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THE PLANETARY REPORT

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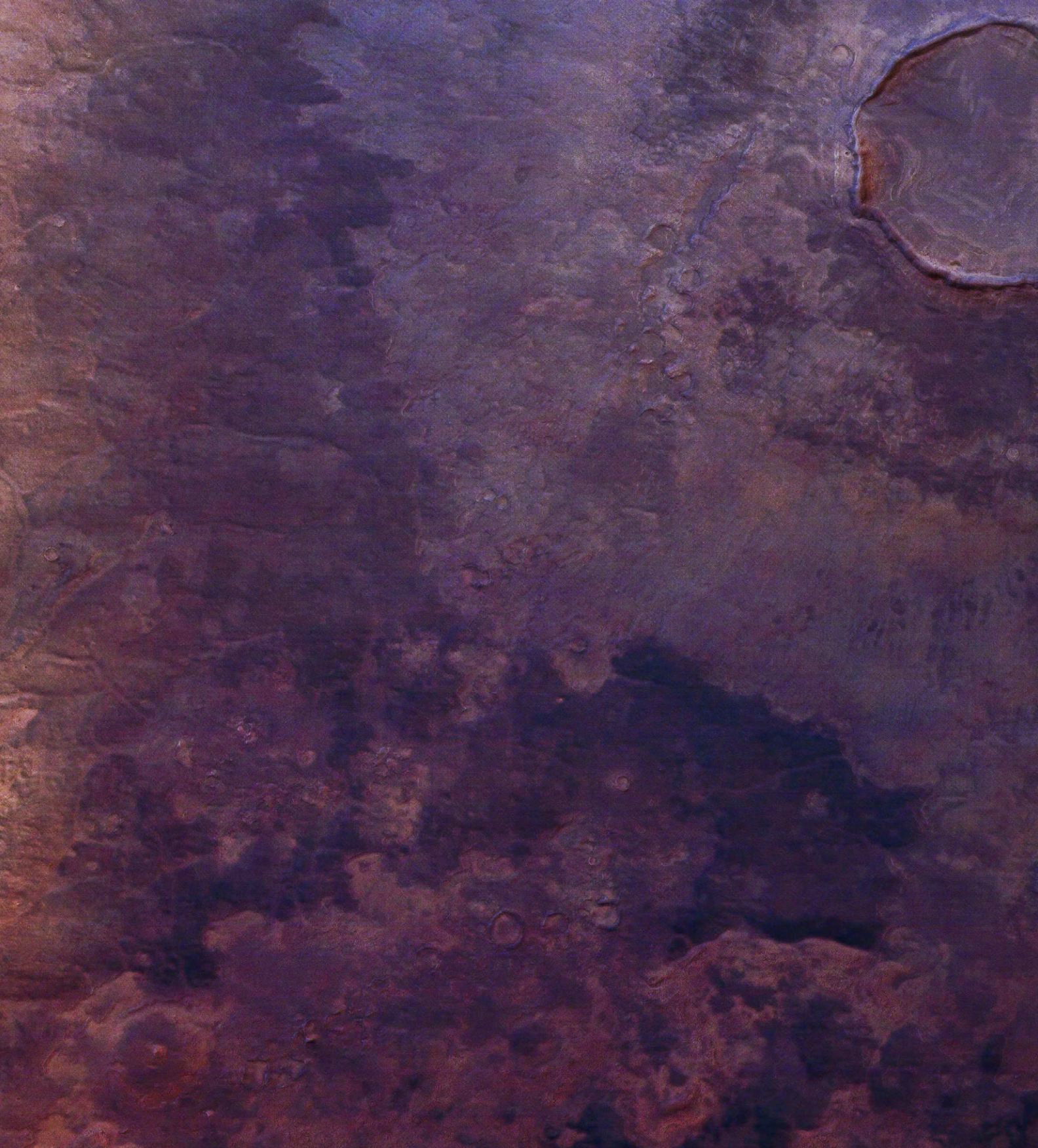
FUTURE FORWARD

THE NEXT CHAPTER IN MARS AND EXOPLANET EXPLORATION



Dark ash on Utopia Planitia

Volcanic ash spread over part of the Utopia Planitia region of Mars, as imaged by the European Space Agency's Mars Express orbiter.

ESA/DLR/FU Berlin

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ON THE COVER

This view of Mars was created by combining 90 individual images captured in 2023 by the High Resolution Stereo Camera on the European Space Agency's Mars Express orbiter. This view enhances color and contrast to highlight variation across Mars' surface. Standing out against Mars' classic red hues are dark and blue-toned areas, which are basaltic sands of volcanic origin.

ESA/DLR/FU Berlin/G. Michael

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BELIEVE IT TO ACHIEVE IT

The optimistic perspective that shapes our work

by Jennifer Vaughn
Chief Executive Officer

The American disability rights activist Helen Keller once said, "Optimism is the faith that leads to achievement; nothing can be done without hope and confidence." For The Planetary Society, optimism is one of the core values codified in our strategic framework. We believe that humanity is capable of doing great things and making important discoveries, we have faith that technological hurdles can be overcome, and we look toward the future of space exploration with hope. When we need to, we take action to help bring that optimistic vision to life.

The missions featured in this issue of The Planetary Report reflect that optimism. The Nancy Grace Roman Space Telescope, which you'll read about in an article by project scientist Jason Rhodes, was in danger of being canceled just last year. When Roman was in danger, The Planetary Society and our global community of members did not lose our optimism or our commitment — we rallied together to advocate for that mission and the others threatened by the White House's proposed NASA cuts. Our shared vision that this mission could be saved — and that it would make groundbreaking discoveries — helped it get to this point. Now, Roman is poised to make some of the greatest advances in the history of exoplanet discovery, among other things.

The Japanese MMX (Martian Moons eXploration) mission, covered in a feature article by Planetary Society space policy fellow Ari Koeppel, represents another achievement of optimism. For years, Planetary Society members have supported the development of PlanetVac, a new sample-collection technology. The donations that enabled the design, building, and testing of this system were investments in optimism — in the idea that ordinary people can have an impact on space exploration. And now, PlanetVac is on a mission to the Martian moons.

You'll also learn more in this issue about a new generation of Mars missions. Many are in very early stages of development, still just hinting at exploration that may be in our future. With vision, long-term commitment, and sustained funding, ambitious ideas like these can become realities.

Stay tuned for more on our 2030 strategic vision, "Together, We Explore," in the next issue of The Planetary Report.

In essence, we explore because we believe there is something out there worth discovering. We believe we're capable of overcoming the challenges posed by spaceflight. We have faith that our discoveries will shape the future for the better. And so we take steps to turn optimism into reality.

