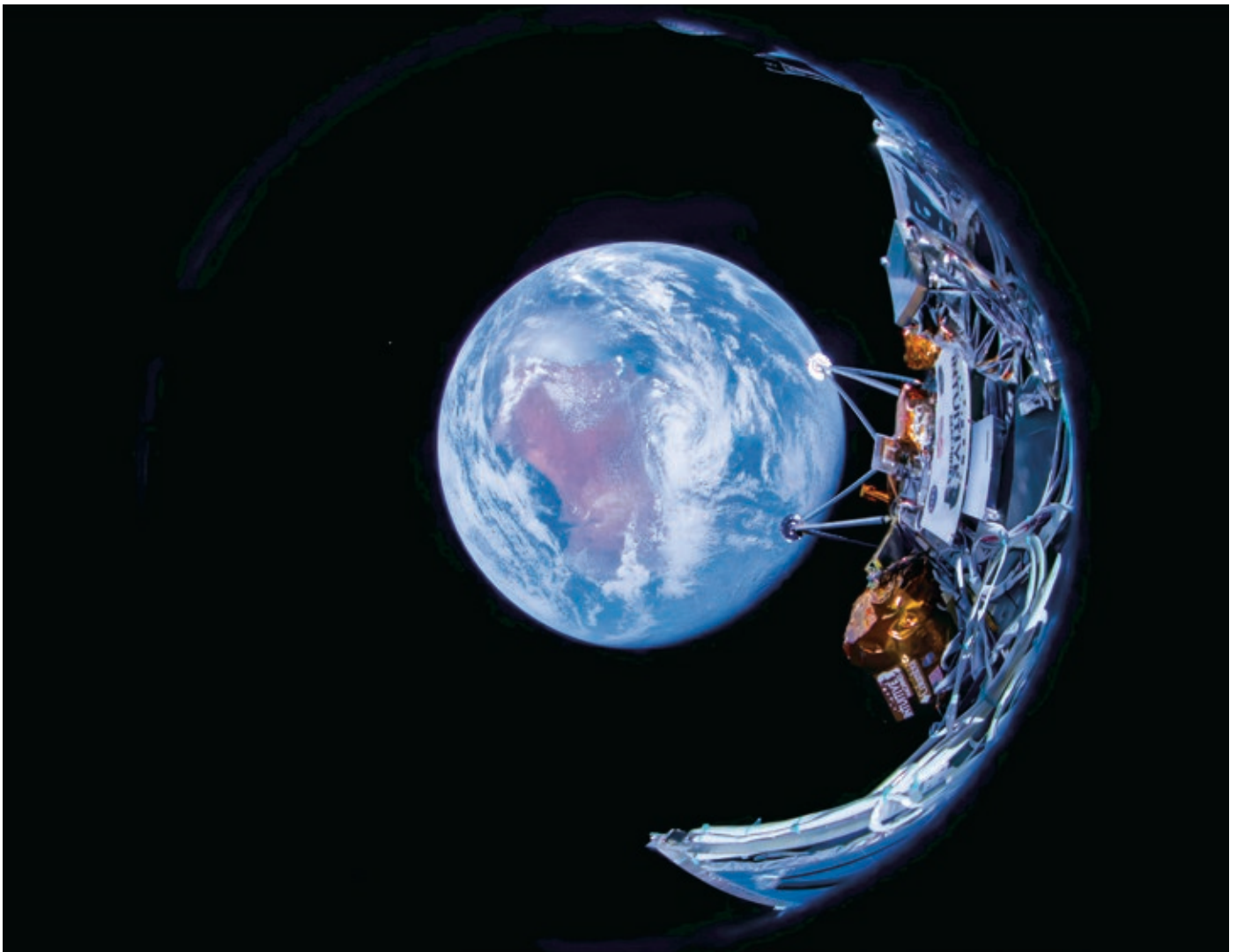
RIGHT This photo of the aurora borealis was shared by Planetary Society member Gene Lewan, whose daughter Elyse and son-in-law Zack captured the image from their backyard in Seattle, Washington.

ELYSE LEWAN

ABOVE This montage of 25 new images created with data from NASA's Chandra X-ray Observatory was released to commemorate the telescope's 25th anniversary in space. The collection is a sampling of the wide range of objects that the telescope has observed, from nearby objects like Jupiter (bottom, second from left) to the very center of our galaxy (upper right). Many of the images combine X-ray data with visible and infrared images from other telescopes. This creates a powerful technique to study these objects.

NASA ET AL.





ABOVE *This image shows the Odyssey lunar lander on its way to the Moon shortly after separating from a SpaceX Falcon 9 booster. Built by private company Intuitive Machines, Odyssey is part of NASA's Commercial Lunar Payload services program.*

INTUITIVE MACHINES



LEFT *This image of China's Chang'e-6 spacecraft was taken by a small rover that detached from the spacecraft shortly after its June 1 landing on the lunar farside. The lander collected samples of rock and regolith, loaded them into an ascent vehicle, and launched them into orbit for collection and return to Earth.*

CNSA/CLEP

RIGHT *Bailey's Beads and solar prominences are seen just before totality from Dallas, Texas, during a total solar eclipse on April 8, 2024.*

