https://www.hermanus.astronomy@gmail.com

"The Southern Cross"

The Hermanus Astronomy Centre's Monthly Newsletter

January 2026

MONTHLY MEETINGS

No Monthly Meeting was held in December.

Our next is on **Tuesday January 20th**.

Dr Christo Venter, a Full Professor of North-West University, presents "*Gamma-ray Pulsars: Treasures of the Dark Skies."*

Pulsars are extremely compact - imagine a star crushed into a sphere only about 20 kilometres wide yet packed with more mass than our Sun! These cosmic lighthouses beam radiation across the spectrum - from radio waves to gamma rays - and unleash powerful winds of particles moving close to the speed of light. The study of pulsars is a vibrant field that connects many areas of modern physics, from gravity, quantum mechanics, electrodynamics, beaming and emission physics, to particle acceleration.

Unless plans change, the presentation will be hybrid at Onrus Manor and on Zoom.

SPECIAL INTEREST GROUP ACTIVITIES

Cosmology

On **December 2nd** we watched episode 35 of the Entire History of the Universe: *"What is The Biggest Thing in the Universe?"*

The YouTube Link:
https://www.youtube.com/watch?v=CuRicHU9sOc&list=PLROBLlvnR7BEF9b1NOvRf_zhboibmywJb&index=33&t=71s&pp=iAQB

The discussion link: https://www.youtube.com/watch?v=tZI3oRmp6bk&ab_channel=DerekDuckitt

Please see the transcript attached to the e-mail, courtesy of Derek Duckitt.

There being no January meeting, our next is episode 36 on **Tuesday 3rd February**, the topic being *"The Mystery of Free Will - Can You Change the Future?"*.

A man in court is at the mercy of judge and jury. He undoubtedly committed the crime and, having free will, it was his own decision and is therefore guilty. But without free will, is he really guilty and just a victim of circumstance?

For further information regarding the Cosmology Group, contact Derek Duckitt – derek.duckitt@gmail.com

The Study Group

The topic for our next meeting, scheduled for **Tuesday January 27th**, will be advised in due course. For further information regarding the Study Group, contact Peter Harvey petermh@hermanus.co.za

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Observing

No suitable evenings were available during October.

Optimal dates for **January 2026**:

SUGGESTED EVENING OBSERVATION WINDOWS
(Lunar observations notwithstanding)

Date		*Moon*	*Dusk end*
January 7	**Rise**	**22h55 (81%)**	**21h43**
to **January 22**	**Set**	**22h05 (16%)**	**21h34**

ASSA

From Tim Cooper

The link to the latest Comet, Asteroid and Meteor Section:

https://assa.saao.ac.za/wp-content/uploads/sites/23/2025/12/ASSA-CAMnotes-2026-Number-1.pdf

MNASSA

The Monthly Notes of the Astronomical Society of Southern Africa are available on:

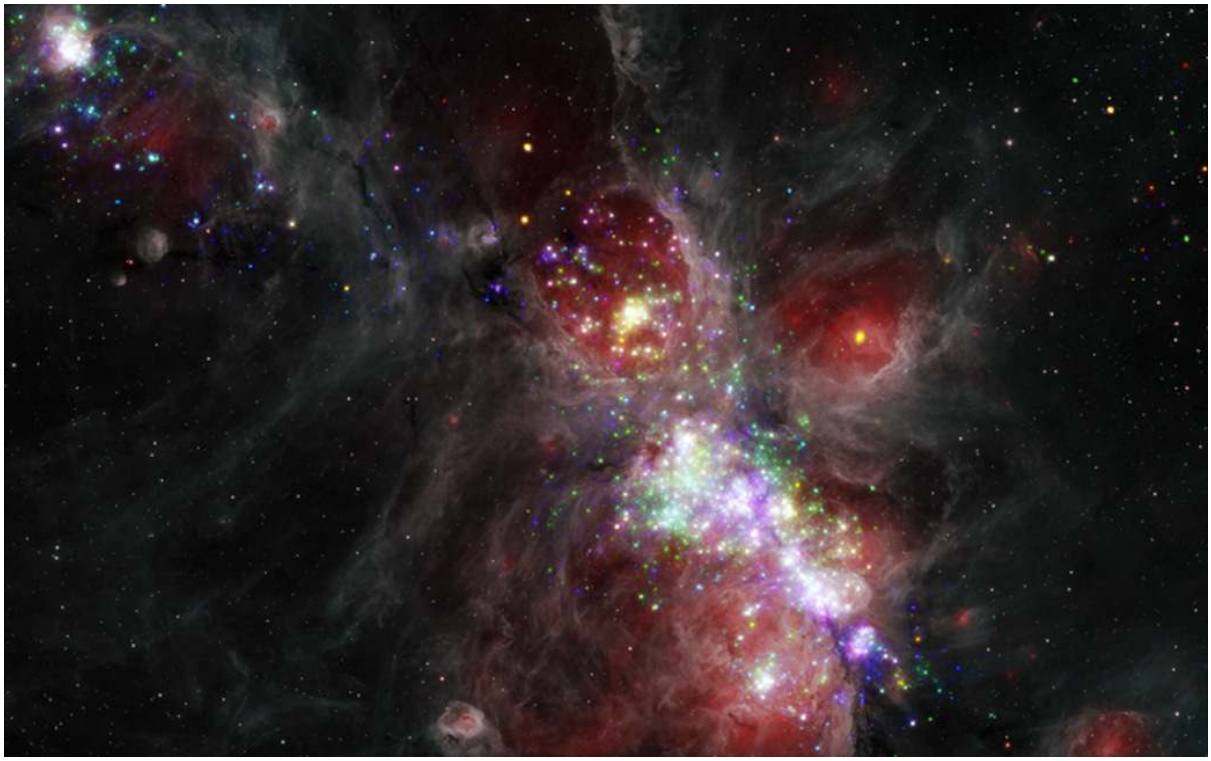
http://www.mnassa.org.za/

Astronomy News November 2026 *continued overleaf…*

ASTRONOMY NEWS DECEMBER 2025

Compiled by Pieter Kotzé

NOVEMBER ASTRONOMY PICTURE



Credit: X-ray: NASA/SAO/CXC; Infrared: NASA/JPL/CalTech/Spitzer; Image Processing: NASA/CXC/SAO/J. Schmidt

