"The Southern Cross"

The Hermanus Astronomy Centre Newsletter

JANUARY 2024

Please note that all our regular meetings are scheduled for **TUESDAYS** commencing at **18.00 (6 pm)** unless otherwise advised. The day and date may change from time to time according to the current Hermanus load shedding status and/or according to venue availability for a physical meeting; such changes will be notified via e-mail and on our website.

MONTHLY MEETINGS

Monthly Meetings are held on the **Third Tuesday** of each month.

No Monthly Meeting was held in December.

Our last meeting was held on **November 21st**. **Prof Martin Snow**, of SANSA Hermanus, presented ***"the Enigma of Betelgeuse"***.

In case you missed it, the YouTube link is still available

https://www.youtube.com/watch?v=VVxz9ptUJBg

The next Monthly Meeting is scheduled for **Tuesday January 16th 2024** and will again be hybrid (physical and virtual), taking place at **Onrus Manor** clubhouse as well as on **Zoom**. Your physical attendance will enable you to meet the presenter in person and to socialize with other centre members. We shall be commencing sharply at **18.00** (**6 pm**) in order to terminate by 19.00 at the latest.

Dr Jenny Morris will speak on ***"Southern Cross: Wobbly Earth"***

Embark on a captivating journey with **Jenny Morris** as she unveils the enchanting narrative behind the Southern Cross, a celestial marvel that has fascinated cultures throughout history. This celestial masterpiece is more than just a constellation; it holds the secrets of an earthly wobble and a starry icon.

SPECIAL INTEREST GROUP ACTIVITIES

Cosmology

These meetings are scheduled for the **First Tuesday** of each month, commencing at 18.00 (6 pm) with no meeting in January.

On **Tuesday December 5th**, in episode 15 of "THE ENTIRE HISTORY OF THE UNIVERSE", we watched– ***"What Was The First Black Hole?"***

In case you missed it, herewith the link -

https://www.youtube.com/watch?v=SedW4SdXNHU&list=PLROBLlvnR7BEF9b1NOvRf_zhboibmywJb&index=14

The next (and penultimate) episode of the "THE ENTIRE HISTORY OF THE UNIVERSE" series is number 16 ***"Where Are All The Hidden Dimensions?"*** - scheduled for **Tuesday February 6th.** After which the last episode in March completes the series.

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

Astrophotography

This SIG is no longer scheduled but can be arranged as requested by group members.

For further information, contact Deon Krige: krige.deon44@outlook.com and please keep an eye on our website calendar and our e-mail notices and invites.

Study Group

Scheduled for the **Last Tuesday** of each month.

The next Study Group meeting is scheduled for Tuesday January 30th.

For further information regarding Study Group, please contact Peter Harvey

petermh@hermanus.co.za

Observing

This section includes recommended dates for **Stargazing**, **Moonwatch**, **Meteors**, **Solar observation** and whatever else deserves a close look.

For quick reference:

Optimal dates for **JANUARY 2024**:

Stargazing – evening observation window **January 1st to 14th** (*Skynotes* page 2 for more detail).

Moonwatch – a few days either side of **First Quarter** (**January 18th**) (*Skynotes* page 2 for more detail).

Eclipses – **None observable in southern Africa**.

The Sun - **The Sun and Auroral Activity**: Daily solar activity and predictions for auroral activity can be found at the following website:

https://www.spaceweatherlive.com/en/solar-activity.html

Meteors - **no significant meteor showers are predicted for January.**

Future Trips

No outings are planned at present.

Website

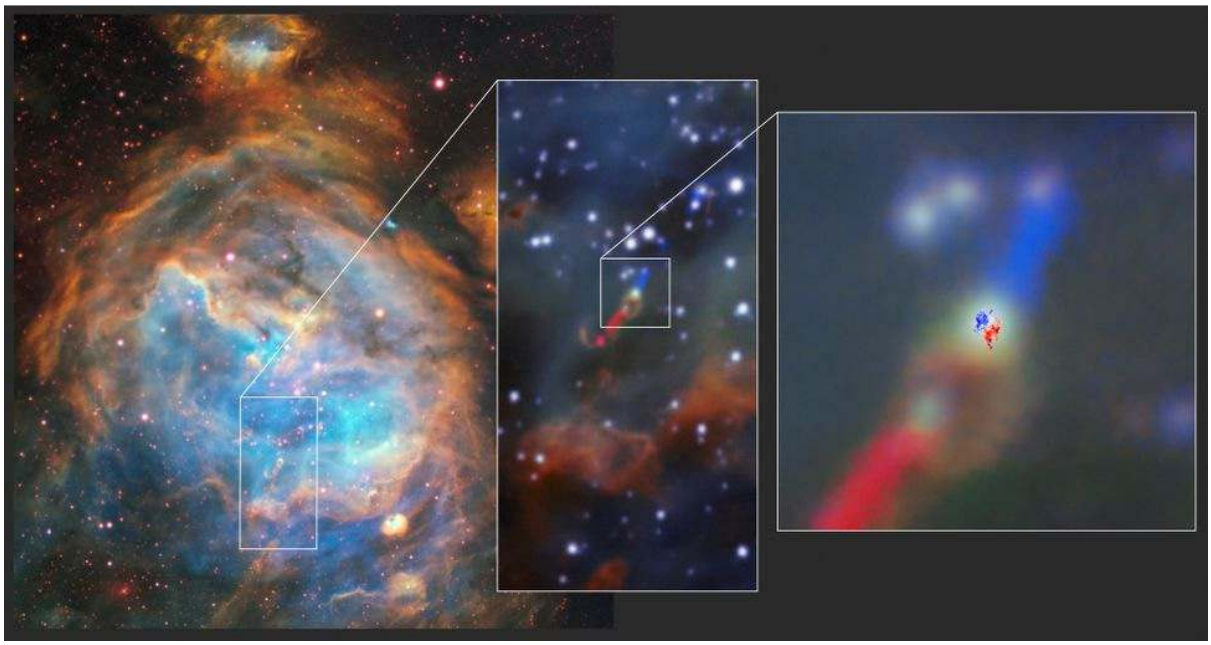
Please check our website calendar for HAC scheduled events:
https://www.hermanusastronomy.co.za

