Latest in Space

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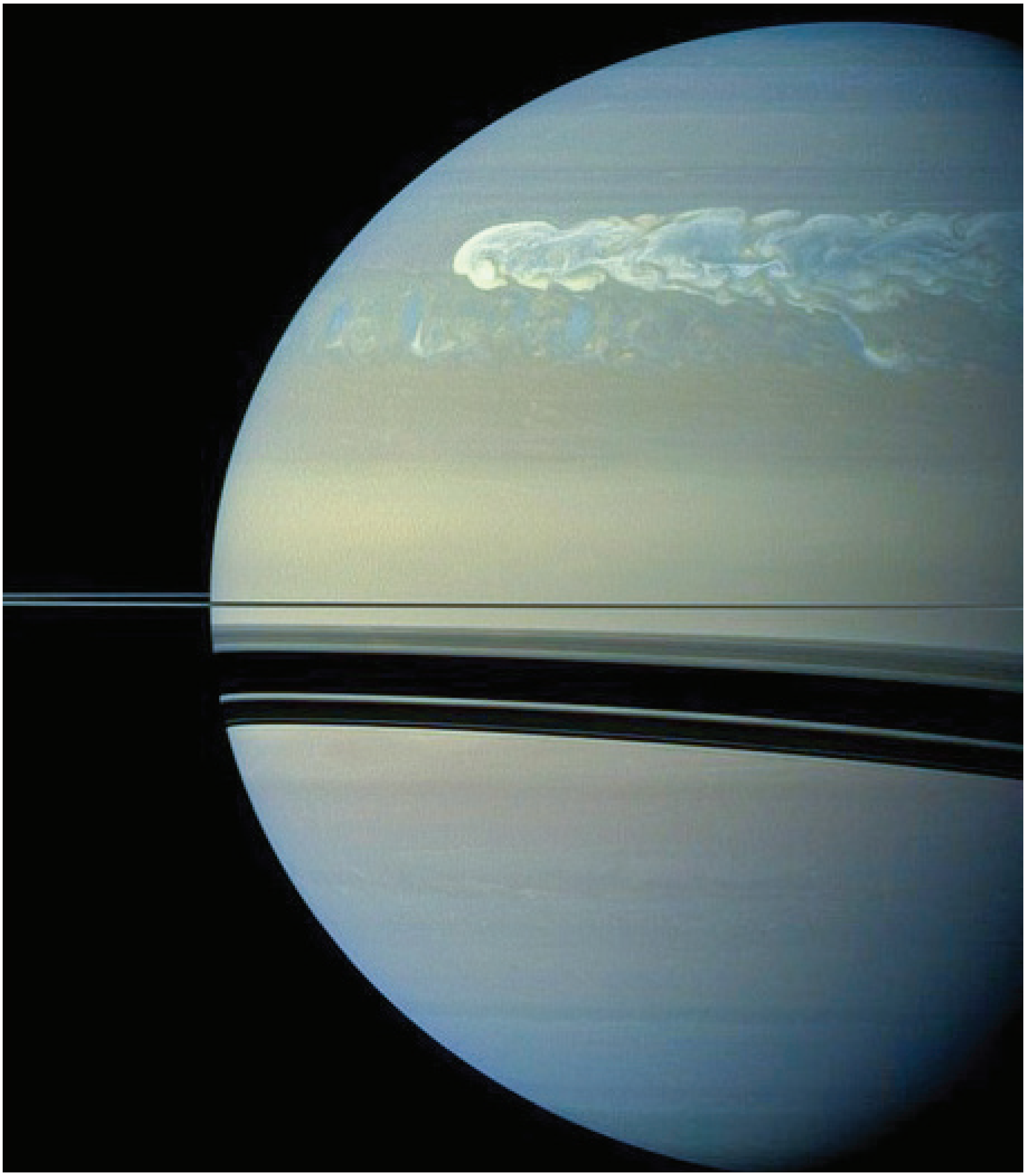
A bizarre gamma-ray burst breaks the rules for these cosmic eruptions

Accompanied by a kilonova, the burst should've lasted under two seconds, but lingered for 50

Astronomers have spotted a bright gamma-ray burst that upends previous theories of how these energetic cosmic eruptions occur. For decades, astronomers thought that GRBs came in two flavors, long and short — that is, lasting longer than two seconds or winking out more quickly. Each type has been linked to different cosmic events. But about a year ago, two NASA space telescopes caught a short GRB in long GRB's clothing: It lasted a long time but originated from a short GRB source.