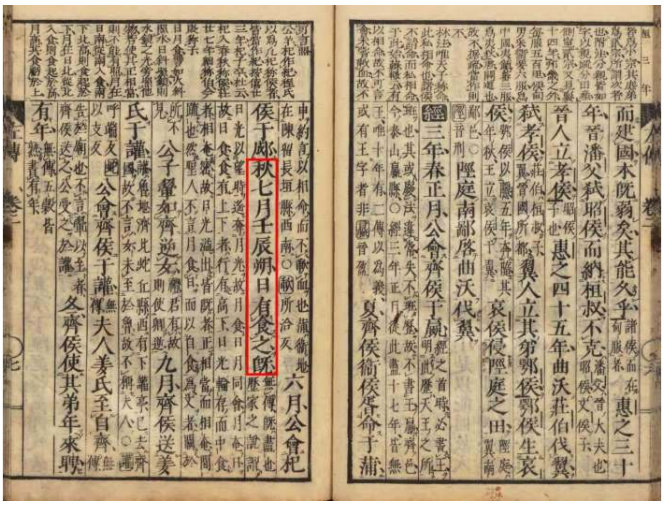
Held in the Cat's Paw

Stars are born within large, massive, dense clouds of gas and dust. The seeds of stars are localized regions in the cloud which, for some random reason, have slightly higher density. Gravity pulls more material into these dense regions, which grow denser and denser and hotter and hotter. There are complications to this simple picture (due magnetic fields, cloud spin, composition and other factors), so the exact process of stellar birth is hard to predict theoretically. And the details of star formation are frustratingly obscured from the gaze of curious astronomers by the thick curtain of dust and gas in the cloud itself. But, when they're old enough, stars themselves pull this curtain aside and make themselves known. Stars do this by shaping large cavities in their natal clouds through the combined actions of strong, powerful stellar winds and supernova explosions. These "superbubbles" give a revealing peak at the baby stars in the stellar nursery. A beautiful example of this is shown above is the NGC 6334 nebula, the so-called "Cat's Paw" nebula shown in the image above. This image is a composite infrared image from the Spitzer Space Telescope and an X-ray image from the Chandra X-ray Observatory. The Spitzer image is dominated by emission from the cool dust in the nebula, along with dark dusty clouds threading the nebula. The X-ray image from Chandra shows that, behind this veil of gas and dust, young stars can be seen by the X-ray emission they produce, shown as red, orange, green, and purple dots in the false-color image. X-rays are driven by the violent activity produced by the strong magnetic fields of the young stars, or by the collisions between the fast-moving stellar winds from the more massive and lumninous stars in the Cat's Paw.

Historical geography helps researchers solve 2700-year old eclipse mystery

An international team of researchers has used knowledge of historical geography to reexamine the earliest datable total solar eclipse record known to the scientific community, enabling accurate measurements of Earth's variable rotation speed from 709 BCE. The researchers calculated how the sun would have appeared from Qufu, the ancient Chinese capital of the Lu Duchy, during the total solar eclipse. Using this information, they analyzed the ancient description of what has been considered the solar corona—the dim outer atmosphere

of the sun visible to the naked eye only during total eclipses—and found that its morphology supports recent solar cycle reconstructions for the 8th century BCE.

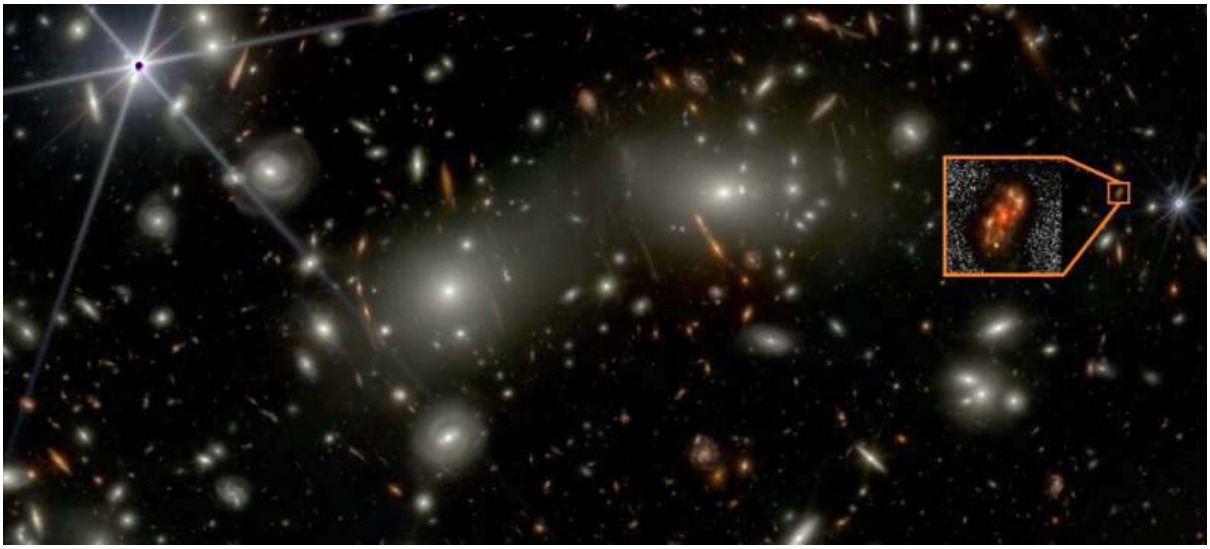


Ancient Chinese text from the Spring and Autumn Annals that contains humanity's earliest datable written record of a total solar eclipse from 709 BCE. The text states "In autumn, in the seventh month, on the renchen day, the first day of the month, the Sun was totally eclipsed." The term "renchen" refers to a specific day in the traditional Chinese 60-day calendar cycle. Credit: National Archives of Japan

Their findings, published in *The Astrophysical Journal Letters*, provide reliable new data about Earth's rotation speed during this period and suggest the sun was becoming more active after a long quiet period, independently confirming what other scientists have found using radiocarbon analysis.The total solar eclipse occurred on 17 July 709 BCE and was reported from Lu Duchy Court. Its description was found in a chronicle titled the "Spring and Autumn Annals" that was compiled roughly 2–3 centuries after the eclipse. The event was recorded as "the sun was totally eclipsed."While the 709 BCE event represents the earliest explicit written mention of a total solar eclipse and possibly the earliest surviving description that refers to a solar corona, Hayakawa and his colleagues raise caveats on the reliability of the corona description because it appears only in the Hanshu as a quote written some seven centuries after the event.

https://phys.org/news/2025-12-historical-geography-year-eclipse-mystery.html

Alaknanda: JWST discovers massive grand-design spiral galaxy from the universe's infancy