NASA/KEEGAN BARBER

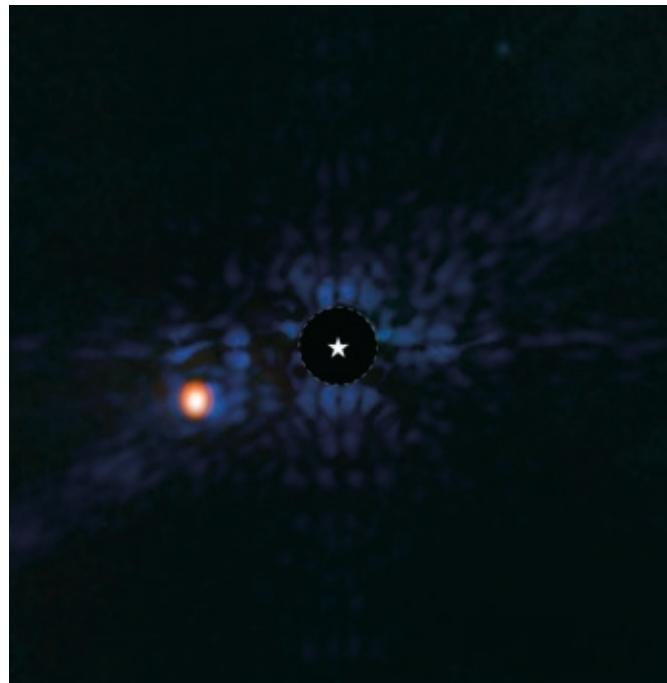
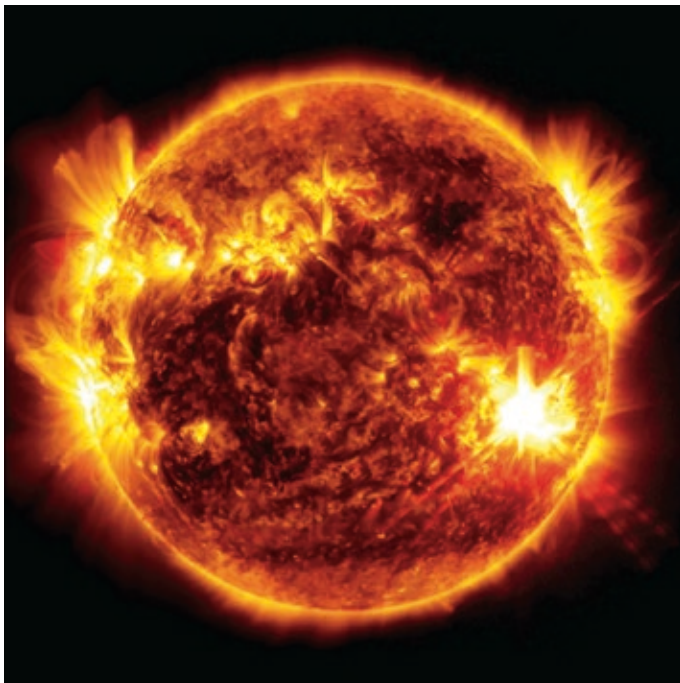
BELOW LEFT *NASA's Solar Dynamics Observatory captured this image of a powerful X5.8 solar flare on May 10, 2024.*

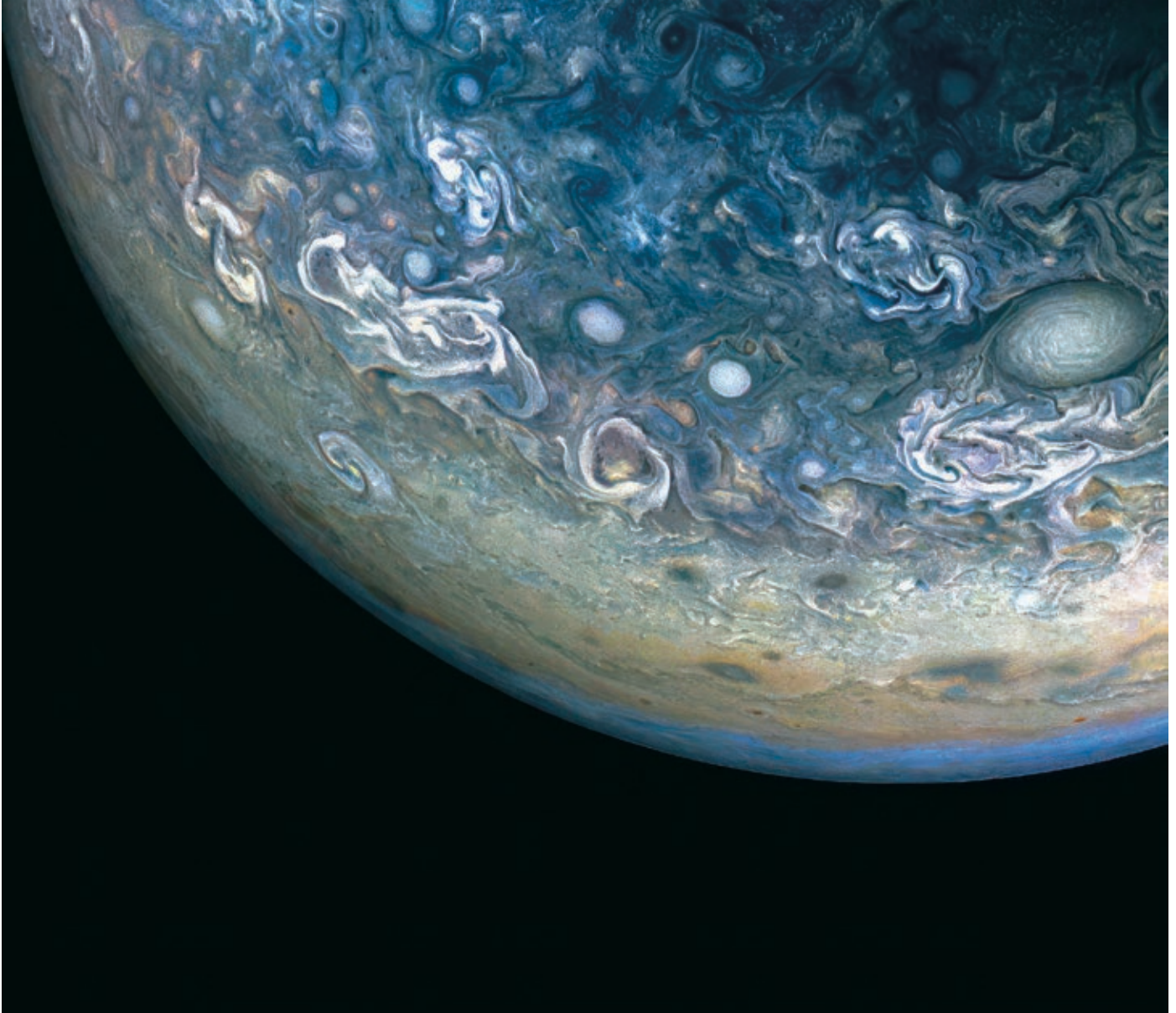
The flare is the brightest region of the image near the center-right. The image shows a subset of extreme ultraviolet light that highlights the hot material in the flare.