"We had this black-and-white vision of the universe," says astrophysicist Eleonora Troja of the Tor Vergata University of Rome. "This is the red flag that tells us, nope, it's not. Surprise!" This burst, called GRB 211211A, is the first that unambiguously breaks the binary, Troja and others report December 7 in five papers in Nature and Nature Astronomy.

Prior to the discovery of this burst, astronomers mostly thought that there were just two ways to produce a GRB. The collapse of a massive star just before it explodes in a supernova could make a long gamma-ray burst, lasting more than two seconds (SN: 10/28/22). Or a pair of dense stellar corpses called neutron stars could collide, merge and form a new black hole, releasing a short gamma-ray burst of two seconds or less.



Saturn's icy rings are probably heating its atmosphere, giving it an ultraviolet glow

Water ice falling into the planet's upper atmosphere may create an excess UV emission

The rings that make Saturn such a spectacle are probably heating its atmosphere and making it glow at ultraviolet wavelengths.

Researchers detected an excess of ultraviolet emission in Saturn's northern hemisphere that comes from hydrogen atoms. The emission, known as Lyman-alpha radiation, is probably the result of water ice, which contains hydrogen, falling into the atmosphere from the planet's rings, the researchers propose March 30 in the Planetary Science Journal.

The detection of similar emission from a distant world could someday lead to the discovery of a Saturn-like planet orbiting another star. The key to the discovery came after two spacecraft — the Hubble Space Telescope and Cassini — observed Saturn simultaneously in 2017, right before Cassini plunged into the planet's atmosphere, says Lotfi Ben-Jaffel, an astrophysicist at the Institut d'Astrophysique de Paris.

This allowed Ben-Jaffel and colleagues to calibrate the ultraviolet detectors on those spacecraft as well as detectors on Voyager 1 and 2, which flew past Saturn in 1980 and 1981, and the International Ultraviolet Explorer, an Earth-orbiting satellite that also observed Saturn. Comparing these ultraviolet observations revealed a band of excess Lyman-alpha radiation spanning 5° to 35° N latitude on Saturn.

The researchers' explanation for the extra ultraviolet glow is plausible, says Paul Estrada, a planetary scientist at NASA's Ames Research Center in Moffett Field, Calif., who was not involved with the new work.

"We know material is falling in from the rings," he says, because Cassini detected it during the spacecraft's spiral into Saturn "The rings are predominantly water ice. It may be the source of the atomic hydrogen" emitting the Lyman-alpha radiation that the researchers have detected, he says.

Artemis I finally launched. Here's what it means for human spaceflight

Almost 50 years after Apollo astronauts left the moon, the certainty of going back gets a boost

Fifty years ago, three NASA astronauts splashed down in the Pacific Ocean, concluding the final Apollo mission. Less than a dozen years after President John F. Kennedy challenged the United States to commit itself to "landing a man on the moon and returning him safely back to the Earth," that historic program had achieved its goals and ended.

Now, we're going back. But this time will be different.A pivotal moment for the return of crewed missions to the moon occurred at 1:47 a.m. EST on November 16, with the successful launch of Artemis I. NASA's high-powered Space Launch System rocket roared and crackled as it lifted off the Florida coast on its maiden voyage. The rocket pushed the Orion capsule toward the moon, on a flight testing the technology that will eventually bring astronauts, both men and women, back to the lunar surface.