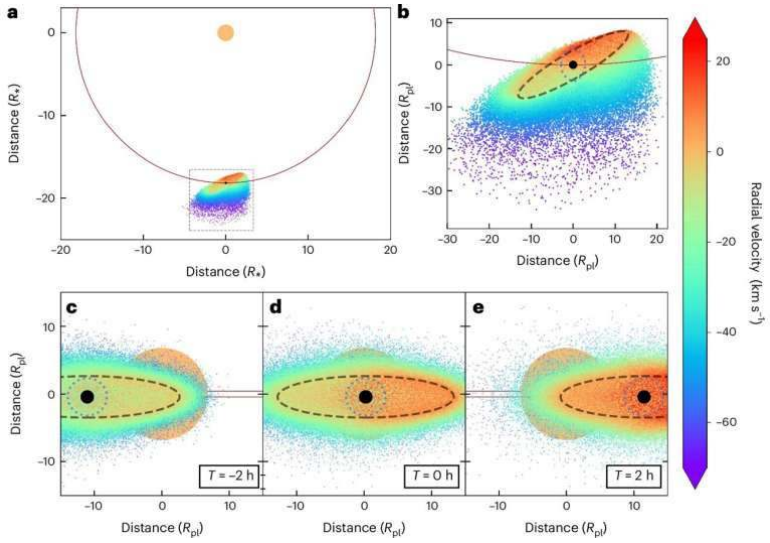
The newly discovered spiral galaxy Alaknanda (inset) as observed in the shorter wavelength JWST bands. Several bright galaxies from the foreground Abell 2744 cluster are also seen. Credit: NASA/ESA/CSA, I. Labbe/R. Bezanson/Alyssa Pagan (STScI), Rashi Jain/Yogesh Wadadekar (NCRA-TIFR)

A spiral galaxy, shaped much like our Milky Way, has been found in an era when astronomers believed such well-formed galaxies could not yet exist. Two astronomers from India have identified a remarkably mature galaxy just 1.5 billion years after the Big Bang—a discovery that challenges our understanding of how galaxies form and evolve. ASA's James Webb Space Telescope (JWST) is a powerful telescope capable of detecting extremely faint light from the early universe. Using JWST, researchers Rashi Jain and Yogesh Wadadekar spotted a galaxy remarkably similar to our own Milky Way. Yet this system formed when the cosmos was barely 1.5 billion years old—roughly a tenth of its present age. They named it Alaknanda, after the Himalayan river that is

a twin headstream of the Ganga alongside the Mandakini—fittingly, the Hindi name for the Milky Way. Classic spiral galaxies like ours—with two clear, symmetric arms (called a "grand-design" spiral)—were thought to take billions of years to form. The prevailing view held that early galaxies should appear irregular and disordered—still in the chaotic process of assembly rather than settled into the graceful spirals we see so often in the nearby universe.

https://phys.org/news/2025-12-alaknanda-jwst-massive-grand-spiral.html#goog_rewarded

Helium leak discovered on the exoplanet WASP-107b



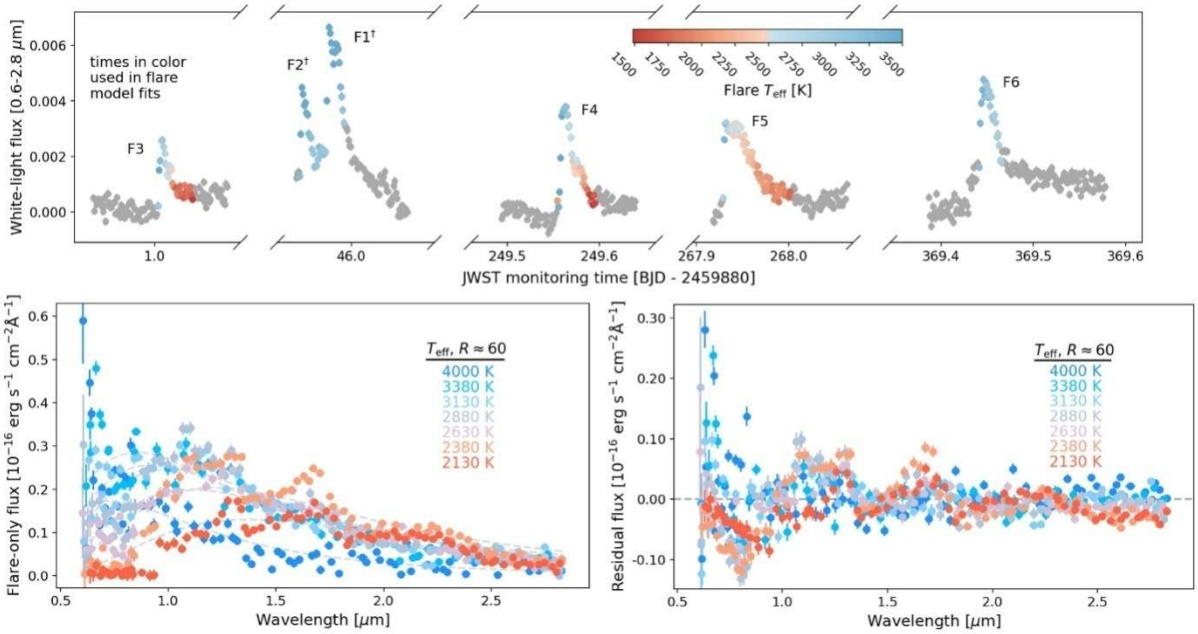
View of the escaping metastable helium in our best-fit EvE model. Credit: Nature Astronomy (2025). DOI: 10.1038/s41550-025-02710-8

An international team including astronomers from the University of Geneva (UNIGE) and the National Center of Competence in Research Planet S has observed giant clouds of helium escaping from the exoplanet WASP-107b. Obtained with the James Webb Space Telescope, these observations were modelled using tools developed at UNIGE. The analysis, published in the journal *Nature Astronomy*, provides valuable clues for understanding this atmospheric escape phenomenon, which influences the evolution of exoplanets and shapes some of their characteristics. Sometimes a planet's atmosphere escapes into space. This is the case for Earth, which irreversibly loses a little more than 3 kg of matter (mainly hydrogen) every second. This process, called "atmospheric escape," is of particular interest to astronomers for the study of exoplanets located very close to their star, which, heated to extreme temperatures, are precisely subject to this phenomenon. It plays a major role in their evolution. Thanks to the James Webb Space Telescope, an international team including scientists from the Observatory of the University of Geneva (UNIGE) and McGill, Chicago, and Montreal universities has succeeded in observing large streams of helium gas escaping from WASP-107b. This exoplanet is located more than 210 light-years from our solar system. This is the first time this chemical element has been identified with the JWST on an exoplanet, allowing for a detailed description of the phenomenon.

https://phys.org/news/2025-12-helium-leak-exoplanet-wasp-107b.html

Frequent flares from TRAPPIST-1 could impact habitability of nearby planets

Like a toddler right before naptime, TRAPPIST-1 is a small yet moody star. This little star, which sits in the constellation Aquarius about 40 light-years from Earth, spits out bursts of energy known as "flares" about six times a day.New research led by the University of Colorado Boulder takes the deepest look yet at the physics behind TRAPPIST-1's celestial temper tantrums. The team's findings could help scientists search for habitable planets beyond Earth's solar system. The researchers used observations from NASA's James Webb Space Telescope and computer simulations (models) to understand how TRAPPIST-1 produces its flares—first building up magnetic energy, then releasing it to kick off a chain of events that launches radiation deep into space. The results could help scientists unravel how the star has shaped its nearby planets, potentially in drastic ways.