NASA/SDO

BELOW RIGHT *A direct image of the giant planet Epsilon Indi A b (orange) taken by NASA's James Webb Space Telescope. Most of the light from the planet's host star, Epsilon Indi A, has been blocked out to reveal the planet. The star's position is marked by an icon.*

NASA/ESA/CSA/STSCI/ELISABETH MATTHEWS (MPIA)





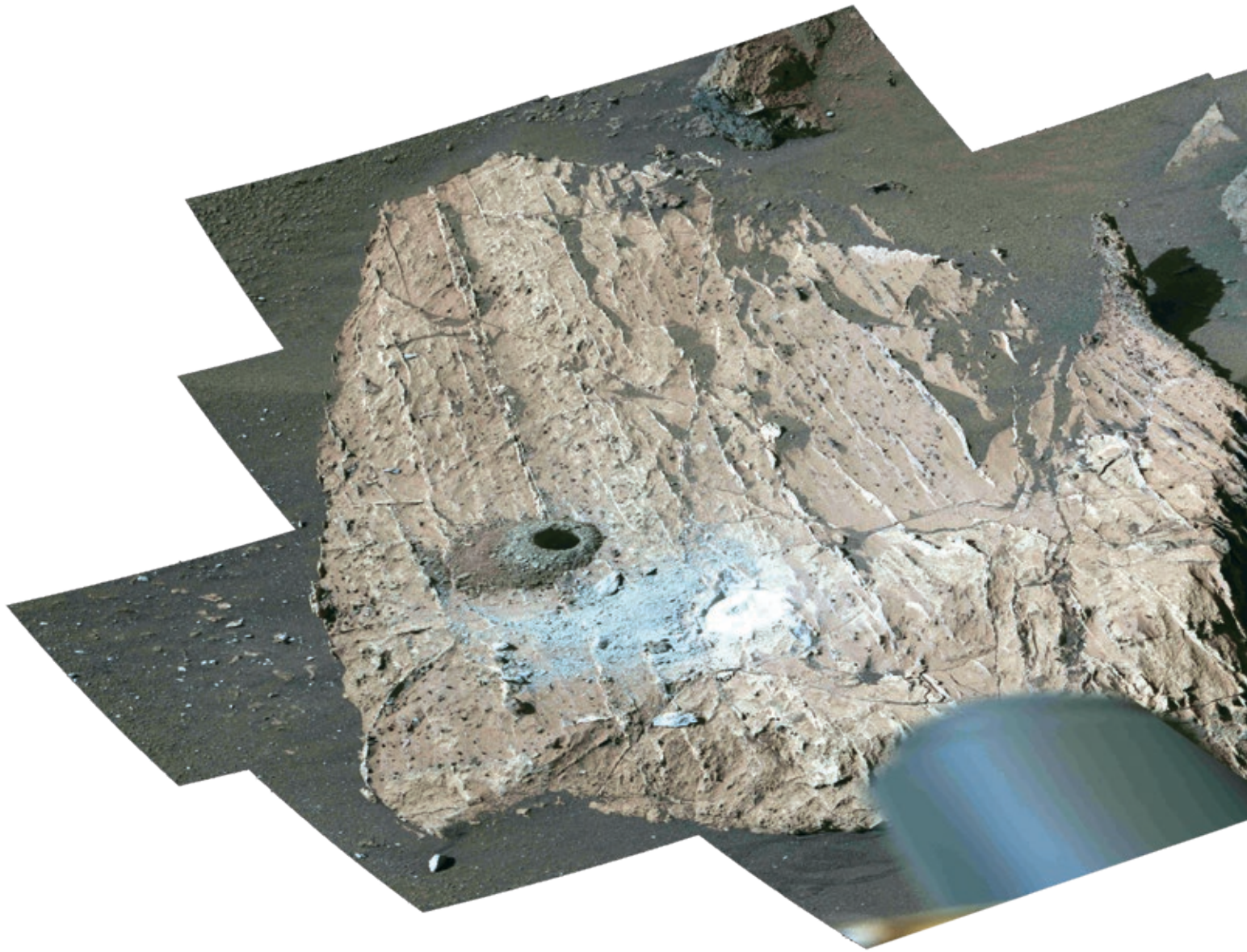
ABOVE A color-enhanced view of the clouds surrounding Jupiter's north pole, taken by NASA's Juno spacecraft from a distance of about 29,000 kilometers (18,000 miles).

NASA/JPL-CALTECH/SWRI/MSSS/PROCESSED BY GARY EASON

LEFT Jupiter's moon Io shows its mottled majesty in this image from the Juno spacecraft's JunoCam instrument in late 2023, processed by amateur image processor Ted Stryk.

NASA/JPL-CALTECH/SWRI/MSSS/TED STRYK





ABOVE

This image shows the Mars rock nicknamed “Cheyava Falls” shortly after NASA’s Perseverance rover drilled into it to collect a sample.

NASA/JPL-CALTECH/ASU/MSSS

NEAR RIGHT

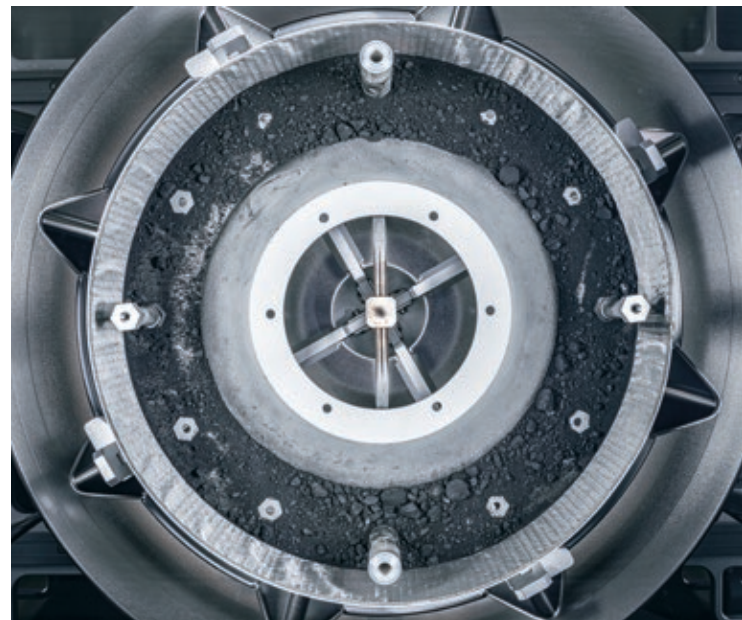
JAXA’s Small Lunar Lander Demonstration Vehicle, SLIM, sits on the lunar surface with its thrusters pointing up. The spacecraft was intended to land in the opposite orientation, after which a small thruster was supposed to tip it onto its side. The image was taken by one of two small rovers the spacecraft deployed.

