"The Southern Cross"

Hermanus Astronomy Centre Newsletter

MARCH 2023

MONTHLY MEETING

This presentation took place on **Monday 13th February: Johan Smit --** *"The Eye as an Observing Instrument"*

"How we See, What we See and How to See Better" are the first few words of Johan's deeply informative presentation to help and encourage the rewarding hobby of astronomical observation. For all those who so enjoy and learn from this occupation, I thoroughly recommend watching this video (or rewatching for those who managed to join us on the 13th).

https://www.youtube.com/watch?v=V9kIlJoGE-o (1hour 32 minutes)

The Annual General Meeting on 20th February was held at the SANSA auditorium.

The meeting was followed by a presentation by **Dr Lee-Anne McKinnell,** managing director of SANSA Hermanus, entitled *"Operational Space Weather Services Project"*. Herewith the link to the AGM and Lee-Anne's address:

https://www.youtube.com/watch?v=GYs11MxHgJc

2023 meeting dates for your diaries – March 20, April 17, May 15, June 19, July 17, August 21, September 18, October 16, November 20. (Monthly Meetings are held on the third Monday of every month except December unless otherwise advised).

SPECIAL INTEREST GROUP ACTIVITIES

Cosmology

(the first Monday of each month)

This is a series of 17 videos titled "COSMOLOGY, THE HISTORY OF THE UNIVERSE".

The last meeting, scheduled for **6th February,** was cancelled.
The next is on **6th March**, Episode 6 -*What Really is Everything?*- 43 minutes

For further information, please contact Derek Duckitt:derek.duckitt@gmail.com

Astrophotography

This SIG meets on the second Monday of each month as requested by group members. For further information, please contact Deon Krige: krige.deon44@outlook.com

13th February - no meeting held.

The next scheduled date is **13th March** 2023.

Study Group

(The last Monday of each month)

Last meeting **30th January** – *"Battery Management and Care"* by Johan Smit.

You Tube link - https://www.youtube.com/watch?v=cRmtn0WLyIU

The meeting scheduled for **27th February** was cancelled.

Next up: **27th March** topic to be advised.

For further information, please contact Peter Harvey: petermh@hermanus.co.za

Stargazing

No Hermanus Astronomy Centre events are currently planned but we shall let you know when a suitable evening is scheduled.

Future Trips

No outings are planned at present.

Please check our website calendar for HAC scheduled events: https://www.hermanusastronomy.co.za

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Outreach

On 5th Feb, Pierre, Peter and Mick assisted learners from **Lukhanyo Primary** to count sunspots from the schools parking terrain. Much enjoyed by the learners and teachers. Pierre saw 6 and one girl saw 7 at the eyepiece. Many more visible from the enlarged afocal cell photo.

On 14th February, Mick met a group of grade 8 learners from **Generation School** at the Tourism Office, explained the Solar System display there and then conducted the Solar System workshop at the clifftop parking terrain. Pierre joined them at Gearing's Point and explained the design of and how to use the Analemmatic sundial. The school wants one at Generation. Mick & Pierre will assist their learners to design and mark out their own Analemmatic sundial on 21st April. They also want to do a sunspot counting session. Date to be decided.

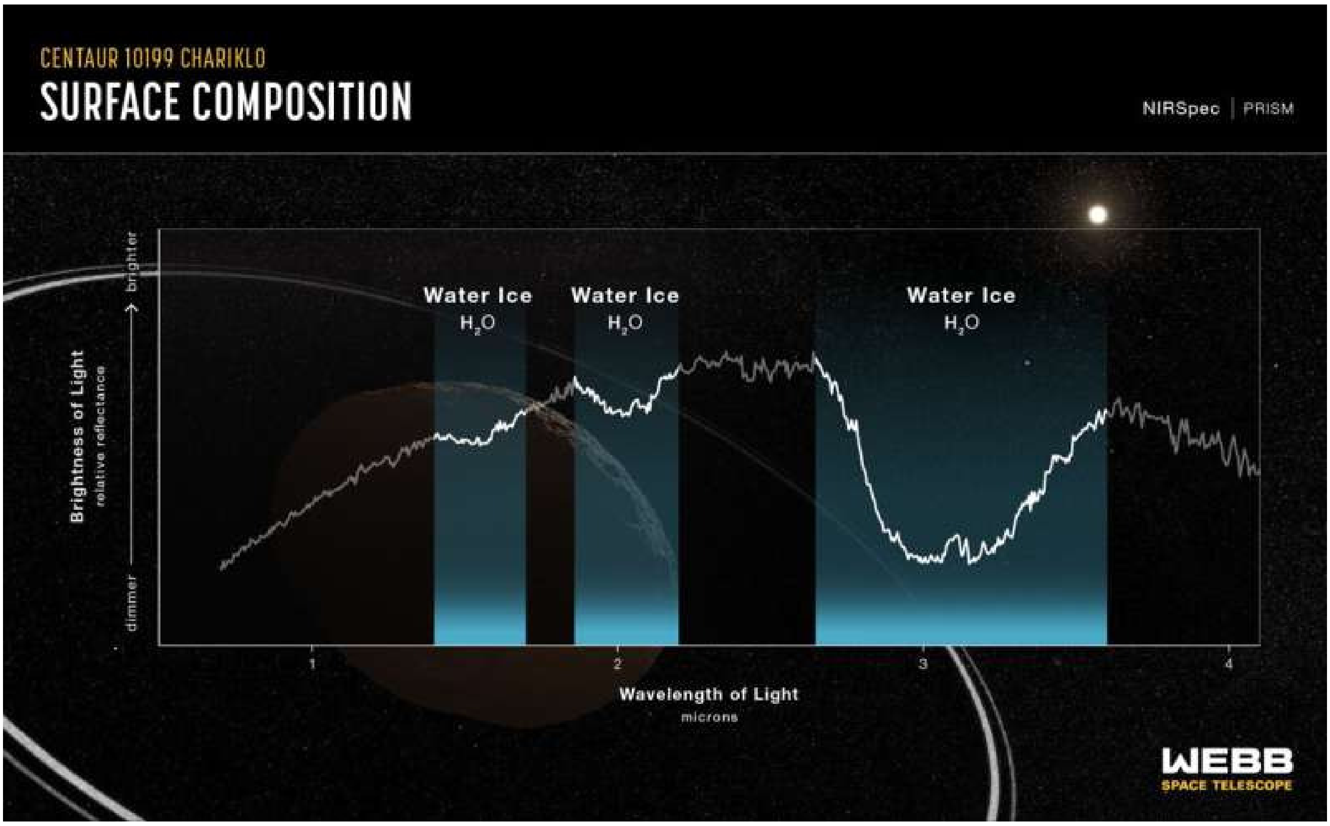
The same afternoon Mick and Pierre met the group from Lukhanyo Primary for the same purpose at 14h45. This group must design and mark out their existing sundial. Marking of their shadow stick's shadow tip was also planned, but a wrist op postponed this activity until further notice.