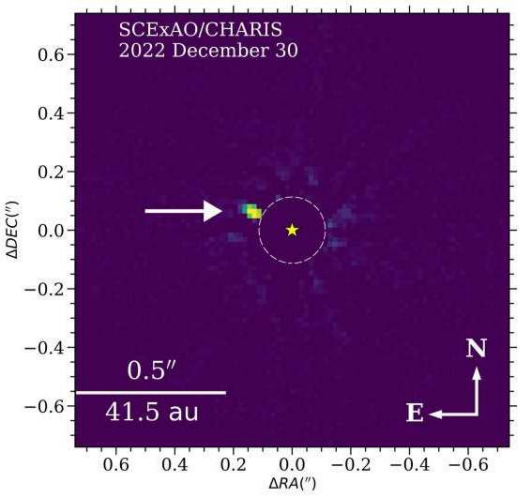


Top: the wavelength-integrated (0.6–2.83 μm) transit-normalized flare light curves of our sample. The flare temperatures of the integrations used for model validation and mitigation are scaled by color. Bottom left: fiducial Teff flare spectra are computed from similar-temperature integrations. Best-fitting blackbody curves are shown with the dashed gray lines. Bottom right: quiescent features appear in the residual spectra after subtracting the best-fit blackbody curves. Credit: The Astrophysical Journal Letters (2025). DOI: 10.3847/2041-8213/ae1960

"We think that the innermost TRAPPIST-1 planets are just bare, denuded rocks because the star has blown away their atmospheres," said Ward Howard, lead author of the new study and a NASA Sagan Fellow in the Department of Astrophysical and Planetary Sciences (APS) at CU Boulder. It's a highlight for the little star, which has attracted a lot of attention from scientists in recent years.TRAPPIST-1 has less than 10% the mass of the sun and is only a bit larger than the planet Jupiter. But it also hosts seven Earth-sized planets, three of which lie in what researchers call the "habitable zone"—a region of space that may have just the right temperatures for liquid water to form on the surface of a planet.https://phys.org/news/2025-12-frequent-flares-trappist-impact-habitability.html

First discoveries from new Subaru Telescope program reveal massive planet and brown dwarf

Astronomers using the Subaru Telescope in Hawai‘i have discovered a massive planet and a brown dwarf orbiting distant stars. The discoveries are the first results from OASIS (Observing Accelerators with SCExAO Imaging Survey), which combines space-based measurements with the Subaru Telescope's advanced imaging to find hidden worlds. These discoveries in turn enable NASA's upcoming Roman Space Telescope to test critical technologies for imaging Earth-like planets. Only about 1% of stars host massive planets and brown dwarfs that can be photographed directly with current telescopes. Even in young planetary systems where these objects are still glowing hot with the energy of having just been formed, making them brighter and easier to detect, they're still much fainter than their host stars and are easily lost in the stellar glare. The key question for astronomers has been: where to look for these objects?



The Subaru Telescope image which led to the discovery of HIP 54515 b (indicated by the arrow). The planet's host star has been blocked in this image. The star's position is indicated by the star mark. The dotted line shows the outline of the mask used to block the star. Credit: T. Currie/Subaru Telescope, UTSA

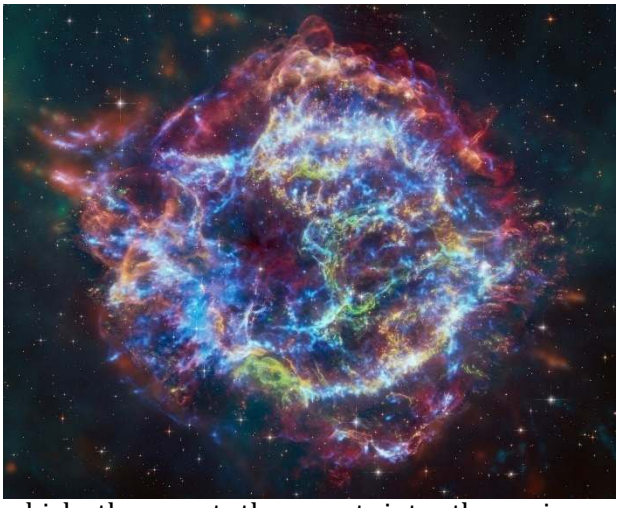
The newly discovered planet, HIP 54515 b, orbits a star 271 light-years away in the constellation Leo. With nearly 18 times Jupiter's mass, it circles its star at about Neptune's distance from our sun. But the star and planet appear very close when seen from Earth; roughly the size that a baseball seen 100 km away would appear. The SCExAO

system produced extremely sharp images allowing us to see the planet.

The second discovery, HIP 71618 B, is a 60 Jupiter mass brown dwarf located 169 light-years away in the constellation Bootes. Brown dwarfs are sometimes called "failed stars"—because they form like stars but never become massive enough to sustain nuclear fusion.

https://phys.org/news/2025-12-discoveries-subaru-telescope-reveal-massive.html

Chlorine and potassium found in supernova remnant at unexpectedly high levels



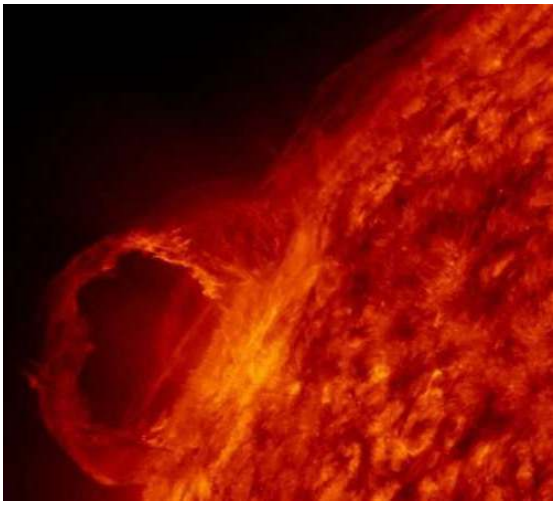
This composite image of the Cassiopeia A (or Cas A) supernova remnantcontains X-rays from Chandra (blue), infrared data from Webb (red, green, blue), and optical data from Hubble (red and white). A study by the XRISM (X-ray Imaging and Spectroscopy Mission) spacecraft has made the first-ever X-ray detections of chlorine and potassium in the wreckage.