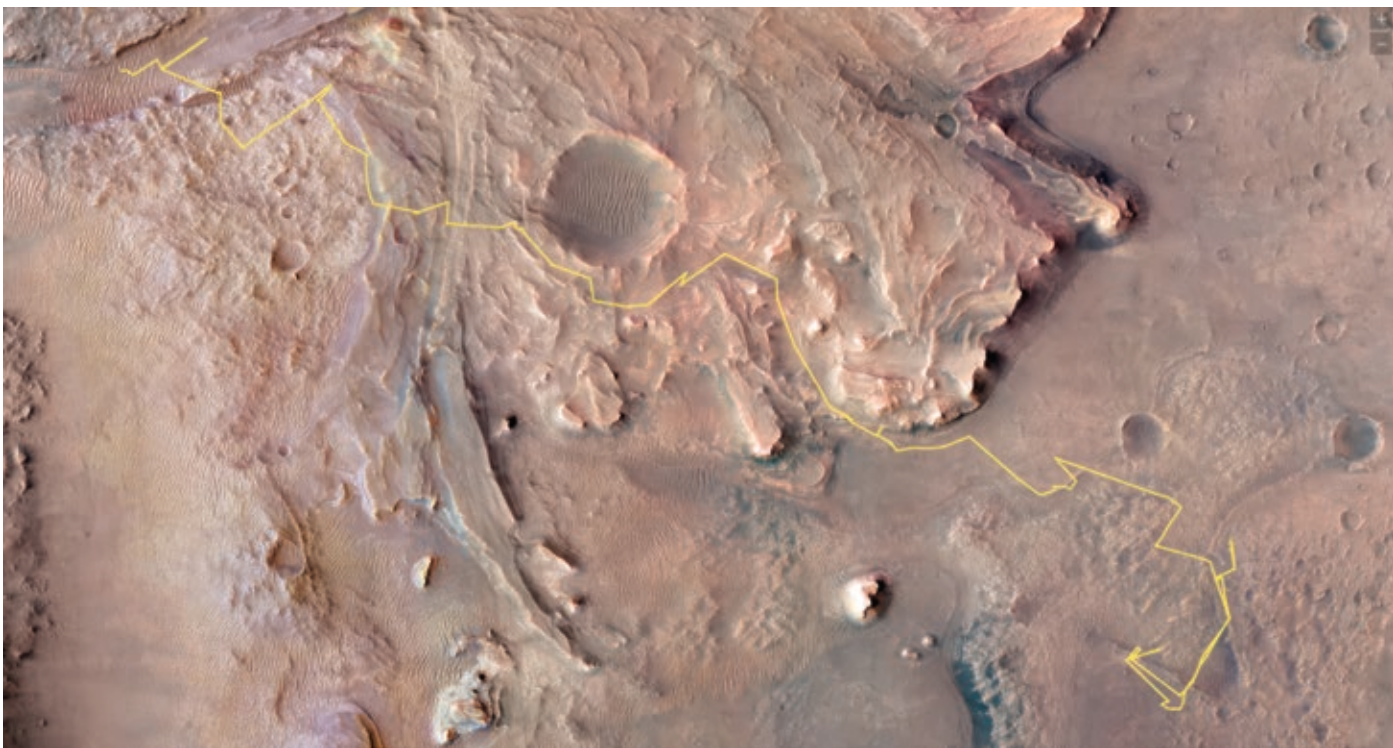
JAXA/TAKARA TOMY/SONY GROUP CORPORATION/DOSHISHA UNIVERSITY

FAR RIGHT

After a lengthy struggle with two stuck fasteners, technicians were finally able to open the OSIRIS-REx Touch-And-Go Sample Acquisition Mechanism (TAGSAM) head that contained the bulk of the mission’s sample from asteroid Benu. The material includes dust and rocks up to about a centimeter (0.4 inches) in size.

NASA/ERIKA BLUMENFELD & JOSEPH AEBERSOLD





TOP This image shows NASA's Perseverance rover as it departed the Bright Angel region of Jezero Crater on Mars.

NASA/JPL-CALTECH/PROCESSED BY ED MULLEN

BOTTOM NASA's Ingenuity Mars helicopter became the first vehicle to achieve powered, controlled flight on another planet when it took to the Martian skies on April 19, 2021. This image maps the location of the 72 flights that the helicopter took over the course of nearly three years.

NASA/JPL-CALTECH

THE PLANETARY SOCIETY RALLIES FOR VIPER

by Casey Dreier

ON JULY 17, 2024, NASA announced the cancellation of its Volatiles Investigating Polar Exploration Rover, or VIPER, mission to map water on the Moon's south pole. VIPER's findings would have paved the way for future lunar habitats while also providing insights into the history and origin of water in the Solar System.

The Planetary Society joined the lunar and planetary science community in rallying together to urge Congress to reverse the decision. The Planetary Society helped circulate a letter signed by nearly 5,000 individuals from the science community. The letter urges Congress to intervene, emphasizing the importance of VIPER for future lunar exploration and scientific discovery. Jack Kiraly, The Planetary Society's director of government relations, organized a dozen in-person meetings between lunar scientists and key congressional offices in support of the mission.