ASTRONOMY NEWS for February 2023

(compiled by Pieter Kotzé)

Webb spies Chariklo ring system with high-precision technique

An occultation light curve from Webb's Near-infrared Camera (NIRCam) Instrument at 1.5 microns wavelength (F150W) shows the dips in brightness of the star (Gaia DR3 6873519665992128512) as Chariklo's rings passed in front of it on Oct. 18. As seen in the illustration of the occultation event, the star did not pass behind Chariklo from Webb's viewpoint, but it did pass behind its rings. Each dip actually corresponds to the shadows of two rings around Chariklo, which are ~4 miles (6-7 kilometers) and ~2 miles (2-4 kilometers) wide, and separated by a gap of 5.5 miles (9 kilometers). The two individual rings are not fully resolved in each dip in this light curve.

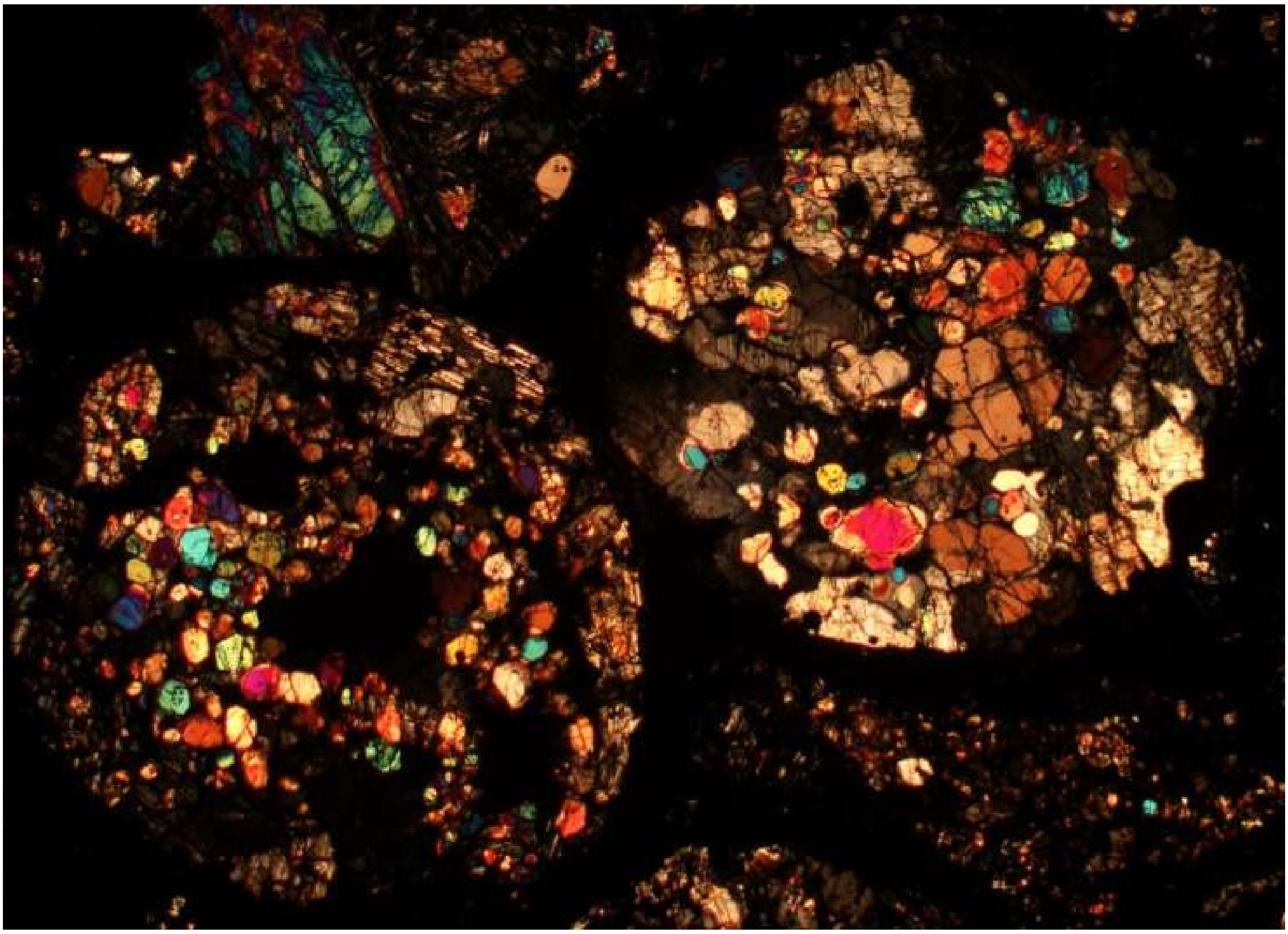


Webb captured a spectrum with its Near-infrared Spectrograph (NIRSpec) of the Chariklo system on Oct. 31, shortly after the occultation. This spectrum shows clear evidence for crystalline water ice, which was only hinted at by past ground-based observations. Credit: NASA, ESA, CSA, L. Hustak (STScI). SCIENCE: Noemí Pinilla-Alonso (FSI/UCF), Ian Wong (STScI), Javier Licandro (IAC).

The successful Webb occultation light curve and spectroscopic observations of Chariklo open the door to a new means of characterizing small objects in the distant solar system in the coming years. With Webb's high sensitivity and infrared capability, scientists can use the unique science return offered by occultations, and enhance these measurements with near-contemporaneous spectra. Such tools will be tremendous assets to the scientists studying distant small bodies in our solar system.

https://phys.org/news/2023-01-webb-spies-chariklo-high-precision-technique.html

Solar system formed from 'poorly mixed cake batter,' isotope research shows.