Our new five-year strategic vision identifies six core values: curiosity, humanity, optimism, independence, credibility, and effectiveness. Each one is as essential to our efforts as the hopeful belief in the future emphasized here. Together, these qualities define our work, unite our members, and shape our future.

Thank you, as always, for being part of this movement for space.

Let's keep exploring,

Jennifer Vaughn

ADVOCACY IN ACTION

Snapshots from the 2026 Day of Action

On Monday, April 20, 2026, more than 130 space advocates from 34 states and the District of Columbia came to the nation's capital for The Planetary Society's annual Day of Action. Over the course of the day, these volunteer advocates held 280 meetings with House and Senate offices to deliver a simple message: Save NASA Science, again. These are some snapshots of members taking action to support space science and exploration.

All photos by Stephen Bobb for The Planetary Society

▲ Left to right: Planetary Society members Gabe Segarra, Max Kaiserman, Brandon Franklin, and Nathan Mohling walking between meetings in Congress.

"I've been to every Day of Action. Casey and Jack have us — old pros and newbies both — very well prepared to present our message about the importance of congressional support for NASA — never more so than these last two Days of Action. It's great to meet all the other participants. It's the most awesome thing I do all year."

— David Key, MN

"The Day of Action is a great event. It gives us a chance to be part of the process of Congress making decisions on the budget. It is great to share our passions to make a difference."

— Nathan Mohling, SC

"The Day of Action is a great opportunity to share passion for NASA science. The Planetary Society does a great job of preparing us, and no one goes alone. I was thankful for the opportunity to share my experience on Planetary Radio and hope it inspires others to join us!"

— Gabe Segarra, SC

▲ Left to right: Planetary Society members Kirby Runyon, Shelby Lane, and Rani Bush in front of the United States Capitol.

▲ Left to right: Planetary Society members Peter Solfest, David Key, and Kristi Shalla walking between meetings in Congress.

THE CASCADE OF DISCOVERY

Every mission has its place in the architecture of exploration

by Kate Howells
Public Education Specialist

No space mission is an independent adventure. When a rocket sends a spacecraft toward its destination, it isn't just beginning a new journey — it is taking the next step in an ongoing odyssey of discovery and laying the path for future missions to tread. Every mission is both an answer and a question, both a conclusion and a premise, carrying with it the missions that made it possible and those that will follow.

In the cascade of discovery, data returned by one mission generate new hypotheses, which motivate new investigations, which incentivize new missions, which return richer data still. Each step depends on the ones before it. A telescope launched this year will spend years cataloging objects that a different observatory, not yet even approved as a formal mission, will one day study in detail. A rover drilling into the ground of another world will prove techniques and generate a scientific case to warrant the next more ambitious attempt.

This issue of The Planetary Report brings you insights into some of the latest additions to that architecture — missions on the near horizon that each fit into a history stretching back decades and forward far into the future. Each of these missions was designed to answer questions prompted by previous discoveries, and each will make it possible to ask the next generation of questions. What each mission enables matters as much as what it discovers.

When a system is based on a cascade like this, disrupting one step can have far-reaching consequences. If NASA never sends spacecraft to retrieve and return the Martian material collected and cached by the Perseverance rover, the questions that scientists hope those samples could answer will remain mysteries. If NASA's missions to Venus are defunded, the world will be deprived not only of the discoveries that those spacecraft would make but of the entire course of exploration that those discoveries would set in motion.

The vulnerability of the cascade applies to the people as much as the hardware. The scientists and engineers behind these missions train students who go on to work on missions of their own and train the subsequent generation of explorers. When thousands of NASA staff left the agency this year due to budget cuts, that chain of knowledge and craftsmanship was permanently disrupted.

This is why The Planetary Society fights so hard to oppose cuts to NASA's science budget. Defunding a mission doesn't just cancel a project; it breaks a link in a chain that took decades to forge, invalidating work that came before and abandoning the potential of what would follow.

To argue for any single mission on its own terms misses the bigger stakes: What we are really fighting to protect is the architecture of exploration itself.

Perseverance selfie at Lac de Charmes

NASA's Perseverance rover took this self-portrait against a sweeping backdrop of ancient Martian terrain at a location the science team calls "Lac de Charmes," with the western rim of Jezero Crater stretching into the background.

NASA/JPL-Caltech/MSSS

MEET THE NANCY GRACE ROMAN SPACE TELESCOPE

Inside NASA's next great observatory

by Dr. Jason Rhodes
Guest Author

In 1959, Nancy Grace Roman became the first chief of astronomy at NASA. She worked tirelessly to advocate for space telescopes to study the Universe. Her leadership and perseverance paid off with some of NASA's greatest achievements, including telescopes like the Hubble Space Telescope (HST) and the James Webb Space Telescope (JWST). Dr. Roman's legacy is now firmly cemented by NASA's newest flagship space telescope, the Nancy Grace Roman Space Telescope.

Roman, as those of us working on the telescope call it, is poised to make transformative discoveries across huge swaths of the astrophysics landscape. The telescope's 2.4-meter primary mirror (the same size as the primary mirror on HST) is relatively modest compared to the standard set by JWST's 6.5-meter mirror. What makes Roman unique are its two instruments.

Roman's science instrument is the Wide Field Instrument (WFI), a camera that can take optical and near-infrared images and spectra. The WFI contains 300 million pixels and will see an area of the sky about 100 times larger than the cameras on HST or JWST. The second instrument, the Roman Coronagraph Instrument, is designed to demonstrate the technology used to block starlight to directly image exoplanets orbiting nearby stars. As the Jet Propulsion Laboratory's project scientist for Roman for the past 11 years, I am personally excited about both of these amazing tools. It has been my privilege to help push the coronagraph instrument through design, build, and delivery, and the WFI will allow me to push forward my own research in ways I have been dreaming about for over two decades.