We published a comprehensive analysis on the cancellation, pointing out that the team behind VIPER was not provided an opportunity to propose cost-saving measures to keep the project viable. Finally, The Planetary Society also issued a statement (shared with you below) and encouraged our members to send it to their representatives in Congress.

As of the time of this publication, NASA is considering proposals from the commercial space industry to take over the VIPER mission. The House science committee has demanded more information from NASA and has expressed concern at the cancellation. The Planetary Society will continue to work with the community to ensure scientific exploration at the Moon is preserved.

CANCELING VIPER undermines the scientific credibility of NASA's Artemis campaign and the goal of establishing a permanent human presence on the lunar surface. The rover — managed by NASA's Ames Research Center and built by Johnson Space Center — would help determine the origin, distribution, and abundance of water on the Moon at scales relevant to future human explorers. It is the most significant U.S. science mission planned at the Moon this decade.

The Planetary Society appreciates that NASA is considering commercial and international partners to continue the project. We urge NASA to prioritize the mission's continuation and to consider the full range of landing systems being developed for the Moon that could deliver VIPER to the surface this decade. Any opportunity at landing is preferable to disassembling an already-built rover and missing out on the scientific results.

NASA has spent nearly half a billion dollars of U.S. taxpayer money on VIPER as a science mission. To ensure this investment serves the public, NASA should prioritize the project's scientific output, regardless of how it moves forward. This includes supporting the multi-institutional, multistate science team already selected for the mission, which knows best how to operate the instruments, pursue its scientific goals, and find water on the Moon.

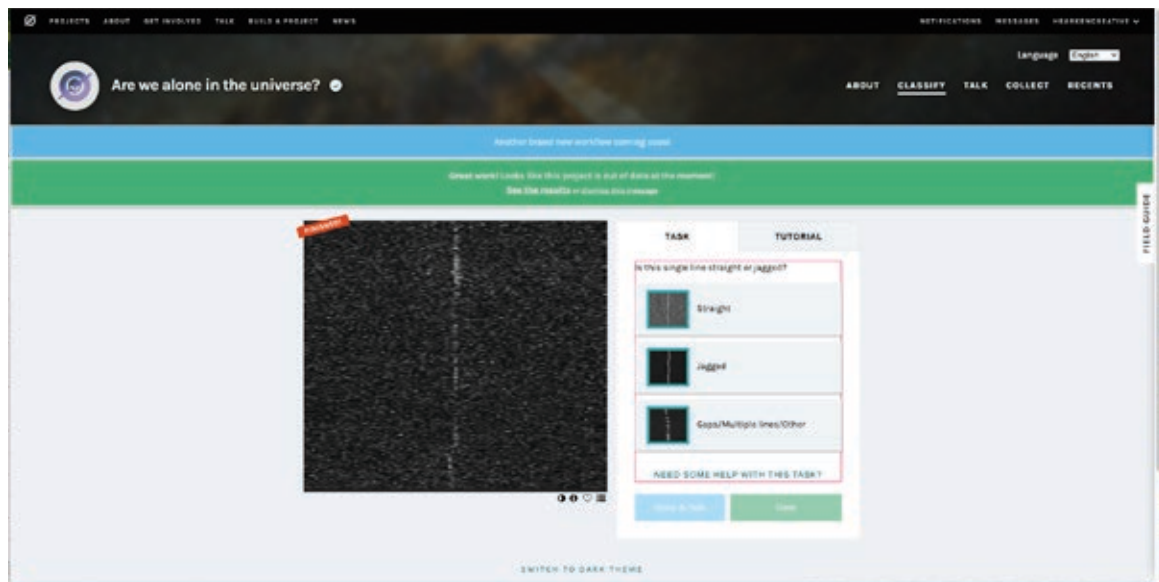
This project's proposed cancellation is yet another casualty of underfunding NASA's science programs. Since 2020, NASA has lost over \$1 billion of buying power in its science portfolio due to congressionally enacted cuts, NASA funding decisions, and inflation. Current and proposed missions are being delayed and canceled, not because of poor performance or lack of quality science but because

of arbitrary budget caps. The Planetary Society continues to urge Congress and the administration to restore NASA's science portfolio to at least \$9 billion per year to maintain U.S. leadership in space exploration and science. Restored funding provides NASA the flexibility to continue VIPER without impacting other important science initiatives.

VIPER's prospecting for lunar water is top-priority science on the Moon and makes Artemis more than just a repeat of the Apollo program. Despite its immediate success, Apollo ended only three years

after its first landing. Artemis is designed to be different by incorporating both science and long-term sustainability into its strategy. VIPER exemplifies the United States' commitment to both as well as the nation's commitment to global leadership in science, resource prospecting, and lunar exploration during a period of increased competition at and around the Moon. We believe the project should continue. 🌱





ARE WE ALONE? A STEP GRANT UPDATE

IN 2022, The Planetary Society awarded two grants in the first round of our STEP (Science and Technology Empowered by the Public) Grant program. One of the inaugural winners was a project titled “Are We Alone? A Citizen-Science-Enabled Search for Technosignatures,” to which we awarded \$49,980. This project is led by Jean-Luc Margot of the University of California at Los Angeles (UCLA).

Part of the search for life beyond Earth involves looking for signals from elsewhere in the Universe sent by intelligent life. Over the decades, though no confirmed signals from aliens have been found, the technology and techniques have become increasingly capable. The “Are We Alone?” project engages citizen scientists — ordinary people from around the world who volunteer their time — to help look for signals amid the interference from human radio frequency sources.

Participants in the project use the Zooniverse citizen science platform to sort and classify data collected by the world’s largest steerable radio telescope, the Green Bank Telescope in West Virginia. The data of interest come from observations focused on 100 stars known to have planets around them, but because the telescope’s field of view is wide, it also picks up data from tens of thousands of

additional stars and planetary systems. Citizen scientists help comb through all of this data to look for signals that may be of interest.

The team’s use of the Green Bank Telescope this year added approximately 3,000 promising signals to Zooniverse as well as more challenging data sets with lower signal-to-noise ratios.