A meteorite thin section under a microscope. Different colors represent different minerals, because light travels through them in different ways. The round mineral aggregates are chondrules, which are a major component in primitive meteorites. Credit: Nicole XikeNie.

Earth's potassium arrived by meteoritic delivery service finds new research led by Carnegie's Nicole Nie and Da Wang. Their work, published in *Science*, shows that some primitive meteorites contain a different mix of potassium isotopes than those found in other, more-chemically processed meteorites. These results can help elucidate the processes that shaped our solar system and determined the composition of its planets. "The extreme conditions found in stellar interiors enable stars to manufacture elements using nuclear fusion," explained Nie, a former Carnegie postdoc now at Caltech.

"Each stellar generation seeds the raw material from which subsequent generations are born and we can trace the history of this material across time." Some of the material produced in the interiors of stars can be ejected out into space, where it accumulates as a cloud of gas and dust. More than 4.5 billion years ago, one such cloud collapsed in on itself to form our sun.

The remnants of this process formed a rotating disk around the newborn star. Eventually, the planets and other solar system objects coalesced from these leftovers, including the parent bodies that later broke apart to become asteroids and meteorites.

https://phys.org/news/2023-01-solar-poorly-cake-batter-isotope.html

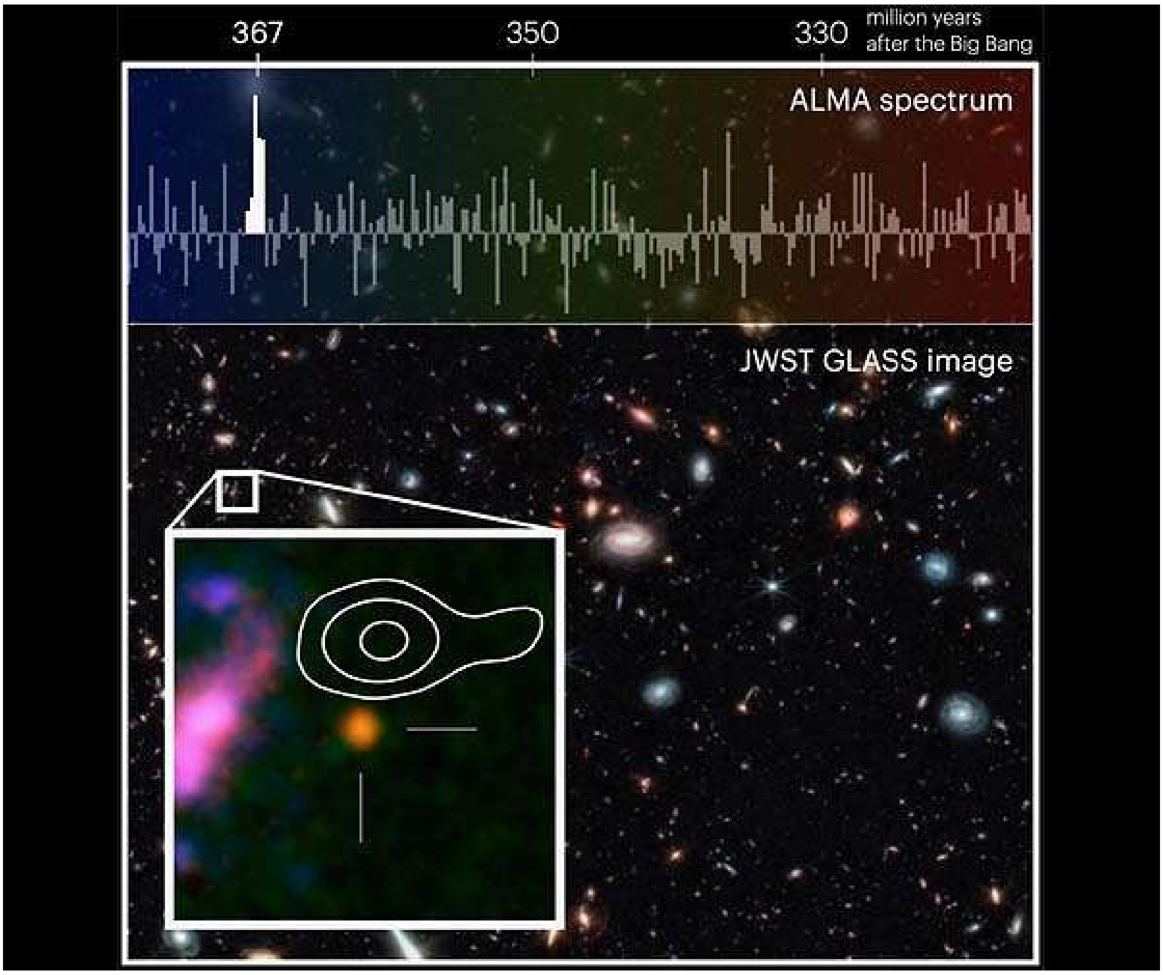
Webb Telescope identifies origins of icy building blocks of life

This image by the NASA/ESA/CSA James Webb Space Telescope's Near-InfraRed Camera (NIRCam) features the central region of the Chameleon I dark molecular cloud. The lights from numerous background stars can be seen as orange dots behind the cloud.

Frozen molecules were central to the origin of life on Earth. In addition to impacts of icy comets and asteroids, according to current theory, our planet likely also received the elementary components of life from the ices of the immense interstellar molecular cloud from which the Earth and the rest of the solar system emerged. In a new study, an international research team, with the participation of a researcher from the University of Bern and the National Centre of Competence in Research (NCCR) PlanetS, has now discovered ice in deeper regions of such a molecular cloud than ever before. At the same time, with a temperature of about minus 263 degrees Celsius (or about ten degrees above absolute zero), it is the coldest ice ever measured. "This is the first time researchers have been able to study the composition of so-called pre-stellar ices near the centre of a molecular cloud," says Melissa McClure, an astronomer at Leiden Observatory and lead author of the study."In addition to simple ices such as water, carbon dioxide, carbon monoxide, ammonia, and methane we were able to identify several other compounds, including the more complex organic ice methanol." The measurements, made by the team with the JWST of NASA, ESA and the Canadian Space Agency (CSA), provide the research community with unprecedented insights into the abundance of icy compounds that can be found inside interstellar molecular clouds - and subsequently incorporated into stars and planets that emerge from them.