X-ray: NASA/CXC/SAO; Optical: ASA/ESA/STScI; IR: NASA/ESA/CSA/STScI/Milisavljevic et al., NASA/JPL/CalTech; Image Processing:NASA/CXC/SAO/J. Schmidt and K. Arcand

"Why are we here?" is humanity's most fundamental and persistent question. Tracing the origins of the elements is a direct attempt to answer this at its deepest level. We know many elements are created inside stars and supernovae, which then cast them out into the universe, yet the origins of some key elements has remained a mystery.Chlorine and potassium, both odd-Z elements—possessing an odd number of protons—are essential to life and planet formation. According to current theoretical models, stars produce only about one-tenth the amount of these elements observed in the universe, a discrepancy that has long puzzled astrophysicists. This inspired a group of researchers at Kyoto University and Meiji University to examine supernova remnants for traces of these elements. Using XRISM—short for X-Ray Imaging and Spectroscopy Mission, an X-ray satellite launched by JAXA in 2023—the team was able to perform high-resolution X-ray spectroscopic observations of the Cassiopeia A supernova remnant within the Milky Way. The scientists utilized the microcalorimeter Resolve device onboard XRISM, providing high energy resolution an order of magnitude better than previous X-ray detectors, which allowed them to detect faint emission lines from rare elements. They then analyzed the X-ray spectrum from Cassiopeia A and compared the abundances of chlorine and potassium with several supernova nucleosynthetic models. The team discovered clear X-ray emission lines of both elements at abundances far higher than predicted by standard supernova models. This provided the first observational evidence that a supernova can create sufficient chlorine and potassium.

https://phys.org/news/2025-12-chlorine-potassium-supernova-remnant-unexpectedly.html

UK space weather probe captures biggest solar radiation spike in almost 20 years



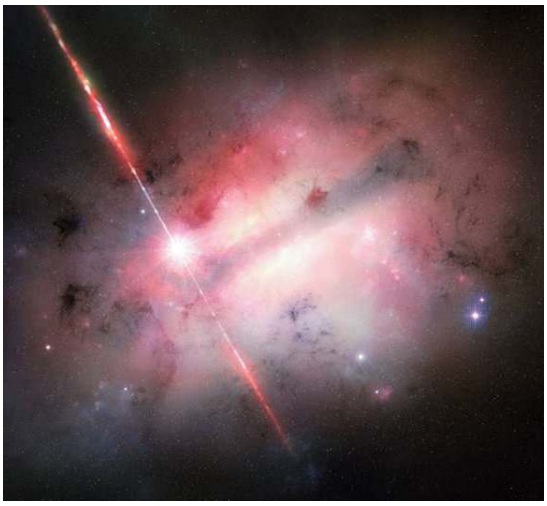
Credit: Pixabay/CC0 Public Domain

New balloon-mounted space radiation probes developed by the Surrey Space Center at the University of Surrey have captured their first measurements of a major solar storm, confirming the research team's model, which indicates the flare caused the highest levels of radiation at aviation altitude in almost two decades. The solar flare—classified as an X5 event—triggered a rare Ground Level Enhancement (GLE) on 11 November 2025, in which solar energetic particles penetrated deep into Earth's atmosphere and caused a radiation surge that was detectable even at ground level. Within an hour, the UK Met Office and their counterparts at KNMI in the Netherlands began launching a sequence of weather observation balloons equipped with Surrey's sensors to measure the storm in real time—right up to commercial aircraft altitudes and into regions used by business jets and supersonic transport.Early analysis shows that radiation levels at 40,000 feet rose to their highest since 2006, reaching almost ten times normal

background levels for a short period. Although this event did not pose any immediate health concern, larger storms in future could be more worrying, not least because they have the potential to disturb on-board aircraft electronic systems. During the storm's peak, the team estimate that single-event upsets—bit-flips in onboard computer memory caused by energetic particles—could have reached around 60 errors per hour per gigabyte.Professor Clive Dyer, an expert in space weather at Surrey Space Center, University of Surrey, said, "This was the strongest Ground Level Event we've seen since December 2006.

https://phys.org/news/2025-12-uk-space-weather-probe-captures.html#goog_rewarded

Record-breaking cosmic explosion challenges astronomers' understanding of gamma-ray bursts



Artist's rendition of GRB 250702B's ultra-relativistic jet (moving at nearly the speed of light) escaping from its dusty, massive host galaxy. Credit: NOIRLab/NSF/AURA/M. Garlick.

Astronomers at the University of North Carolina at Chapel Hill have helped uncover new clues about the longest-lasting cosmic explosion ever observed, a gamma-ray burst that lasted nearly seven hours. The event, known as GRB 250702B, challenges decades of understanding about how and why these bursts occur. Gamma-ray bursts are intense flashes of high-energy light produced by catastrophic cosmic events, usually lasting just a few seconds or minutes. But GRB 250702B broke all known records. After its initial detection by space-based observatories, researchers used some of the world's largest ground-based telescopes to capture images of a fading glow located in a massive, dusty galaxy.As part of a coordinated international effort, the UNC team led observations with some of the United States' largest ground-based telescopes. The team's data, combined with observations from the European Southern Observatory's Very Large Telescope, NASA's Hubble Space Telescope and X-ray data suggest that this explosion could have several possible origins including the collapse of a massive star, the collision of exotic stellar remnants, or even a star being torn apart by a black hole, but current observations can't yet reveal which scenario is correct."This was the longest gamma-ray burst that humans have observed—long enough that it does not fit into any of our existing models for what causes gamma-ray bursts," said Jonathan Carney, lead author of the study and Ph.D. student in physics and astronomy at UNC-Chapel Hill.