Students are also a big part of the project. This year, Margot’s students at UCLA witnessed the operation of the telescope remotely via Zoom and learned about its operation from Dr. Ryan Lynch, staff scientist at Green Bank Observatory. UCLA graduate student Megan Li is also deeply involved in developing the future of the project by training artificial intelligence to contribute to data processing. Thanks to Li’s work, the AI program can now achieve high-confidence (>95%) predictions of the signal class for 80% of the data presented to it. The team hopes to accelerate its search with the help of this automatic classification system.

This year, the team also launched translations of the project in Bengali, French, Portuguese, and Italian to further broaden the engagement of citizen scientists worldwide.

You can learn more about the project and volunteer as a citizen scientist at arewealone.earth.

ABOVE This screenshot is from the Zooniverse SETI citizen science project asking the user to classify a radio signal.
UCLA SETI GROUP/ZOONIVERSE

ENCOURAGING THE SPACE LEADERS OF TOMORROW

THE PLANETARY SOCIETY is committed to supporting young people who aspire to someday contribute to humanity's exploration and understanding of the Cosmos.

For several years now, The Planetary Society has been participating in the Zed Factor Fellowship program. This program empowers aspiring aerospace professionals from historically excluded backgrounds through practical hands-on experience, leadership training, and community. In August, we welcomed our fourth Zed Factor fellow, Elizabeth Koenck. She is a student at Georgetown University in Washington, D.C., and spent the fall semester with us working on special advocacy and space policy projects.

In addition, this year, with support from the Halicioğlu Family Foundation, we sponsored 20 international students to attend the 2024 Astrobiology Graduate Conference at Cornell University in Ithaca, New York. This conference brought together 101 students, ranging from first-year graduate students to post-docs, from 59 different universities and institutions in the United States and Puerto Rico, Canada, the United Kingdom, Italy, Germany, Spain, India, Australia, Japan, and Brazil. Participants heard lectures by experts in various fields related to astrobiology, from nanoscale biochemistry to space policy; gave their own presentations about the work they're undertaking in the field; took part in field trips and workshops; and built community with their peers from around the world.

The conference organizers applauded The Planetary Society for supporting the international students' participation, saying, "Your generous support was the impetus for lifelong memories and friendships, increased confidence, and the exchange of ideas that will shape the future of astrobiology."

Below are some testimonials from participants who attended the conference thanks to Planetary Society support.

"AbGradCon provided an incredible opportunity to present research in a safe and supportive environment. It also cultivated a community culture that was beneficial in networking with people in the field."

"AbGradCon24 was an amazing experience, especially as an international student. It was my first trip to the U.S., and the organizers couldn't have picked a more beautiful location to host the conference. The event highlighted to me how interconnected — but most importantly, welcoming — the astrobiology community is!"

"This experience made me feel much more connected to others in my field. This collaboration was inspiring to me and made me feel more excited about my research. I learned a few new things from other scientists that will be very valuable for my research."

"I feel like I've got a whole new astrobiology family. If the folks at AbGradCon represent the future of astrobiology, we're in safe hands. I have met so many amazing people and have seen so much cool research; I am really inspired by everything from AbGradCon. Though I was already a confident presenter, I really enjoyed presenting to peers rather than long-time academics. I also felt doing the PWR [Proposal Writing Retreat] was a great benefit, as I feel much more job-ready after doing that. My confidence has increased greatly in feeling that I am ready to work in this career."

BELOW *Students in the 2024 Astrobiology Graduate Conference at Cornell University took part in a guided fossil hunt with the Paleontological Research Institution. The fossil hunt took place in Tully, New York, where a PRI paleontologist helped participants search for and identify fossils that they could take home as souvenirs.*

SATHESH RAJ



Are you interested in learning more about astrobiology and the search for life? Check out our seven-part course "The Search for Life" in The Planetary Society's online member community. Log in today at community.planetary.org and look for "Free Online Courses" in the left-hand navigation bar.

SHOW US YOUR ART

EVERY ISSUE OF our weekly email newsletter, The Downlink, includes a call for readers to submit their space-inspired artwork. This year, Planetary Society members' creativity didn't disappoint! Here are a few of the phenomenal submissions that members from around the world shared with us. You can subscribe to The Downlink at planetary.org/connect and see past issues at planetary.org/downlink. If you have creative work you'd like to share, send it to us at connect@planetary.org and be sure to tell us you're a member!



ABOVE This painting by Planetary Society member Jeff Lundeen shows two imagined worlds snuggling up from the viewer's perspective, with a nebula in the background.

JEFF LUNDEEN



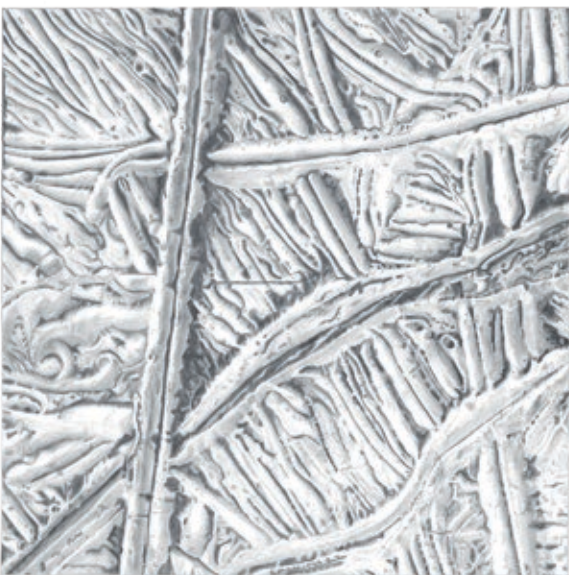
LEFT Planetary Society member and astronomical artist Pavel Gabzdyl was inspired by the 30th anniversary of the Shoemaker-Levy 9 impact on Jupiter and created this depiction of an imagined view of the impact from the surface of Jupiter's moon Io. "The image shows the last of all the impacts, which occurred on July 22, 1994," says Gabzdyl. "Then, on the right, you can see one of the eruptions of volcanic material, hovering high above the active volcanoes of this moon."

PAVEL GABZDYL



ABOVE This portrait of Venus' south pole was made by Canadian artist Susan Gaby-Trotz, a retired teacher and Planetary Society member who used traditional rug hooking techniques.