https://www.spacedaily.com/reports/Webb_Telescope_identifies_origins_of_icy_building_blocks_of_life_999.html

Astronomers confirm age of most distant galaxy with oxygen

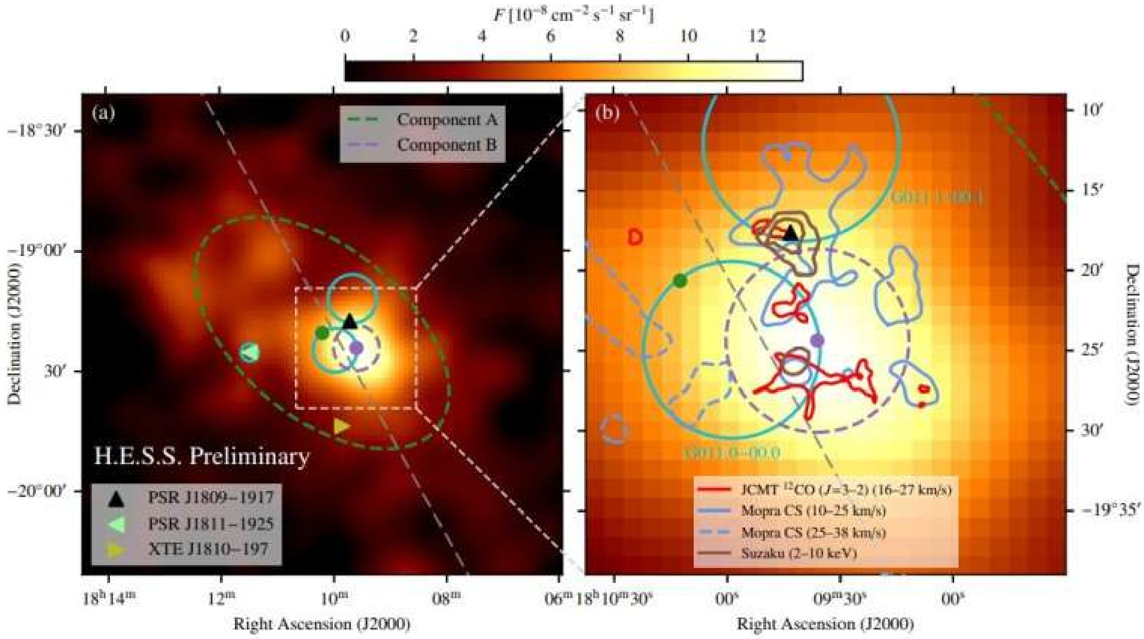


The radio telescope array ALMA has pin-pointed the exact cosmic age of a distant JWST-identified galaxy, GHZ2/GLASS-z12, at 367 million years after the Big Bang. ALMA's deep spectroscopic observations revealed a spectral emission line associated with ionized Oxygen near the galaxy, which has been shifted in its observed frequency due to the expansion of the Universe since the line was emitted. This observation confirms that the JWST is able to look out to record distances, and heralds a leap in our ability to understand the formation of the earliest galaxies in the Universe. Credit: NASA / ESA / CSA / T. Treu, UCLA / NAOJ / T. Bakx, Nagoya U.

A new study led by a joint team at Nagoya University and the National Astronomical Observatory of Japan has measured the cosmic age of a very distant galaxy. The team used the ALMA radio telescope array to detect a radio signal that has been travelling for approximately 97% of the age of the Universe. This discovery confirms the existence of galaxies in the very early Universe found by the James Webb Space Telescope. The galaxy, named GHZ2/GLASS-z12, was initially identified in the JWST GLASS survey, a survey that observes the distant Universe and behind massive clusters of galaxies. These observations consist of several images using different broad-band colour filters, similar to the separate RGB colours in a camera.

https://www.spacedaily.com/reports/Astronomers_confirm_age_of_most_distant_galaxy_with_oxygen_999.html

Study inspects gamma-ray emission from HESS J1809−193



Map showing the γ-ray flux above 0.27 TeV from HESS J1809−193.(a) full region. (b) zoom-in on core region. Credit: Mohrmann et al, 2023