From its position at the Earth-Sun Lagrange point 2 (L2), about 1.5 million kilometers (over 900,000 miles) from Earth, Roman will be thermally stable and able to make observations nearly 100% of the time. The WFI's field of view and L2 orbit combine to make Roman about 1,000 times as fast as HST in surveying the sky. Likewise, thermal stability and new coronagraph technologies will

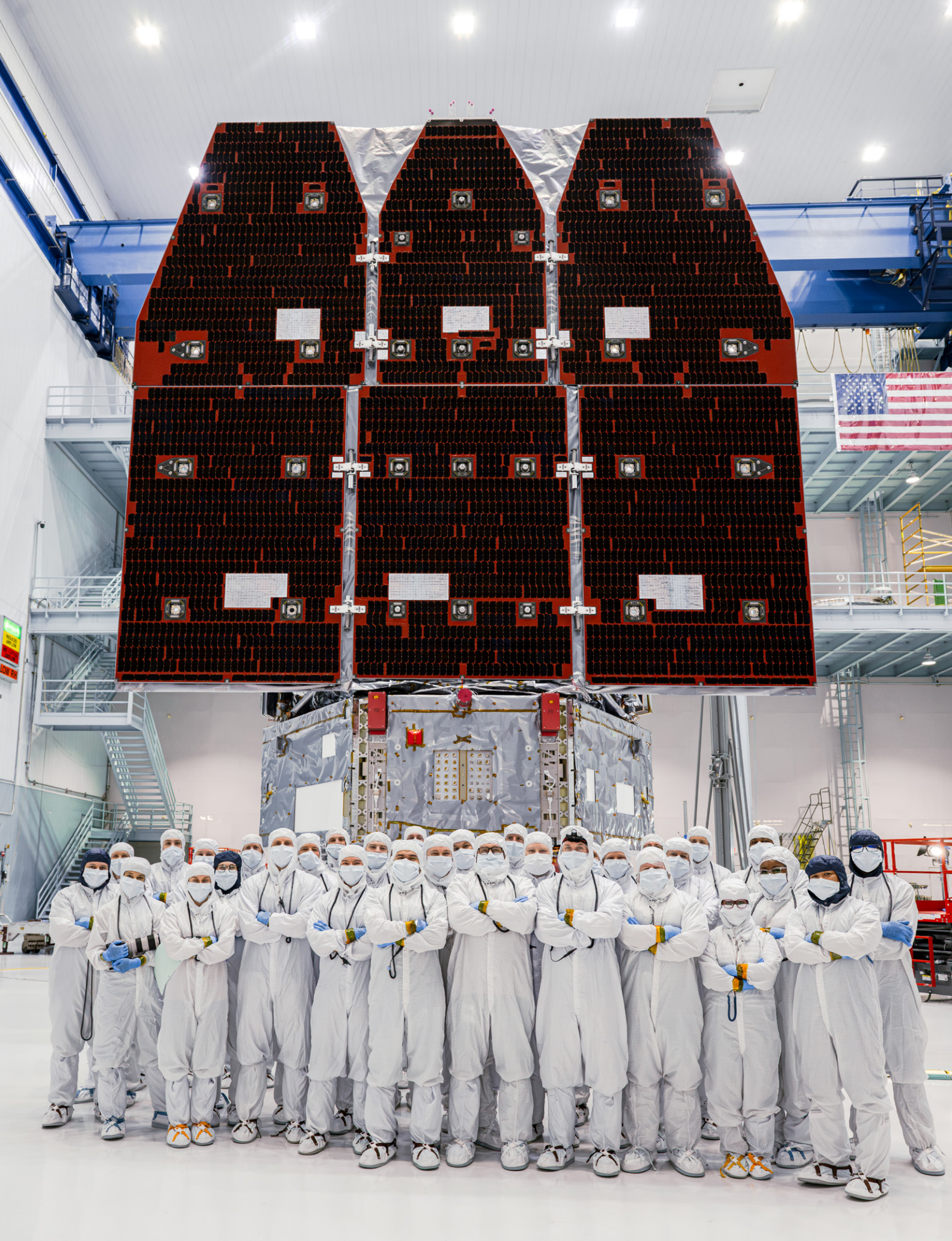
Nancy Grace Roman Space Telescope illustration

The Nancy Grace Roman Space Telescope is named after NASA's first chief of astronomy.

NASA

provide greater than a 100-fold improvement in Roman's ability to see faint exoplanets compared to HST and JWST.

Roman's impressive new coronagraph technologies include silver-dollar-size deformable mirrors with thousands of pistons that allow the mirror's shape to be modified to correct for telescope imperfections, as well as detectors that can count single photons. The WFI will have the largest number of near-infrared pixels ever flown on a space telescope, and the grand-piano-size Roman coronagraph is the most complex instrument ever built at NASA's Jet Propulsion Laboratory. Despite the complexities of these instruments and the challenge of marrying them to a large telescope and getting everything tested and ready to fly into space, the Roman project, managed by NASA's Goddard Space Flight Center, has another achievement to be proud of: staying on budget and on schedule. Its launch was even moved up by over half a year, with the launch window now opening on Aug. 30, 2026. I expect that Roman may be safely on its way to L2 by the time you read this article!



◀ **Roman Space Telescope**

Technicians stand proudly with the Nancy Grace Roman Space Telescope after meticulously connecting the inner and outer segments of the spacecraft.

NASA/Sydney Rohde

▲ **Hardware testing: SCIPA pathfinder**

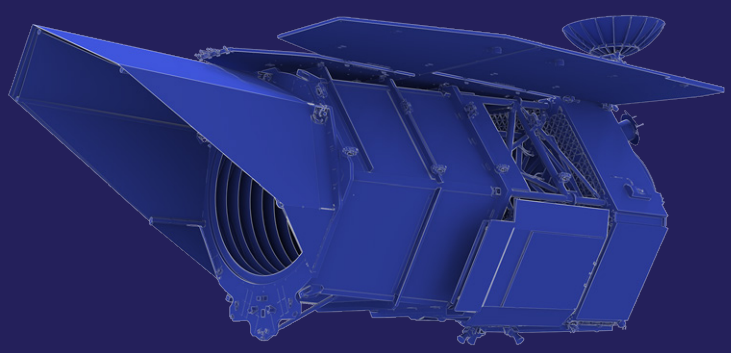
NASA engineers completed an environmental testing dress rehearsal to prepare for the thermal vacuum test for Roman's Spacecraft Integrated Payload Assembly, or SCIPA.

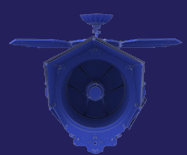
NASA

▼ **Roman map**

An illustration showing various views of the telescope along with its ground systems.