SUSAN GABY-TROTZ



LEFT Planetary Society member Edward Smith drew this pencil sketch of ridged plains on Europa, inspired by an image from NASA's Galileo spacecraft. "When I came across the photo," said Ed, "I was floored and decided to make a drawing of it."

EDWARD SMITH

LEFT Planetary Society member William Perrish painted this view of Pluto, inspired by images from the New Horizons spacecraft's 2015 flyby of the distant dwarf planet.

WILLIAM PERRISH



Beyond the Horizon: The Planetary Society campaign to create space for everyone

We are all explorers. We come from a long line of explorers. And together, we are a community of explorers. Join us and usher in the next great era of space exploration. With your investment, we will go beyond the horizon, make new discoveries, and change the world!

– Bill Nye, CEO

Because of generous members like you, The Planetary Society is within reach of our ambitious \$40 million goal as we approach the end of our five-year Beyond the Horizon fundraising campaign this month. Launched with a generous gift from our lead donor, Taner Halicioğlu, we've been on a mission to raise financial support to explore worlds, search for life, defend Earth from asteroids, and grow and strengthen the Society. We are nearly there! As of this writing, we have raised an astounding \$39 million! But we can't get across the finish line without your continued support — and every gift we receive on or before Dec. 31, 2024, counts more than ever.

Through our campaign over the past five years, we have worked to connect everyone with the beauty, adventure, and promise of space exploration. We've launched our new youth membership program, Planetary Academy, which is now introducing thousands of kids to the passion, beauty, and joy of space exploration. We've invited members to participate in our new digital community, and nearly 13,000 of you have joined us there. We literally launched a spacecraft, LightSail 2, and proved not only that light can provide propulsion but that ordinary people can come together to make extraordinary things happen. These are but a few of the milestones we achieved as part of our Space for Everyone strategic framework that has guided the Society over this period. You can read more about our exciting work in the impact report we're mailing to all members for our year-end fundraising campaign.

Our fundraising efforts this month will be critical to meeting our goal as we make the final push to the finish line. With a \$100,000 matching gift challenge by our lead donor, Taner, our year-end appeal is your best and final opportunity to make a difference!

I invite you to join us in this worthy endeavor. With your support, we will help everyone come to know the Cosmos and our place within it.

Robert Picardo
Board of Directors Development Committee Chair

A NEW ONLINE COURSE: STARGAZING 101

Explore the Cosmos above you with Stargazing 101, our new in-depth guide to backyard astronomy for everyone from newbies to space nerds. Learn about the wonders waiting to be seen overhead, develop practical skills for parsing the night sky and seeing the best possible views, and hear practical tips from professional astronomy communicators on how to help others fall in love with stargazing. No matter where you live or whether you own a telescope, this how-to guide will transform the stars overhead into a clear window to the Universe.

Log in at community.planetary.org.



CALENDAR OF EVENTS

DECEMBER

13

Lucy flyby of Earth

13-14

Geminid meteor shower

22-23

Ursid meteor shower

JANUARY

3-4

Quadrantid meteor shower

9

Bepi-Colombo flyby of Mercury

10

Venus at greatest eastern elongation (best viewing)

16

Mars at opposition (best viewing); conjunction of Venus and Neptune

MARCH

8

Mercury at greatest eastern elongation (best viewing)

14

Total lunar eclipse

20

March equinox

EXPLORE THE COSMOS WITH THE PLANETARY SOCIETY AND LERNER PUBLISHING

Welcome to an exciting new chapter in space education! Get ready to embark on a journey through the Cosmos with our engaging series of books that make space science fun and accessible for young readers.

In collaboration with Lerner Publishing Group, Planetary Society Chief Scientist Bruce Betts has written a series of books about the Solar System for kids. “Exploring Our Solar System” is an eight-book series that takes young readers (age 7 to 10) on an exciting journey through our Solar System. With vibrant photos and informative diagrams, children will learn about the planets, their moons, and other celestial wonders.

More books that will empower young readers to explore space and science are also in the works from The Planetary Society and Lerner Publishing Group.

Our members play a crucial role in ensuring that these educational resources reach as many young minds as possible. Here’s how you can support the initiative:

- **Request:** Contact your local schools and public libraries to request that they stock these books. Ensuring they are available in libraries will make them accessible to more children.
- **Purchase:** Buy these books for your own friends or family to help inspire the young space enthusiasts in your life.
- **Review:** After reading one of our books, leaving a review on Amazon helps elevate the book’s visibility and credibility. Share your thoughts to help us spread the word!

Learn more at planetary.org/planetary-society-books.

MAKE A YEAR-END DONATION TO THE SOCIETY

Your year-end donation to The Planetary Society is a powerful way to make an impact on our shared mission to advance space science and exploration.

Make your gift today at planetary.org/planetaryfund

For U.S. tax purposes, gifts must be received on or before the last day of the year. Here are some common methods of making a gift and their associated deadlines.

- Online credit card gifts: transaction completed by 11:59 p.m. EST (8:59 p.m. PST), Dec. 31, 2024.
- Credit card gifts via U.S. mail: received and processed on or before Dec. 31, 2024.
- Checks sent via U.S. mail: postmarked on or before Dec. 31, 2024.
- Checks sent via third-party shipping (such as FedEx or UPS): delivered on or before Dec. 31, 2024.
- Stock transfer: broker-to-broker instructions issued in time for completed transfer on or before Dec. 31, 2024.