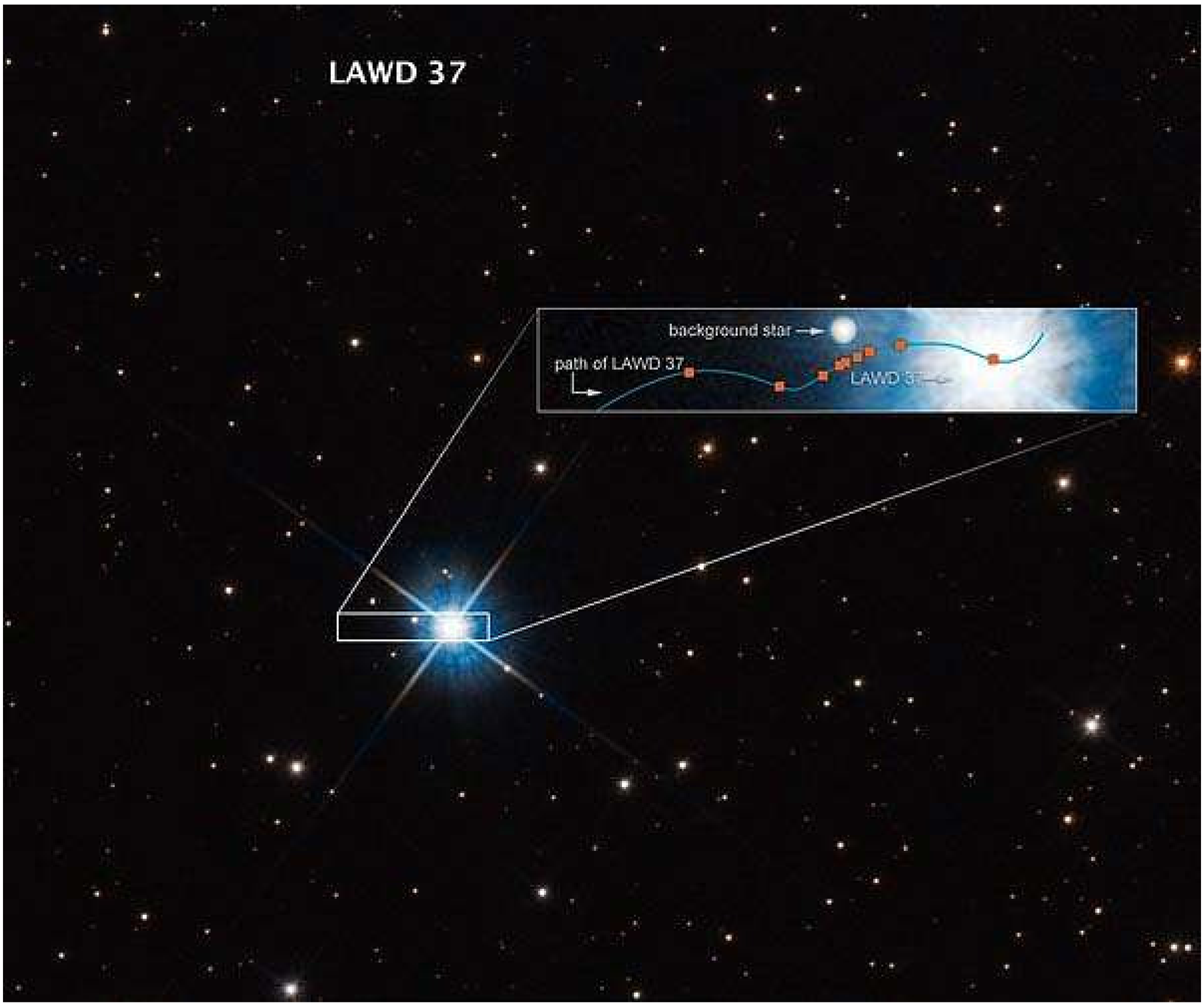
Using the High Energy Stereoscopic System (HESS), German astronomers have investigated a very-high-energy (VHE) gamma-ray source known as HESS J1809−193. Results of the study, published January 18 on the *arXiv* preprint server, deliver important insights into the properties of gamma-ray emission from this source.

Sources emitting gamma radiation with photon energies between 100 GeV and 100 TeV are called very-high energy (VHE) gamma-ray sources, while those with photon energies above 0.1 PeV are known as ultra-high energy (UHE) gamma-ray sources. The nature of these sources is still not well understood; therefore, astronomers are constantly searching for new objects of this type to characterize them, which could shed more light on their properties in general.

Discovered in 2007 as part of the H.E.S.S. Galactic Plane Survey (HGPS), HESS J1809−193 is an unassociated VHE (over 100 GeV) gamma-ray source. Previous observations of HESS J1809−193 have found that the source is located in a rich environment, with an energetic pulsar (designated PSR J1809−1917) at a distance of some 10,750 light years, X-ray pulsar wind nebula (PWN), several supernova remnants (SNRs), and molecular clouds.

https://phys.org/news/2023-01-gamma-ray-emission-hess-j1809193.html

Astronomers observe light bending around an isolated white dwarf

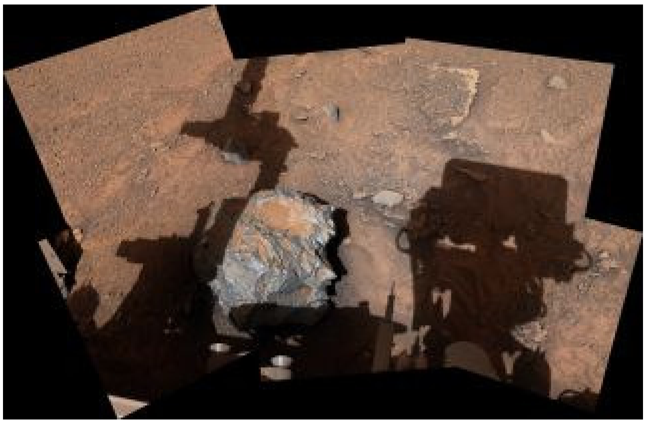


This graphic shows how microlensing was used to measure the mass of a white dwarf star. The dwarf, called LAWD 37, is a burned-out star in the centre of this Hubble Space Telescope image. Though its nuclear fusion furnace has shut down, trapped heat is sizzling on the surface at 100,000 degrees C, causing the stellar remnant to glow fiercely. The inset box plots how the dwarf passed in front of a background star in 2019.

Astronomers have directly measured the mass of a dead star using an effect known as gravitational microlensing, first predicted by Einstein in his General Theory of Relativity, and first observed by two Cambridge astronomers 100 years ago. The international team, led by the University of Cambridge, used data from two telescopes to measure how light from a distant star bent around a white dwarf known as LAWD 37, causing the distant star to temporarily change its apparent position in the sky.This is the first time this effect has been detected for a single, isolated star other than our Sun, and the first time the mass of such a star has been directly measured. LAWD 37 is a white dwarf, the result of the death of a star like our own. When a star dies, it stops burning its fuel and expels its outer material, leaving only a hot, dense core. Under these conditions, matter as we know it behaves very differently and turns into something called electron-degenerate matter.
https://www.spacedaily.com/reports/Astronomers_observe_light_bending_around_an_isolated_white_dwarf_999.html
https://www.spacedaily.com/reports/For_the_First_Time_Hubble_Directly_Measures_Mass_of_a_Lone_White_Dwarf_999.html

NASA's Curiosity rover has found another meteorite on Mars.

The space rock is about 1 foot (0.3 meters) wide and consists primarily of iron and nickel, Curiosity team members announced via Twitter on Thursday (Feb. 2). And the meteorite has a name.