NASA





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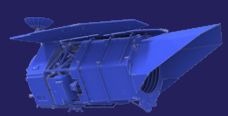

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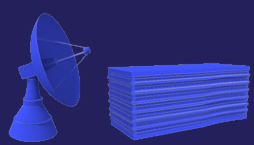


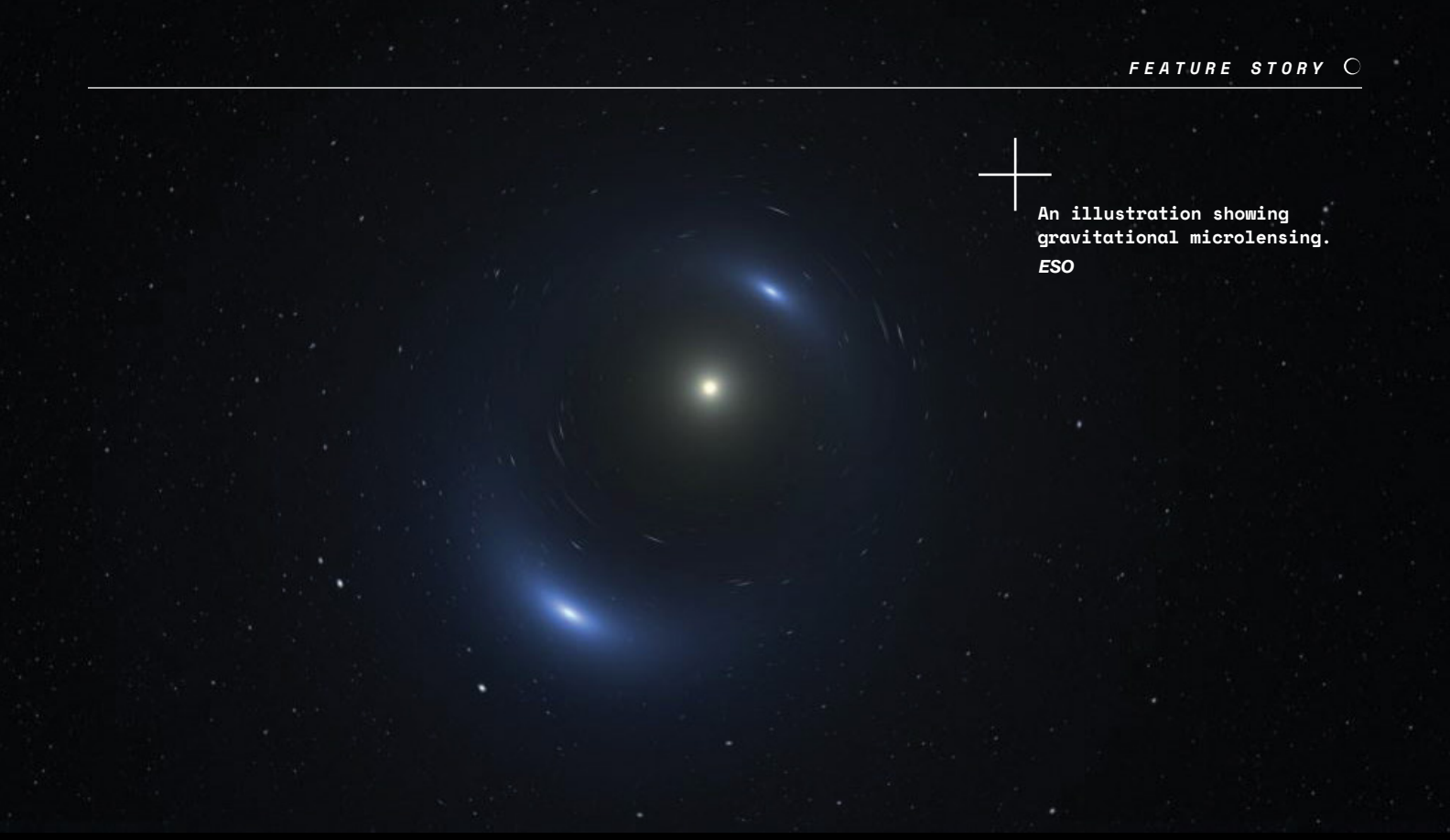
Ground

Roman comes with many science goals that will make use of its enormous field of view and advanced coronagraph. A primary driver for Roman is the study of dark energy. Despite being the dominant component of our Universe that drives its accelerating expansion, dark energy remains poorly understood. Roman will conduct surveys to study this mysterious force using three separate techniques: weak gravitational lensing, whereby foreground matter warps the observed shapes of background galaxies, allowing us to map out how cosmic structures evolve over time; the clustering of galaxies over cosmic time; and using a certain type of exploding star (so-called supernova Ia) as a "standard candle" to measure the expansion history of the Universe. Dark energy is my own area of expertise, and I am excited to see the gains Roman's multipronged approach will make in this quickly evolving field alongside the European Space Agency's Euclid mission, the National Science Foundation/Department of Energy Vera C. Rubin Observatory, and NASA's SPHEREx space telescope. Roman's WFI will also perform an extensive survey of the plane of our Milky Way galaxy, including a much deeper study of the center of the galaxy, which is densely packed with stars. These surveys will be complemented by coronagraph studies of nearby stellar systems, enabling more detailed studies of their planets and disks of asteroid and cometlike debris.

Additionally, 25% of Roman's time will be made available for competitively selected surveys defined by the worldwide astronomy community. (Let us know if you have ideas!) Best of all, data taken by Roman will be accessible to anyone in the world as soon as it is processed. Anyone can download and work with Roman images and spectra.

Of particular interest to readers of The Planetary Report will be the ability of Roman to transform the study of exoplanets, planets outside our own Solar System. Since the discovery of the first exoplanets in the mid-1990s, the study of exoplanets has gone from a niche area to one of the most vibrant and fast-moving fields in astrophysics. The pace of exoplanet discovery has been driven in large part by new instruments and new telescopes, most notably NASA's Kepler (launched 2009) and Transiting Exoplanet Survey Satellite (TESS, launched 2018), which together are responsible for more than half of the known exoplanets. Most of the exoplanets discovered by TESS and Kepler were found via the "transit" method, whereby the exoplanet passes in front of the star from our perspective and causes that star's light to briefly dim. This technique is most sensitive to large planets (think Jupiter) and those close to the star (with orbital periods of days rather than years). This means that if an alien race were observing our Solar System from across the galaxy using only the transit method, they would miss discovering most of the planets, including Earth.

◀ **Nancy Grace Roman with a model of the Hubble Space Telescope.**
NASA



An illustration showing gravitational microlensing.
ESO

While Roman will observe exoplanet transits, it aims to address the detection gap by using an additional technique: microlensing. When one star passes in front of another, the foreground star acts as a lens, briefly magnifying the light of the background star. When the foreground star has a planet, that orbiting world causes a secondary smaller magnification. In some cases where there is no foreground star, a planet can cause microlensing of the background star anyway. We call these planets that are not bound to stars "rogue planets." Trillions of these are thought to exist in our Milky Way galaxy alone. Microlensing is good at finding planets that are small or orbit far from their star (or are not orbiting a star at all in the case of rogue planets), making it an excellent way to survey planets big and small, near and far from their stars. With both microlensing and transit detection capabilities, Roman is expected to discover over 100,000 planets, enormously expanding the list of known exoplanets, which currently stands at around 6,000. These surveys will answer fundamental questions about planet formation and reveal the prevalence of planets like those in our Solar System, including Earth-like planets in the so-called "habitable zone" where liquid water can exist.