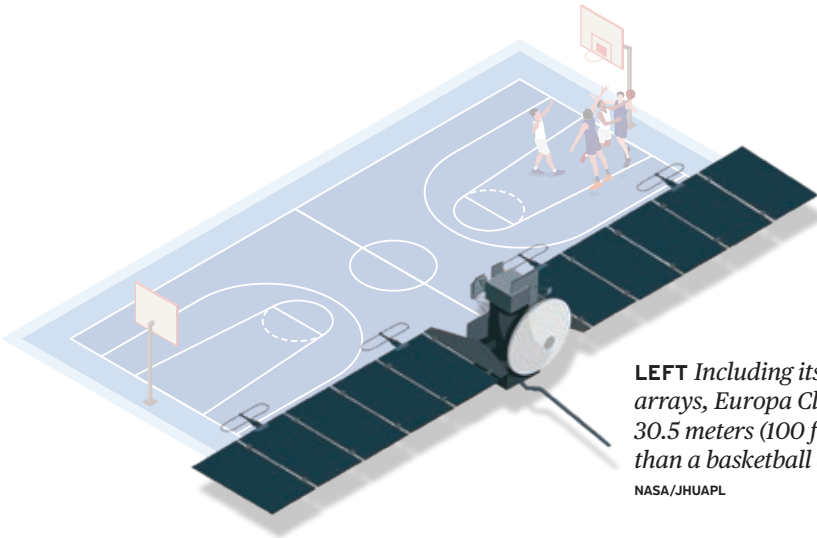
MONTHLY MEMBERS: ACTION NEEDED

We've made changes to our recurring credit card charging process for monthly members. For many, the process happened automatically, and you won't notice any changes. For others, however, these changes will require us to have members update their credit/debit card information. To facilitate this, we've sent communications to monthly members who need to update their credit card information. Please note that if you don't update your information, your membership will lapse, and you will lose access to your benefits, like The Planetary Report. **So, please be sure to update your information today!**

Questions? Please contact Richard Chute, Chief Development Officer, at Richard.Chute@planetary.org or call 626.793.5100



WHAT'S UP?



LEFT Including its solar arrays, Europa Clipper spans 30.5 meters (100 feet), longer than a basketball court.

NASA/JHUAPL

IN THE SKY

There are lots of easy-to-see planets in the evening. Bright reddish Mars is in the east in the evening. It reaches opposition, the opposite side of Earth from the Sun, on Jan. 16. Watch it brighten before opposition, which is approximately when Earth and Mars are closest in their orbits for this time around the Sun. Near opposition, Mars will be about as bright as the brightest star in the night sky: Sirius. Mars will start to gradually dim after opposition. Very bright Jupiter is above Mars in the evening east. Super-bright Venus will be in the early evening west. Yellowish Saturn is above Venus until they are close together in the sky on Jan. 19, after which Saturn will be lower. Mercury will be visible low to the western horizon soon after sunset in early March. The Quadrantids meteor shower will peak on the night of Jan. 2-3. The Quadrantids is an above-average shower but often with a very brief peak. A waxing crescent Moon will provide little interference. On March 14, there will be a total lunar eclipse visible from North and South America. For more night sky tips, you can always check out [planetary.org/night-sky](https://www.planetary.org/night-sky).

RANDOM SPACE FACT

With its solar arrays deployed, the Europa Clipper spacecraft is about 30 meters (100 feet) across — about the length of a basketball court.

TRIVIA CONTEST

Our March Equinox contest winner is Mark Saltzman of Fort Collins, Colorado, USA. Congratulations! The question was: **What was the first exoplanet discovered around a Sunlike star?** The answer: **51 Pegasi b.**

Try to win a copy of the new book “Mars: The Red Planet” from the series “Exploring Our Solar System with The Planetary Society” by Bruce Betts and a Planetary Radio T-shirt by answering this question: **Who has spent the most time in space (over multiple missions)?**

Email your answer to planetaryreport@planetary.org or mail your answer to The Planetary Report, 60 S. Los Robles Ave., Pasadena, CA 91101. Make sure you include the answer and your name, mailing address, and email address (if you have one). By entering this contest, you are authorizing The Planetary Report to publish your name and hometown. Submissions must be received by March 1, 2025. One entry per person. The winner will be chosen in a random drawing from among all the correct entries received.

SOCIETY TRAVEL



Please contact Terri or Taunya at Betchart Expeditions for brochures and updated information on COVID and travel. Call 1-800-252-4910 or email info@betchartexpeditions.com.

We invite you to join other members and friends of The Planetary Society to discover the world on a Betchart Expeditions adventure!

ALASKA AURORA BOREALIS

FEB. 23-MARCH 1, 2025

Come see the greatest light show on Earth! Visit Seward on the Kenai peninsula, take the train to Fairbanks, and delight in the ice festival and aurora borealis in the night sky!

TANZANIA SAFARI & LUNAR ECLIPSE

SEPT. 3-14, 2025

Come with us on a Safari in Tanzania! See the finest wildlife reserves in east Africa and the total lunar eclipse! This is a tremendous opportunity for travelers to view the Milky Way over spectacular Ngorongoro crater and the Serengeti. With leadership by excellent safari guides, this will be an exceptional experience.

HIGH ARCTIC TOTAL SOLAR ECLIPSE VOYAGE

JULY 31-AUG. 16, 2026

A unique opportunity to see a cosmic wonder in an Arctic wonderland! From Spitsbergen to east Greenland's spectacular Scoresby Sund fjord system to Iceland, we'll explore some of the best areas for viewing polar bears, Arctic foxes, various seals, whales, and enormous icebergs. We'll see the total solar eclipse above the Arctic Circle!

MAJORCA, SPAIN TOTAL SOLAR ECLIPSE

AUG. 3-13, 2026

We invite you to join our Spain total solar eclipse adventure including a special visit to Madrid's historic Royal Observatory, the Castile La Mancha Science Museum in Cuenca, the remarkable City of Arts & Science Center in Valencia, and the enchanting western Mediterranean Balearic island of Majorca to see the total solar eclipse at sunset!



“Loose Lids Stain Ships”

Danielle Rose Baker

This watercolor and ink painting by Planetary Society member Danielle Rose Baker shows the IFT-3 test of the SpaceX Starship and Falcon Super Heavy, which took place on March 14, 2024. It’s a near-perfect depiction of one of the images we included on the cover of this issue but with one difference. “The unique texture and starburst are a testament to the permanence of professional calligraphy ink,” said the artist. “I spilled most of a bottle across this painting while in progress, hence the title. I finished it as a tribute to the messy process of art, the sometimes chaotic pursuit of scientific discovery, and the nonlinear path to space exploration.”

Do you want to see your artwork here? We love to feature our members throughout this magazine. Send your original, space-related artwork to connect@planetary.org.