The iron-nickel meteorite "Cacao," discovered on Mars by NASA's Curiosity rover. The Curiosity team posted this photo on Twitter on Feb. 2, 2023.(Image credit: NASA/JPL-Caltech)

"We're calling it 'Cacao,'" the Curiosity team wrote in the Twitter post (opens in new tab), which includes a photo of the rock.The robot's work over the past decade has answered that question in the affirmative, showing that Gale hosted a potentially habitable lake-and-stream system in the ancient past. What's more, this watershed likely persisted for millions of years at a stretch, possibly allowing time for the rise of Martian microbes.

https://www.jpl.nasa.gov/images/pia25737-curiosity-finds-a-meteorite-cacao

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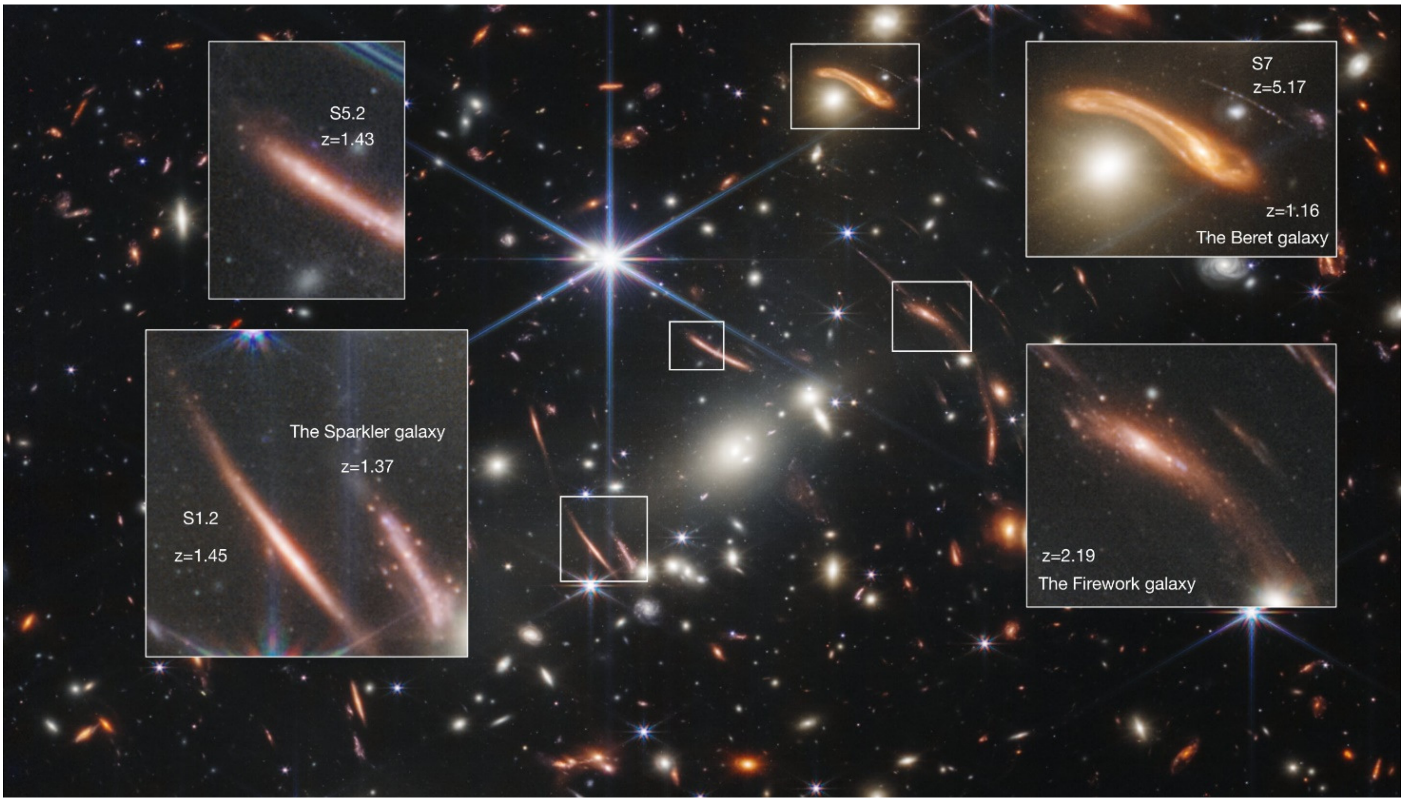
James Webb Space Telescope captures the first phase of star formation in distant galaxies.