"It was just a spectacular launch," says geologist Jose Hurtado of the University of Texas at El Paso, who works with NASA on mission simulations and programs to train astronauts in geology. "It really hits home to me what I love about space exploration, especially human exploration. It's just an aspirational and inspirational spectacle, and I hope that everybody that was watching it got some of that inspiration."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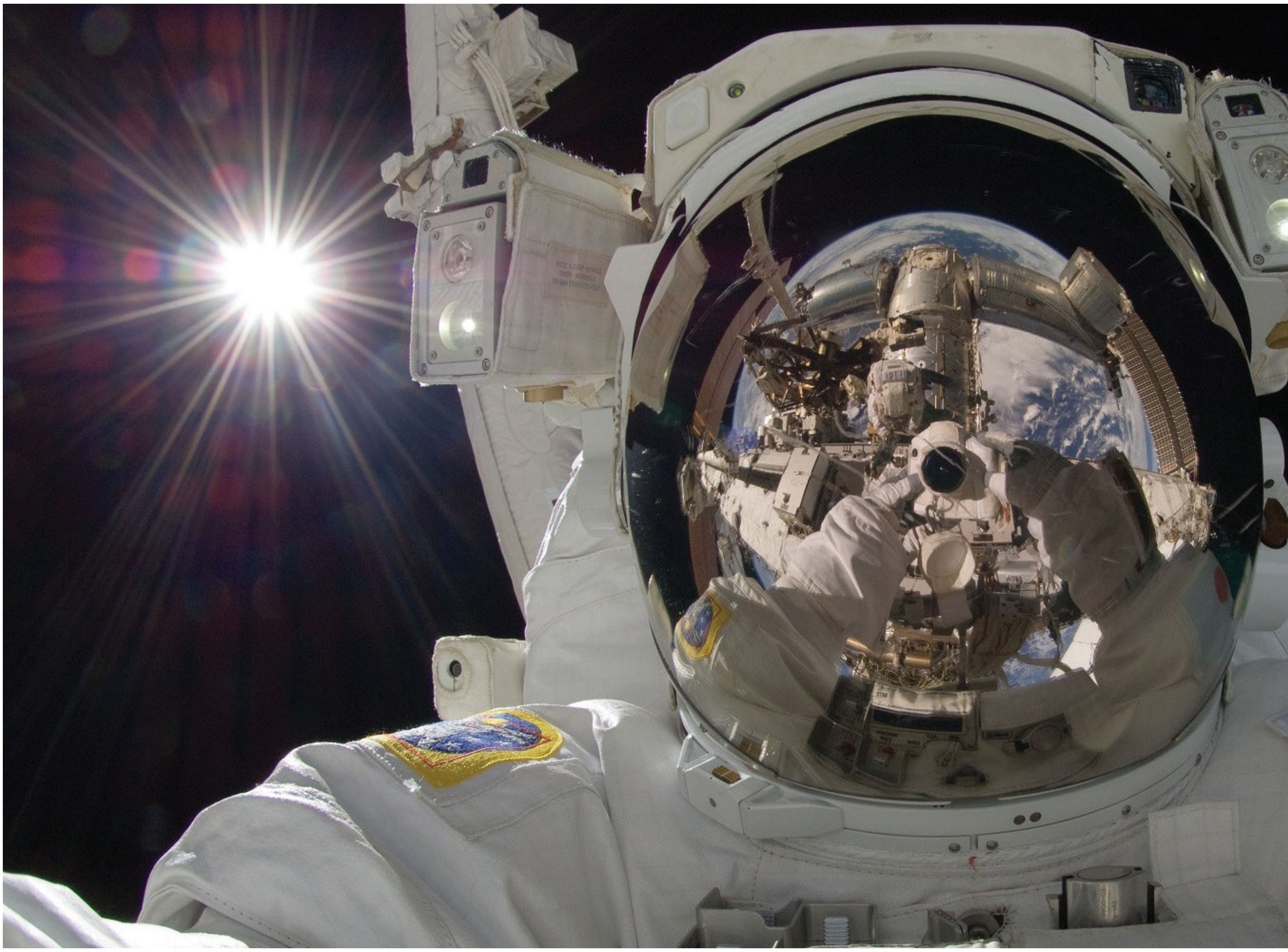


Humans haven't set foot on the moon in 50 years.

That may soon change.

The Apollo missions continue adding to our knowledge of the moon and Earth. Scientists have used lunar soil samples collected by Apollo astronauts to show that growing plants on the moon, while challenging, may be possible (SN: 7/2/22, p. 4). In May, NASA researchers began scrutinizing untouched lunar rock and soil samples from the Apollo 17 mission for hints of past moon conditions and the chemicals crucial for life. Then in November, a new era of moon missions dawned with the launch of NASA's Artemis I mission. NASA hopes to land humans on the moon in 2025 to pick up where Apollo 17 astronauts left off.

Here's the best timeline yet for the Milky Way's big events

Our galaxy formed its original disk 2 billion years before its stellar halo

A new analysis of nearly a quarter million stars puts firm ages on the most momentous pages from our galaxy's life story.