https://phys.org/news/2025-12-cosmic-explosion-astronomers-gamma-ray.html

'Monster Stars' from the cosmic dawn: Astronomers find first direct evidence

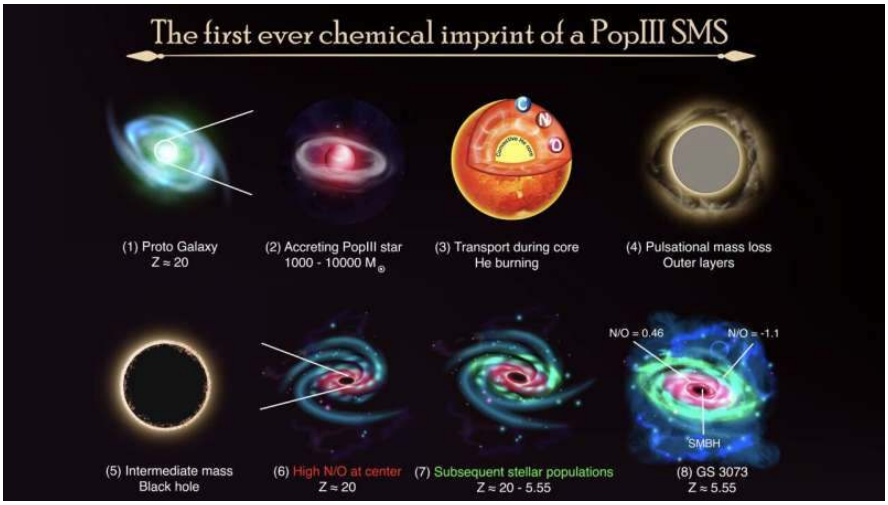


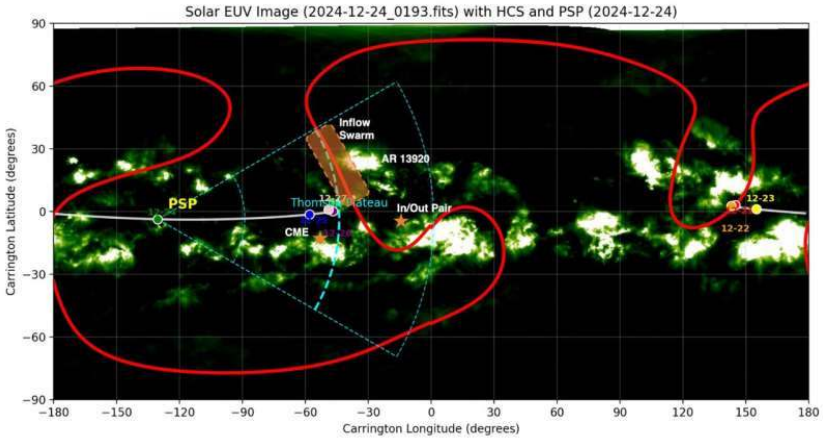
Image showing how super massive stars develop. Credit: Devesh Nandal, Center for Astophysics Institute for Theory and Computing

Using the James Webb Space Telescope, a team of international researchers have discovered chemical fingerprints of gigantic primordial stars that were among the first to form after the Big Bang. For two decades, astronomers have puzzled over how supermassive black holes—some of the brightest objects in the universe—could exist less than a billion years after the Big Bang. Normal stars simply couldn't create such massive black holes quickly enough. Now, using the James Webb Space Telescope (JWST), an international team has found the first compelling evidence that solves this cosmic mystery: "monster stars" weighing between 1,000 and 10,000 times the mass of our sun existed in the early universe. The breakthrough came from examining chemical signatures in a galaxy called GS 3073. A study led by the University of Portsmouth in England and the Center for Astrophysics (CfA), Harvard and Smithsonian in the U.S. discovered an extreme imbalance of nitrogen to oxygen that cannot be explained by any known type of

star."Our latest discovery helps solve a 20-year cosmic mystery," said Dr. Daniel Whalen from the University of Portsmouth's Institute of Cosmology and Gravitation. "With GS 3073, we have the first observational evidence that these monster stars existed."These cosmic giants would have burned brilliantly for a brief time before collapsing into massive black holes, leaving behind the chemical signatures we can detect billions of years later. A bit like dinosaurs on Earth—they were enormous and primitive. And they had short lives, living for just a quarter of a million years—a cosmic blink of an eye."

https://phys.org/news/2025-12-monster-stars-cosmic-dawn-astronomers.html

Parker Solar Probe spies solar wind 'U-turn'

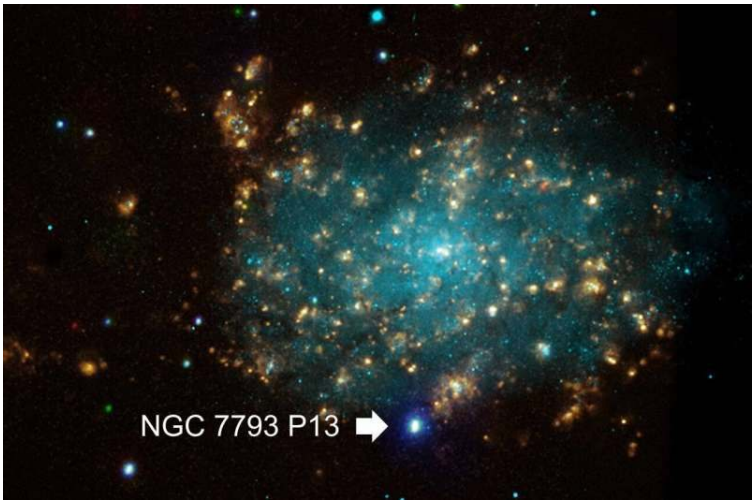


EUV 193/195 Å image of the solar corona overlaid with the heliospheric current sheet (HCS) from a PFSS model. PSP's position at 12:00 UT on 23rd (yellow), 24th (green), and 25th (blue) shows its rapid traversal of Carrington longitudes near perihelion. WISPR's approximate field of view is indicated by arcs representing the Thomson sphere (thick dashed) and plateau (thin dashed). The locations of features discussed in the text are also marked by the orange arrows and box. Credit: The Astrophysical Journal Letters (2025). DOI: 10.3847/2041-8213/ae0d7d

Images captured by NASA's Parker Solar Probe as the spacecraft made its record-breaking closest approach to the sun in December 2024 have now revealed new details about how solar magnetic fields responsible for space weather escape from the sun—and how sometimes they don't. Like a toddler, our sun occasionally has disruptive outbursts. But instead of throwing a fit, the sun spews magnetized material and hazardous high-energy particles that drive space weather as they travel across the solar system. These outbursts can impact our daily lives, from disrupting technologies like GPS to triggering power outages, and they can also imperil voyaging astronauts and spacecraft. Understanding how these solar outbursts, called coronal mass ejections (CMEs), occur and where they are headed is essential to predicting and preparing for their impacts at Earth, the moon, and Mars. Images taken by Parker Solar Probe in December 2024, have revealed that not all magnetic material in a CME escapes the sun—some makes it back, changing the shape of the solar atmosphere in subtle, but significant, ways that can set the course of the next CME exploding from the sun. These findings have far-reaching implications for understanding how the CME-driven release of magnetic fields affects not only the planets, but the sun itself.

https://phys.org/news/2025-12-parker-solar-probe-spies.html

Neutron star P13 shows dramatic X-ray variability linked to rotation velocity



The image that combines data from X-ray, optical, and Hα line observations. NGC 7793 P13 is located away from the galactic center of NGC 7793. Credit: X-ray (NASA/CXC/Univ of Strasbourg/M.Pakull et al; Optical (ESO/VLT/Univ of Strasbourg/M.Pakull et al); H-alpha (NOAO/AURA/NSF/CTIO 1.5m)