Roman will go a step beyond finding exoplanets — it will actually demonstrate the technologies needed to directly image these distant worlds. Most exoplanet detection techniques are indirect. We look for the dimming of a star (transits), the brightening of a star (microlensing), or even the wobble of a star (a method called radial velocities). This tells us that a planet is there without actually observing the planet directly. To take images or spectra of exoplanets themselves, we must block out the bright light coming from the planet's host star to allow the much fainter planet light to come through. Roman's coronagraph will do just that, allowing the telescope to take reflected-light images of cold, Jupiter-like planets around Sun-like stars for the first time. Crucially, the technologies being tested on Roman's coronagraph are precursors for a future coronagraph that could fly on NASA's Habitable Worlds Observatory (HWO), which is currently in its mission concept phase. With a larger, more stable telescope, HWO would use the technologies developed and demonstrated by Roman to look for signs of life on a few dozen Earth-like planets around Sun-like stars. Thus, in addition to answering fundamental questions about the contents of the Universe, the formation and prevalence of planets, and the makeup of our Milky Way galaxy, Roman is a key stepping stone in NASA's greatest quest: answering the age-old question, "Are we alone?"

Dr. Jason Rhodes is chief scientist for astrophysics, heliophysics, and fundamental physics at NASA's Jet Propulsion Laboratory (JPL) and the JPL project scientist for the Nancy Grace Roman Space Telescope.

THE NEW FACES OF MARS

The next generation to explore the red planet

by Dr. Ari Koeppel
AAAS Policy Fellow

Since the mid-1990s, Mars has enjoyed a steady beat of primarily NASA-led satellites, landers, and rovers focused on the search for water, habitability, and any evidence of past or present life. But recently, NASA's focus has shifted. The ambitious Mars sample return program (MSR) has been put on an indefinite hold, and NASA's three upcoming robotic missions to Mars, while sustaining the Mars momentum, have faced criticism from many in the science community. The opaque selection process for these missions has been a notable departure from the competitive, peer-led, and decadal survey-informed proposal review that has guided NASA in tackling the biggest scientific challenges in space for a generation.

Nonetheless, the SR-1 Freedom mission would achieve something NASA has been trying to do for 60 years by launching the first nuclear fission-powered interplanetary spacecraft. Its SkyFall payload would build on the success of the Ingenuity helicopter by sending three small helicopters to Mars equipped with cameras and ground-penetrating radars to map out future human landing sites.

The Mars Telecommunications Network (MTN) is a mission with special funding from Congress to enhance data transfer capabilities from Mars orbit. This infrastructure would be necessary for any high-throughput human communication from the surface.

Finally, the Aeolus mission is California-based Relativity Space's effort to prove the viability of sending a SmallSat mission to Mars at low cost with private funds. The instruments it is launching, however, will be paid for and built by NASA. They include compact tools to measure Mars' wind and track how it circulates heat across the planet.

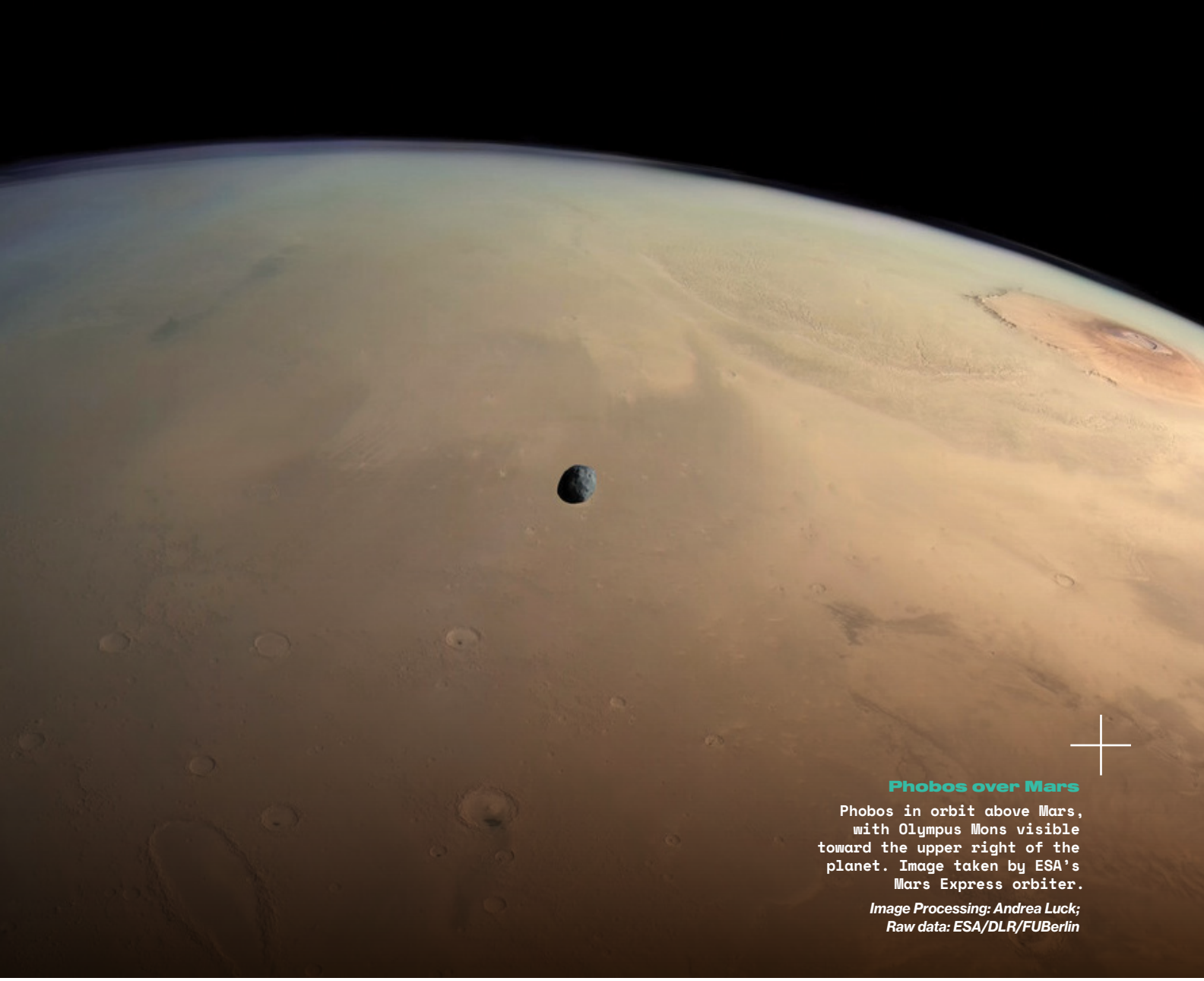
While these missions from NASA appear to be designed primarily to pave the way for human landings and bolster commercial capabilities, other international players are ramping up their Mars programs with a focus on science. The United Arab Emirates and China have already emphatically entered the scene with the Hope probe and Tianwen-1 mission, respectively. And those are only just the beginning.