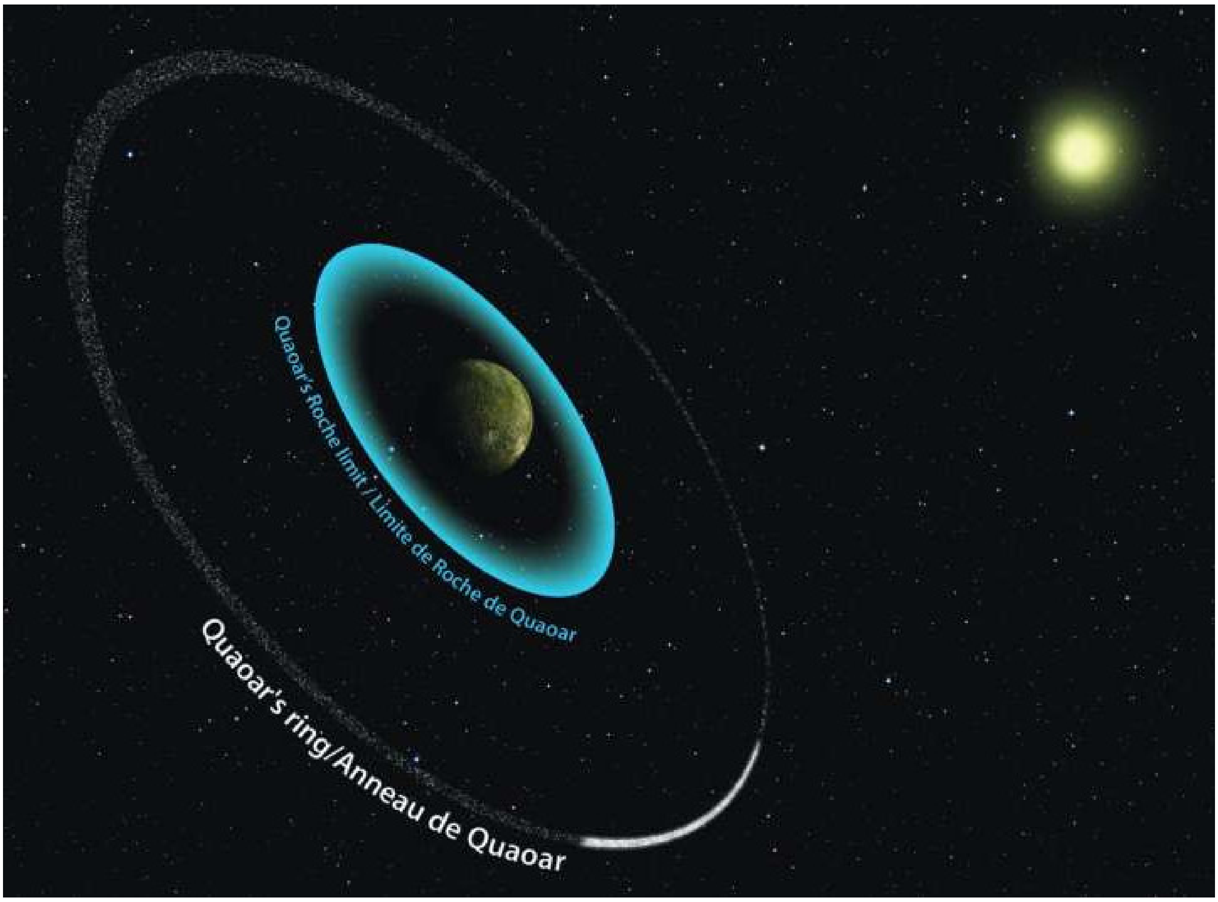


The James Webb Space Telescope captured this image of a galaxy cluster (SMACS0723). The five zoomed in galaxies are so far away that we observe them as they were when the universe was between one and five billion years old. Today the universe is 13.7 billion years old. Credit: Image adapted from image release by NASA, ESA, CSA, STScI

Thanks to the James Webb Space Telescope's first images of galaxy clusters, researchers have, for the very first time, been able to examine very compact structures of star clusters inside galaxies, so-called clumps. In a paper published in the *Monthly Notices of the Royal Astronomical Society,* researchers from Stockholm University have studied the first phase of star formation in distant galaxies. "The galaxy clusters we examined are so massive that they bend light rays passing through their center, as predicted by Einstein in 1915. And this in turn produces a kind of magnifying glass effect: the images of background galaxies are magnified," explains Adélaïde Claeyssens, Department of Astronomy, Stockholm University, one of the lead authors of the study.

https://phys.org/news/2023-02-james-webb-space-telescope-captures.html

A new ring system discovered in our solar system

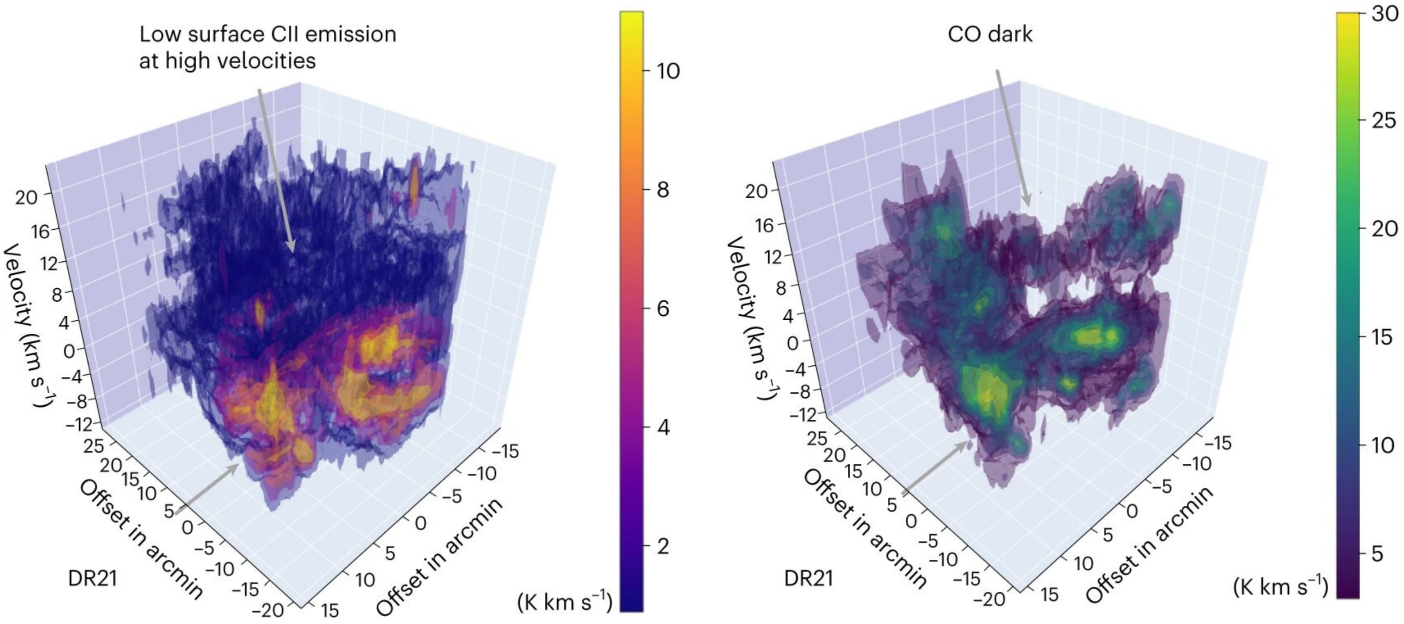


Artist's impression of Quaoar's rings. Credit: Paris Observatory

Scientists have discovered a new ring system around a dwarf planet on the edge of the solar system. The ring system orbits much further out than is typical for other ring systems, calling into question current theories of how ring systems are formed. The ring system is around a dwarf planet, named Quaoar, which is approximately half the size of Pluto and orbits the sun beyond Neptune. The discovery was made by an international team of astronomers using HiPERCAM—an extremely sensitive high-speed camera developed by scientists at the University of Sheffield which is mounted on the world's largest optical telescope, the 10.4 meter diameter Gran Telescopio Canarias (GTC) on La Palma. The rings are too small and faint to see directly in an image. Instead, the researchers made their discovery by observing an occultation, when the light from a background star was blocked by Quaoar as it orbits the sun. The event lasted less than a minute, but was unexpectedly preceded and followed by two dips in light, indicative of a ring system around Quaoar.