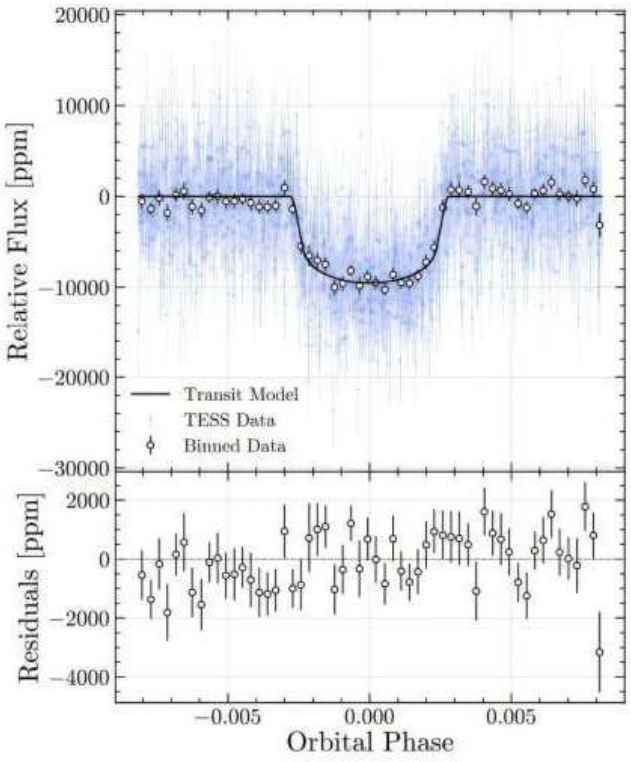
A research team has investigated long-term X-ray variability in the neutron star NGC 7793 P13, an object thought to be driven by supercritical accretion, where an extraordinary amount of gas

falls onto the object and emits intense X-rays. The team found a relation between the X-ray luminosity and the rotation velocity, which could provide clues to reveal the supercritical accretion mechanism. When gas falls onto a compact object, such as a neutron star or black hole, due to its strong gravity (a process called accretion), it emits electromagnetic waves. High-sensitivity observations have discovered objects with extremely high X-ray luminosities. One possible explanation for this ultraluminosity is that an extraordinary amount of gas falls onto a compact object through a process called supercritical accretion. However, the mechanism of supercritical accretion remains unclear. The research team focused on NGC 7793 P13 (hereafter, P13), which is a neutron star located in the galaxy NGC 7793 (about 10 million light-years from Earth).As gas falls onto a neutron star, it forms a column structure (called an accretion column) on magnetic poles, from which an intense X-ray is thought to be emitted. Then, coherent X-ray pulsation accompanied by the rotation of a neutron star can be detected. According to previous studies, P13 rotates with a period of 0.4 s with a constant acceleration rate. Moreover, the luminosity changed by more than two orders of magnitude in about 10 years.

https://phys.org/news/2025-12-neutron-star-p13-ray-variability.html

Rare brown dwarf discovered orbiting ancient star

Astronomers from the Harvard-Smithsonian Center for Astrophysics (CfA) and elsewhere report the discovery of a new brown dwarf about 60 times more massive than Jupiter. The newfound substellar object, designated TOI-7019 b, is a brown dwarf known to orbit a star that is part of the Milky Way's ancient thick disk. The finding is detailed in a paper published December 5 on the *arXiv* preprint server.

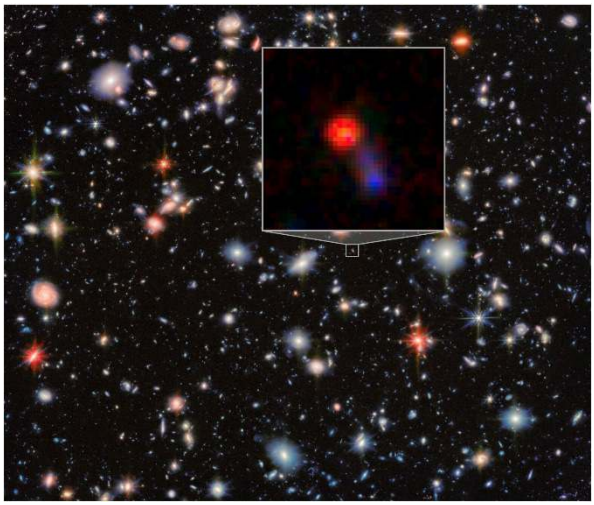


Phase-folded TESS light curve of TOI-7019b from eight transit events observed in Sectors 14, 26, 40, 53, 55, 58, 81, and 85. Credit: arXiv (2025). DOI: 10.48550/arxiv.2512.06069

Brown dwarfs (BDs) are intermediate objects between planets and stars, occupying the mass range between 13 and 80 Jupiter masses (0.012 and 0.076 solar masses). However, although many brown dwarfs have been detected to date, these objects orbiting other stars are a rare find. Recently, a team of astronomers led by CfA's Jea Adams Redai found another rare brown dwarf, which is a companion to the star TOI-7019. This star was initially observed with NASA's Transiting Exoplanet Survey Satellite (TESS), which detected a transit signal in its light curve. Now, follow-up observations of this star confirmed that the transit signal is produced by a substellar object."Using follow-up photometry and radial velocity measurements, we determined the physical properties of this companion, which turns out to be a dense brown dwarf," the researchers wrote in the paper.According to the study, the newfound brown dwarf has a radius of about 0.82 Jupiter radii and is approximately 61.3 times more massive than Jupiter, which yields a density at a level of 141.7 g/cm^3. The BD orbits its host star every 48.26 days, at a distance of some 0.25 AU from it, and its equilibrium temperature is estimated to be 479 K.When it comes to TOI-7019, it is a main sequence star nearly the size of the sun, while its mass is around 0.78 solar masses. With an estimated age of 12 billion years, it is an old, metal-poor star—a member of the Milky Way's ancient thick disk.

https://phys.org/news/2025-12-rare-brown-dwarf-orbiting-ancient.html

The monster hiding in plain sight: JWST reveals cosmic shapeshifter in the early universe



Covering a tiny patch of sky spanning less than a tenth of the full moon, the famous "Hubble eXtreme Deep Field" image revealed thousands of galaxies, including objects from the universe infancy. The James Webb Space Telescope observed the same region over three years. U of A researchers zoomed in on the galaxy reported in this study (inset), captured when the universe was only 800 million years old. The team found that even at its young age, it already harboured a supermassive black hole, shrouded in dust. Credit: ESA/Webb, NASA & CSA, G. Östlin, P. G. Perez-Gonzalez, J. Melinder, the JADES Collaboration, M. Zamani (ESA/Webb)