Three new international collaborations are poised to define the next half-decade of the scientific exploration of Mars. The China National Space Administration (CNSA) looks to return to the surface by 2030 and attempt a sample return with the Tianwen-3 lander and rotorcraft, although construction has only just begun, and public details are scarce. More concrete and launch-ready are plans from the European Space Agency (ESA) and the Japan Aerospace Exploration Agency (JAXA), with collaborative and ambitious science missions that will take us to a new surface region on Mars and for the first time to its moon Phobos.

MMX: Solving a 4-billion-year mystery

JAXA's Martian Moons eXploration (MMX) mission will be the first to launch, as soon as November of this year. With contributions from NASA, ESA, CNES (France), and DLR (Germany), it will attempt something extraordinary: It will take a detailed look at — and the first taste of — a Martian moon. As it approaches Phobos, it will capture images and spectra with unprecedented detail to learn about its overall composition and structure. It will then deploy a small rover for fine-scale analysis and reconnaissance ahead of the main lander. Finally, using two different systems to make sure samples can be retrieved under the array of possible surface conditions, MMX will slurp up 10 grams of Phobos' regolith and send it back to Earth. One of those systems is a small drill core reaching down to 2 centimeters. The other is the PlanetVac pneumatic sampling system that was developed with funding from Planetary Society members.

These samples could help answer questions that have been debated for decades, including those on the origin of Phobos and Mars' other moon, Deimos. MMX-participating scientist Christopher Edwards explained that the primary tension concerns whether they are asteroids from the outer Solar System that were captured by Mars' gravity or if they are debris left over from the formation of Mars. Visible and near-infrared spectral data of Phobos resemble the type of ancient asteroids that may have delivered water to the inner Solar System — but that's not the full story. In recent thermal infrared images, Phobos looks increasingly like fine-grained Martian basalt. "Early Solar System dynamics are really in question," said Edwards, and both hypotheses have implications for how the inner Solar System assembled and water ended up on Earth.



Phobos over Mars

Phobos in orbit above Mars, with Olympus Mons visible toward the upper right of the planet. Image taken by ESA's Mars Express orbiter.

Image Processing: Andrea Luck; Raw data: ESA/DLR/FUBerlin

If Phobos is a captured asteroid, it can teach us about the primordial materials — organic molecules, minerals, and ices — that were available when rocky planets and life were first forming. If the material in Phobos comes from the early Martian crust, the samples collected by MMX could represent the best-preserved, least-altered samples ever obtained from the Mars system, standing out from other battered Martian meteorites that have landed on Earth. By studying samples of ancient Mars using mass spectrometers and electron microscopes back on Earth, scientists could paint an even more detailed picture of surface evolution and atmospheric composition through time.

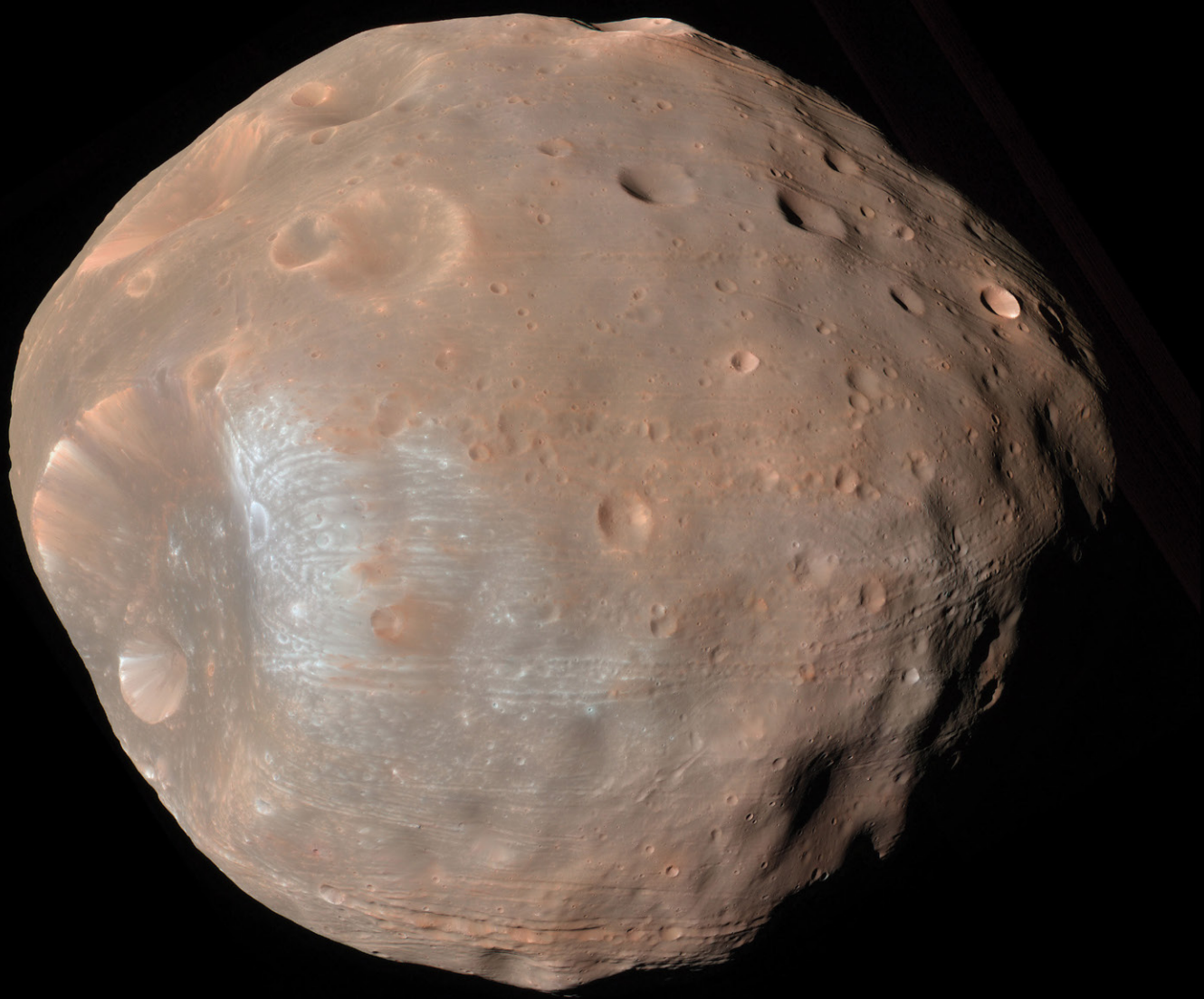
MSR was originally proposed to do that, and more, for Mars. Although neither MMX samples nor the samples from China's Tianwen-3 will achieve the full list of objectives set out for MSR, Edwards offered a valuable perspective: In the grand scheme of uncovering the Universe's mysteries, "it's way better to have a bunch of folks working toward the same goals than not."