Far grander than most of its neighbors, the Milky Way arose long ago, as lesser galaxies smashed together. Its thick disk — a pancake-shaped population of old stars — originated remarkably soon after the Big Bang and well before most of the stellar halo that envelops the galaxy's disk, astronomers report March 23 in Nature.

"We are now able to provide a very clear timeline of what happened in the earliest time of our Milky Way," says astronomer Maosheng Xiang.

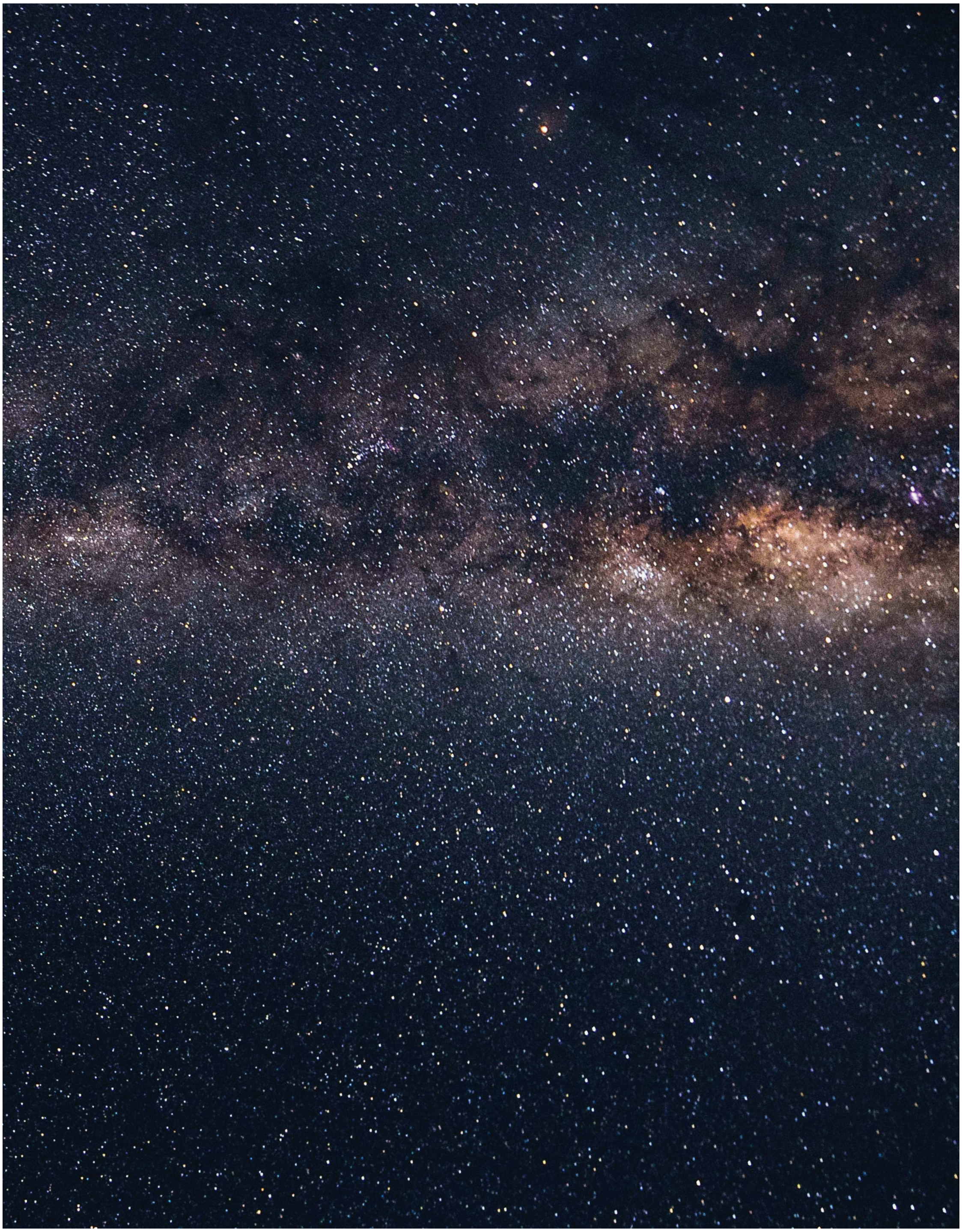
He and Hans-Walter Rix, both at the Max Planck Institute for Astronomy in Heidelberg, Germany, studied almost 250,000 subgiants — stars that are growing larger and cooler after using up the hydrogen fuel at their centers. The temperatures and luminosities of these stars reveal their ages, letting the researchers track how different epochs in galactic history spawned stars with different chemical compositions and orbits around the Milky Way's center.