https://phys.org/news/2023-02-solar.html

Scientists observe high-speed star formation



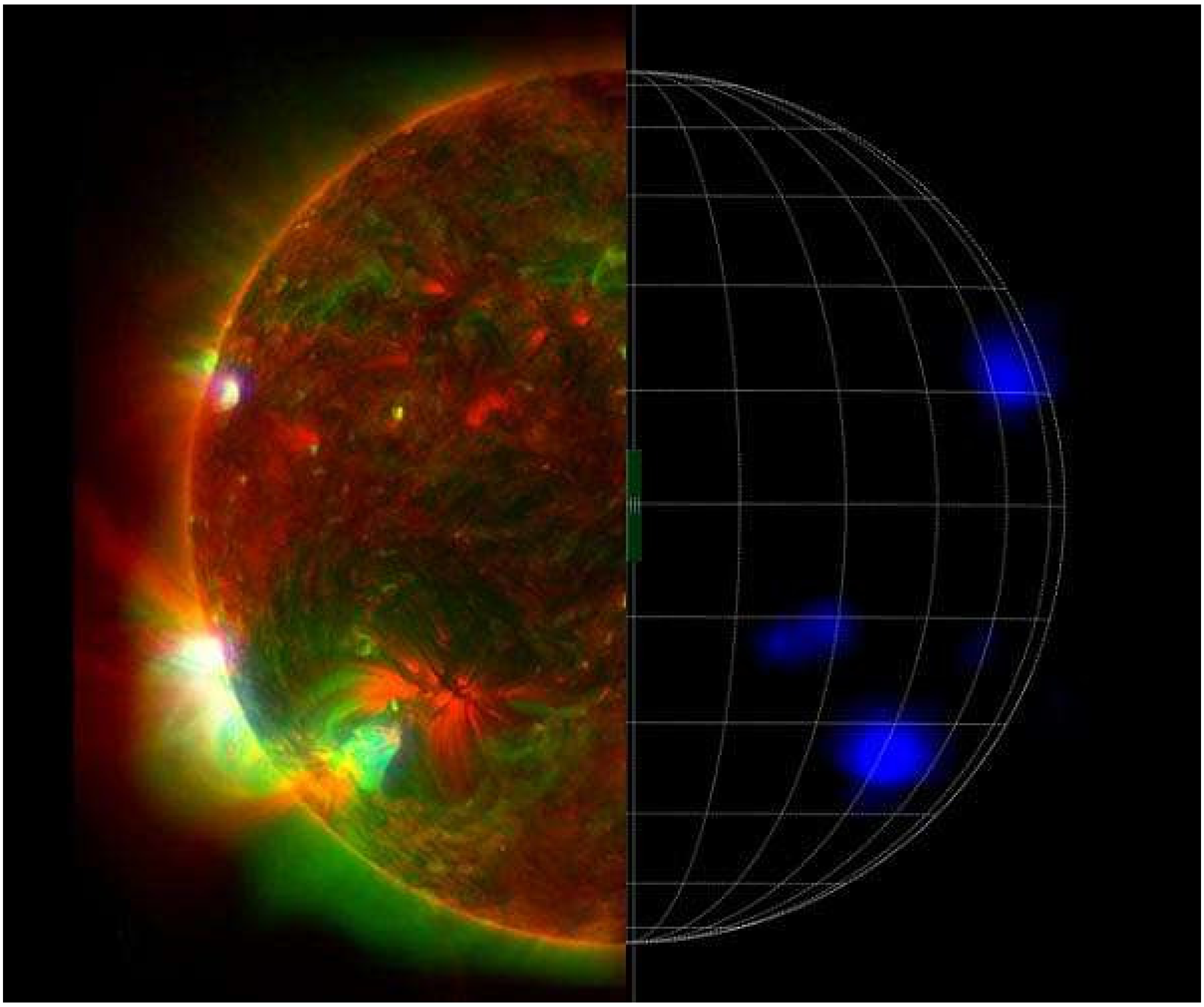
3D iso-surface rendering of position–velocity cuts for [CII] and CO 1 → 0 emission over the entire area observed in [CII]. The x and y axes are offsets in arcmin from the central map position; the z axis is velocity in km s^{-1}. The emission starts at the 5σ level for both tracers. The bright star-forming cloud DR21 and other dense molecular clouds are embedded in a large-scale cloud structure only visible in [CII] (dark blue). Credit: Nature Astronomy (2023). DOI: 10.1038/s41550-023-01901-5

Gas clouds in the Cygnus X Region, a region where stars form, are composed of a dense core of molecular hydrogen (H_2) and an atomic shell. These ensembles of clouds interact with each other dynamically in order to quickly form new stars. That is the result of observations conducted by an international team led by scientists at the University of Cologne's Institute of Astrophysics and at the University of Maryland.

Until now, it was unclear how this process precisely unfolds. The Cygnus X region is a vast luminous cloud of gas and dust approximately 5,000 light years from Earth. Using observations of spectral lines of ionized carbon (CII), the scientists showed that the clouds have formed there over several million years, which is a fast process by astronomical standards.

https://phys.org/news/2023-02-scientists-high-speed-star-formation.html

NASA's NuSTAR reveals hidden light shows on the Sun



Wavelengths of light from three space observatories are overlapped to provide a unique view of the Sun in the image at left. The high-energy X-ray light detected by one of those observatories, NASA's NuSTAR, is seen isolated at right; a grid was added to indicate the Sun's surface.

In the composite image above (left), NuSTAR data is represented as blue and is overlaid with observations by the X-ray Telescope (XRT) on the Japanese Aerospace Exploration Agency's Hinode mission, represented as green, and the Atmospheric Imaging Assembly (AIA) on NASA's Solar Dynamics Observatory (SDO), represented as red. NuSTAR's relatively small field of view means it can't see the entire Sun from its position in Earth orbit, so the observatory's view of the Sun is actually a mosaic of 25 images, taken in June 2022.NuSTAR's view could help scientists solve one of the biggest mysteries about our nearest star: why the Sun's outer atmosphere, called the corona, reaches more than a million degrees - at least 100 times hotter than its surface.The source of the corona's heat could be small eruptions in the Sun's atmosphere called nanoflares. Flares are large outbursts of heat, light, and particles visible to a wide range of solar observatories. Nanoflares are much smaller events, but both types produce material even hotter than the average temperature of the corona

https://www.spacedaily.com/reports/NASAs_NuSTAR_reveals_hidden_light_shows_on_the_Sun_999.html

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