The Rosalind Franklin rover: Playing the long game

ESA's ExoMars Rosalind Franklin rover is another example of international collaboration finally coming to fruition despite facing setbacks and uncertainty. After the mission was selected, the 2008 financial crisis nearly pushed ESA to terminate the project. That began the process of seeking more international support. NASA got involved … and then backed out. Russia got involved and launched the orbital component of the mission, the ExoMars Trace Gas Orbiter, in 2016, but with the war in Ukraine, that partnership ceased. Now, NASA is back in the picture, contributing a scientific payload, engineering components, and, most crucially, a confirmed launch contract for 2028.

ExoMars project scientist Jorge Vago first began thinking about an updated astrobiology-focused mission to Mars in the early 1990s as a graduate student at Cornell University.

For decades, it has passed over Mars like a rumor, glimpsed only sparingly by rovers and orbiters, its shadowy face watching down over Mars' vermilion seas of sand and dust in silence. Phobos, named after the Greek word for fear and a son of the god Mars, is the larger of Mars' two moons, and soon, as part of a new wave of international missions, it will elude us no more.



Color view of Phobos from Mars Reconnaissance Orbiter

Mars Reconnaissance Orbiter approached within 6,800 kilometers (4,200 miles) of Phobos to capture this enhanced-color view of the Martian moon on March 23, 2008.

NASA/JPL/U. Arizona

There, The Planetary Society's co-founder Carl Sagan introduced him to the interdisciplinary partnerships that go into studying the origins of life (he also introduced him to his wife, who happened to be another student in one of Sagan's courses). Today, Dr. Vago looks back on the persistence of the ExoMars program. He offered two explanations: "Firstly, the people involved in ExoMars, at all levels, have a tremendous drive. And secondly, the mission is genuinely interesting."

The Rosalind Franklin rover will land in a region of Mars called Oxia Planum, adjacent to where the fictional characters in Andy Weir's "The Martian" landed. A clay-rich region at the mouths of several channels that may have fed into an ancient northern ocean, it is the perfect laboratory for testing the possible origins of life.

Vago explained, "Mars is called a 'terrestrial planet' because it formed from the same ingredients as ours. However, it does not appear to have experienced plate tectonics — responsible for reforming most of our crust — and so, on Mars, it is possible to study the very early stages of planetary evolution, affording the conditions for life to appear on Earth. To do this, we need to target an ancient, water-rich location, and Oxia fits the bill."

Unlike protagonist Mark Watney in "The Martian," the Rosalind Franklin rover will drill into the Martian surface, reaching depths of up to 2 meters (6.5 feet), deeper than any surface mission has ever reached. The current record was set by NASA's Viking lander, which dug to only 15 centimeters (6 inches) deep in 1976. Given the constant exposure of Mars' surface to ionizing radiation, 2 meters beneath the surface just might be the refuge needed for soil microbes to survive.

The Rosalind Franklin rover will also assess for biosignatures using a state-of-the-art molecular analysis suite and a guiding framework that considers a cumulative case across multiple independent lines of evidence and multiple samples — the Sherlock Holmes approach to life detection. This is the part that "clicks" for Vago and links his work back to what he learned in class with Carl Sagan. All the pieces must fit together in a way that "cannot be explained away by anything other than life."

What these missions mean for life on Earth

In the next five years, we may be closer to answering three of the most anticipated questions about Mars: How and when did Mars and its moons form? Is there evidence of life in Mars' ancient northern channels? Where should humans take their first footsteps on the red planet? Extending beyond their science goals, MMX, Rosalind Franklin rover, Hope, and Tianwen-1 and 3 together also represent a shift in how discoveries are being made at Mars. NASA risks moving into a supporting role while others take the lead. While this may mean a challenging period for U.S.-based Mars scientists, the fact that more nations are committing resources means these questions are now more of a global priority than ever before, bigger than any single agency or budget cycle. The new faces arriving at Mars over the next half-decade are not just new flags; they are new instruments, refined questions, and a wider community insisting that these answers belong to everyone.

Dr. Ari Koeppel is a planetary geoscientist who has collaborated on the science teams for NASA's Curiosity, Perseverance, and 2001 Mars Odyssey missions. He is The Planetary Society's first AAAS Science & Technology Policy Fellow.

ADVOCACY UPDATE

Continuing the fight for NASA and space science

by Jack Kiraly
Chief of Advocacy

For the past few months, our advocacy program has taken Casey, Ari, and me to science and tech conferences in California, Wisconsin, Arizona, Washington, D.C., and even Italy. The focus of these gatherings varied, but the message we brought was consistent: We're continuing the fight to save NASA Science. The agency still faces an existential threat of a 46% cut to its science budget, and the annual budgeting process has stalled in Congress. And though there are many new, exciting projects recently announced, NASA has not been able to clearly articulate how to pay for them without enacting the mission terminations proposed in the FY 2027 budget request.

On Capitol Hill, we're working with members of both parties in the House and Senate to secure adequate funding and policy support for NASA and its science programs. We've also hosted major events showcasing the value and importance of NASA Science. At the end of April, we educated a packed room of congressional staffers about the AVATAR experiment that flew on Artemis II with representatives from NASA's Biological and Physical Sciences Division, the American Society for Gravitational and Space Research, and Space Tango. We also joined forces with Johns Hopkins University, the National Air & Space Museum, and SpaceNews to celebrate the 50th anniversary of Viking 1 landing on Mars on July 20.