In a glimpse of the early universe, astronomers have observed a galaxy as it appeared just 800 million years after the Big Bang—a cosmic Jekyll and Hyde that looks like any other galaxy when viewed in visible and even ultraviolet light but transforms into a cosmic beast when observed at infrared wavelengths.This object, dubbed Virgil, is forcing astronomers to reconsider their understanding of how supermassive black holes grew in the infant universe. The discovery examines a known galaxy named Virgil, but exposes its hidden nature: a supermassive black hole in the galaxy's center accreting material at an extraordinary rate, with its energy output obscured by thick veils of dust. The inferred black hole mass is far larger than its host galaxy should be able to support, placing Virgil among the so-called "overmassive" black holes that challenge current models of how black holes formed in the early universe. The discovery challenges prevailing theories about how supermassive black holes and galaxies grew together. Before NASA's James Webb Space Telescope, astronomers believed that galaxies formed first and gradually nurtured black holes in their cores, with both growing in lockstep over cosmic time.

https://phys.org/news/2025-12-monster-plain-sight-jwst-reveals.html

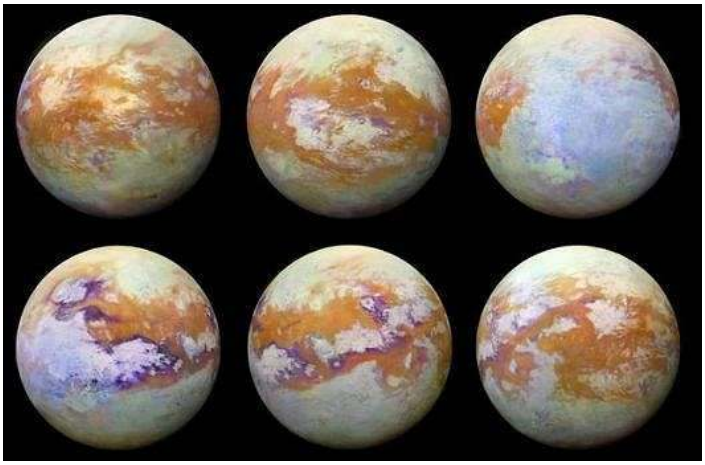
Radio observations find nothing at Omega Centauri's heart

The globular cluster Omega Centauri. Credit: Chuck Ayoub

Omega Centauri dominates the southern sky as the Milky Way's largest and brightest globular cluster, a dense sphere containing roughly 10 million stars. Earlier this year, astronomers found evidence that an intermediate mass black hole hides within the cluster's core, revealed by seven stars moving far too quickly to remain bound unless something massive holds them gravitationally. Now, researchers have searched for the black hole itself using radio telescopes, and their discovery is what they didn't find. Intermediate mass black holes represent a missing link in our understanding of how black holes evolve. We know stellar mass black holes form from dying stars, with masses up to perhaps 200 times the sun. We know supermassive black holes weighing millions or billions of solar masses dominate galactic centres. But intermediate mass black holes, with masses between these extremes, remain frustratingly rare. The recent Hubble Space Telescope study tracked 1.4 million stars in Omega Centauri across two decades of observations. Seven stars in the cluster's innermost region move so rapidly they should escape entirely, yet remain bound. The gravitational pull keeping them corralled suggests a black hole with at least 8,200 solar masses, though estimates reach as high as 47,000 solar masses.

https://phys.org/news/2025-12-radio-omega-centauri-heart.html#google_vignette

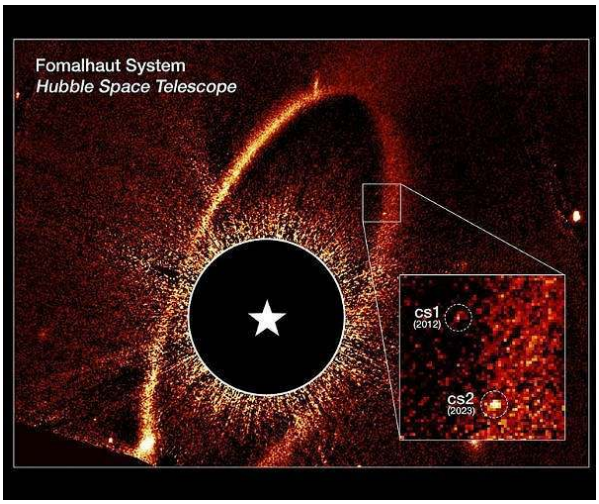
Titan interior study points to thick slushy ice shell instead of global ocean



Careful reanalysis of measurements gathered more than a decade ago indicates that Saturn's largest moon, Titan, likely lacks a vast liquid-water ocean beneath its ice, contrary to earlier interpretations of Cassini data. Instead, the work suggests that an icy journey downward from the surface would encounter extensive high-pressure ice, slushy layers, and pockets of meltwater closer to the rocky core. NASA's Cassini mission, launched in 1997 and operated for nearly 20 years, provided detailed gravity and radio-tracking data on Saturn and its 274 known moons, including Titan. Titan is veiled by a dense, hazy atmosphere and is the only known world besides Earth with stable surface liquids, with temperatures near minus 297 degrees Fahrenheit that allow methane, rather than water, to form lakes and fall as rain. Earlier analyses of Cassini tracking data showed that Titan's shape changes as it moves along its elliptical orbit around Saturn, stretching and compressing under the planet's gravity. In 2008, researchers concluded that these deformations implied a global subsurface ocean, because a thick liquid layer would allow the crust to flex more than a fully frozen interior.

https://www.spacedaily.com/reports/Titan_interior_study_points_to_thick_slushy_ice_shell_instead_of_global_ocean_999.html

Hubble pinpoints asteroid smash ups in nearby Fomalhaut system



In a historical milestone, catastrophic collisions in a nearby planetary system were witnessed for the first time by astronomers using the NASA/ESA Hubble Space Telescope. As they observed the bright star Fomalhaut, the scientists saw the impact of massive objects around the star. The Fomalhaut system appears to be in a dynamical upheaval, similar to what our solar system experienced in its first few hundred million years after formation.

"This is certainly the first time I've ever seen a point of light appear out of nowhere in an exoplanetary system," said principal investigator Paul Kalas of the University of California, Berkeley. "It's absent in all of our previous Hubble images, which means that we just witnessed a violent collision between two massive objects and a huge debris cloud unlike anything in our own solar system today. Amazing!"

Just 25 light-years from Earth, Fomalhaut is one of the brightest stars in the night sky. Located in the constellation Piscis Austrinus, also known as the Southern Fish, it is more massive and brighter than the Sun and is encircled by several belts of dusty debris.

https://www.spacedaily.com/reports/Hubble_pinpoints_asteroid_smash_ups_in_nearby_Fomalhaut_system_999.html

https://phys.org/news/2025-12-hubble-captures-rare-collision-nearby.html

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