"There's just an incredible amount of information here," says Rosemary Wyse, an astrophysicist at Johns Hopkins University who was not involved with the study. "We really want to understand how our galaxy came to be the way it is," she says. "When were the chemical elements of which we are made created?"

Xiang and Rix discovered that the Milky Way's thick disk got its start about 13 billion years ago. That's just 800 million years after the universe's birth. The thick disk, which measures 6,000 light-years from top to bottom in the sun's vicinity, kept forming stars for a long time, until about 8 billion years ago.

During this period, the thick disk's iron content shot up 30-fold as exploding stars enriched its star-forming gas, the team found. At the dawn of the thick disk era, a newborn star had only a tenth as much iron, relative to hydrogen, as the sun; by the end, 5 billion years later, a thick disk star was three times richer in iron than the sun.

Xiang and Rix also found a tight relation between a thick disk star's age and iron content.



Lots of Tatooine-like planets around binary stars may be habitable

SEATTLE — Luke Skywalker's home planet in Star Wars is the stuff of science fiction. But Tatooine-like planets in orbit around pairs of stars might be our best bet in the search for habitable planets beyond our solar system.

Many stars in the universe come in pairs. And lots of those should have planets orbiting them (SN: 10/25/21). That means there could be many more planets orbiting around binaries than around solitary stars like ours. But until now, no one had a clear idea about whether those planets' environments could be conducive to life. New computer simulations suggest that, in many cases, life could imitate art.

Earthlike planets orbiting some configurations of binary stars can stay in stable orbits for at least a billion years, researchers reported January 11 at the American Astronomical Society meeting. That sort of stability, the researchers propose, would be enough to potentially allow life to develop, provided the planets aren't too hot or cold.

A planet orbiting binary stars can get kicked out of the star system due to complicated interactions between the planet and stars. In the new study, the researchers found that, for planets with large orbits around star pairs, only about 1 out of 8 were kicked out of the system. The rest were stable enough to continue to orbit for the full billion years. About 1 in 10 settled in their habitable zones and stayed there.

Cosmic antimatter hints at origins of huge bubbles in our galaxy's center

MINNEAPOLIS — Bubbles of radiation billowing from the galactic center may have started as a stream of electrons and their antimatter counterparts, positrons, new observations suggest. An excess of positrons zipping past Earth suggests that the bubbles are the result of a burp from our galaxy's supermassive black hole after a meal millions of years ago.

For over a decade, scientists have known about bubbles of gas, or Fermi bubbles, extending above and below the Milky Way's center (SN: 11/9/10). Other observations have since spotted the bubbles in microwave radiation and X-rays (SN: 12/9/20). But astronomers still aren't quite sure how they formed.

A jet of high-energy electrons and positrons, emitted by the supermassive black hole in one big burst, could explain the bubbles' multi-wavelength light, physicist Ilias Cholis reported April 18 at the American Physical Society meeting.

In the initial burst, most of the particles would have been launched along jets aimed perpendicular to the galaxy's disk.

As the particles interacted with other galactic matter, they would lose energy and cause the emission of different wavelengths of light.

Those jets would have been aimed away from Earth, so those particles can never be detected. But some of the particles could have escaped along the galactic disk, perpendicular to the bubbles, and end up passing Earth. "It could be that just now, some of those positrons are hitting us," says Cholis, of Oakland University in Rochester, Mich.

So Cholis and Iason Krommydas of Rice University in Houston analyzed positrons detected by the Alpha Magnetic Spectrometer on the International Space Station. The pair found an excess of positrons whose present-day energies could correspond to a burst of activity from the galactic center between 3 million and 10 million years ago, right around when the Fermi bubbles are thought to have formed, Cholis said at the meeting.

The result, Cholis said, supports the idea that the Fermi bubbles came from a time when the galaxy's central black hole was busier than it is today.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