But our biggest effort was responding to the Office of Management and Budget's proposed rewrite of federal grant rules, which would let political appointees override expert peer review, cancel grants at will, and restrict how publicly funded science reaches the public. We filed a formal comment detailing how it would raise the cost of accessing federal research, destabilize multiyear awards, and sever the pipeline of discoveries. Ours was one of nearly 500,000 filed nationwide, including more than 1,500 from our members and supporters.

And, thanks to members like you, our annual fundraising campaign for our Space Policy and Advocacy program raised just over $80,000 this year. This incredible support ensures that we can continue fighting for science, exploration, and our future in space.

Planetary Society Chief of Advocacy Jack Kiraly presenting at the Viking 1 anniversary event on Capitol Hill.
JHU Applied Physics Lab

FROM THE CHIEF SCIENTIST

What's on our cosmic radar

by Dr. Bruce Betts
Chief Scientist

IN THE SKY

The Geminids meteor shower peaks the night of Dec. 13-14, with increased activity several days before and after. The Geminids are usually the best shower of the year, with 100+ meteors per hour from a dark site. When the shower peaks, a 20% full Moon will rise around 2:00 a.m., washing out some of the meteors. The predawn east is where most of the planet party is during this period. In particular, in mid-November, super-bright Venus and Mercury below it are low in the predawn east. Very bright Jupiter is above them, very close to dimmer, reddish Mars. Yellowish Saturn rises in the eastern sky in the evening. By December, in the evening south, winter constellations such as Orion are shining brightly.

For more night sky tips, you can always check out planetary.org/night-sky.

Geminids meteor shower

An outburst of Geminid meteors lights up the sky in this time-lapse image.

NASA/JPL

TRIVIA CONTEST

Our March Equinox contest winner is Edward Jordan of La Cañada, California, USA. Congratulations!

The question was: ***In college, when Bill Nye took the class Introduction to Astronomy, who was his professor?***

The answer: ***Planetary Society co-founder Carl Sagan***

Try to win a copy of the book "Saturn: The Ringed Planet with The Planetary Society" by Bruce Betts and a Planetary Radio T-shirt by answering this question:

What was the first Mercury orbiter?

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 Jan. 15, 2027. One entry per person. The winner will be chosen in a random drawing from among all the correct entries received.

RANDOM SPACE FACT

Mars' moon Phobos orbits the planet in 7 hours and 39 minutes. It rises in the west and sets in the east as seen from the surface because its orbit is faster than Mars' rotation. Mars' day is about 24 hours and 40 minutes, so Phobos orbits more than three times per Mars day.

ORBITAL FIELDS 07

Mette Oldager is a Copenhagen-based painter working in acrylic on canvas, whose process works with physics rather than against it. She allows the paint to flow freely within taped geometric boundaries, spreading and settling according to gravity's constraints. Structure defines the field; physics does the rest. Growing up, her father's astronomy magazines were a fixture on the coffee table. Passing images of galaxies and orbital diagrams and explorations of the vastness of space left behind a lingering feeling of wonder and wanderlust. In her latest series, Orbital Fields, these memories are reflected in her paintings, which capture a brief glimpse into the windows of our Cosmos.

More of Mette Oldager's work can be found at **oldager.art**.

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.

Mette Oldager

THE PLANETARY SOCIETY'S CELESTIAL ESCAPE TO MAUNA KEA SWEEPSTAKES

The Planetary Society recently raised $542,800 to support our mission through our Celestial Escape to Mauna Kea Sweepstakes. From among 11,788 entries, Freya Sato of Duluth, Georgia, USA, won a five-night trip to Mauna Kea in Hawai'i, including a luxury stay at the Westin Hapuna Beach Resort, a special stargazing experience, private behind-the-scenes access to the Keck telescopes, and more. We thank everyone who entered as well as our partners TapKat, Mauna Kea Resort, the Westin Hapuna Beach Resort, Keck Observatory, and Hawaii Forest & Trail.

Observatories atop Mauna Kea.
Hawaii Forest & Trail

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Alaska aurora borealis expedition
Feb. 28 – March 6, 2027

Explore the vast beauty of Alaska in winter and the greatest light show on Earth!

Arizona dark skies and archeoastronomy of the Southwest
May 2 – 9, 2027

Discover the day and night wonderland of the famed American Southwest in spring!

Eclipse adventures
August 2027

We invite travelers with an appetite for adventure and discovery to join an expert astronomer for the Aug. 2, 2027, total solar eclipse in one of three exciting locations:

- Discover Egypt, including the total solar eclipse in Luxor with Dr. Tyler Nordgren
- Malta and Sicily by yacht – a special total solar eclipse voyage with Dr. Joe Llama
- Mystique of Morocco – total solar eclipse in Tangier with Dr. Jim Bell

Call **1-800-252-4910** or email **info@betchartexpeditions.com**.
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Julia Icenogle

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From the volcanic landscapes of the South Pacific to Europe's City of Love, Sirius Travel invites you to explore two unforgettable journeys shaped by culture, history, and astronomy.

Easter Island 2027

From May 28 to June 4, 2027, journey to one of the world's most remote destinations on our Easter Island culture and ecology tour. Explore the iconic Moai statues, learn about Polynesian heritage, and experience the island's dramatic landscapes alongside expert-led discussions on archaeology, ecology, and astronomy. With small-group travel and immersive cultural experiences, Easter Island offers a rare chance to connect with a place unlike anywhere else on Earth.

Megaliths of France 2027

From Oct. 4 to 15, 2027, discover the beauty of France on a thoughtfully curated journey through historic cities, stunning countryside, and the megalithic sites of Carnac and Locmariaquer. Take in everything from architecture and art to local cuisine and scenic landscapes.

Mont Saint-Michel, France.
Bas van Breukelen

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Jacob Buffo

YOU POWER THE NEXT GREAT DISCOVERY

For over 45 years, Planetary Society members like you have teamed up to crowdfund science and technology projects, from LightSail to the Shoemaker NEO Grants supporting amateur astronomers.

Now, through our STEP Grant program (Science and Technology Empowered by the Public), your support has already helped one team study frozen, salty lakes in British Columbia that mirror conditions on Mars, Europa, and Enceladus. They collected hundreds of samples and proved that drone imagery can map these features from above.

That team is ready for phase two — and that's where you come in! A gift of any amount today will help advance independent scientific research and power the next great discovery. Give today at planetary.org/step.

THE PLANETARY SOCIETY