ASTRONOMY NEWS: December 2023

(Compiled By Pieter Kotzé)

Scientists just found a planet-forming disc beyond our Milky Way for the 1st time

Astronomers have discovered the first example of a swirling disk of material feeding a young star located in a galaxy outside the Milky Way. The disk is near-identical to those found around infant stars in the Milky Way and suggests that stars and planets form in other galaxies just as they do in our own.



Observations from the Multi Unit Spectroscopic Explorer (MUSE) on the VLT, left, show the parent cloud LHA 120-N 180B in which this system, dubbed HH 1177, was first observed. The image at the center shows the jets that accompany it. The top part of the jet is aimed slightly towards us and thus blueshifted; the bottom one is receding from us and thus redshifted. Observations from ALMA, right, then revealed the rotating disc around the star, similarly with sides moving towards and away from us. (Image credit: ESO/ALMA (ESO/NAOJ/NRAO)/A. McLeod et al.)

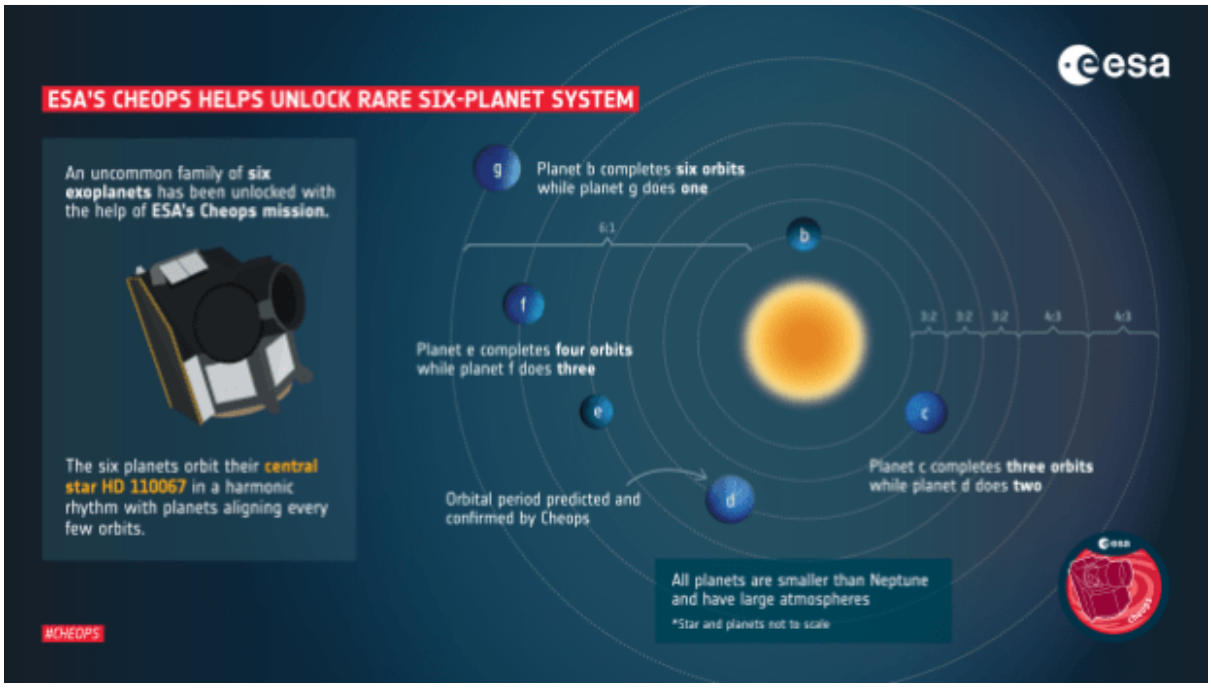
The young star in question is located in the Large Magellanic Cloud — a neighbouring galaxy to the Milky Way located 160 000 light-years away — and its system, designated HH 1177, is embedded in a massive cloud of gas. The team behind this discovery observed the system with the Atacama Large Millimetre/submillimetre Array (ALMA), the largest astronomical project on Earth consisting of 66 antennas in Northern Chile that make up a single radio telescope.

https://www.space.com/planet-forming-disk-young-star-1st-outside-milky-way-galaxy

https://www.spacedaily.com/reports/First_extragalactic_exoplanet_disc_spotted_outside_of_the_Milky_Way_999.html

Astronomers find six planets orbiting in resonance

A newly discovered system of six planets circling a nearby Sun-like star may be the key to unlocking how planetary systems form. All between the size of Earth and Neptune, the worlds are orbiting in a so-called resonant chain — a configuration that it's relatively rare to observe in nature, making the system a valuable find that offers a window into a uniquely "gentle" history. The planets' path to discovery spawned from an initial detection in 2020 by NASA's Transiting Exoplanet Survey Satellite (TESS), which searches for dips in brightness as planets cross in front of their parent star. At that time, based on the dips, researchers were able to confirm one planet and posit a second possible world. But TESS only observes a given patch of sky for about two months before moving on; it doesn't return for two years. TESS finally observed the star again in 2022, yielding more transits. This revealed a sure second planet, but there were still more transits than could be explained by two worlds.



Credit: ESA

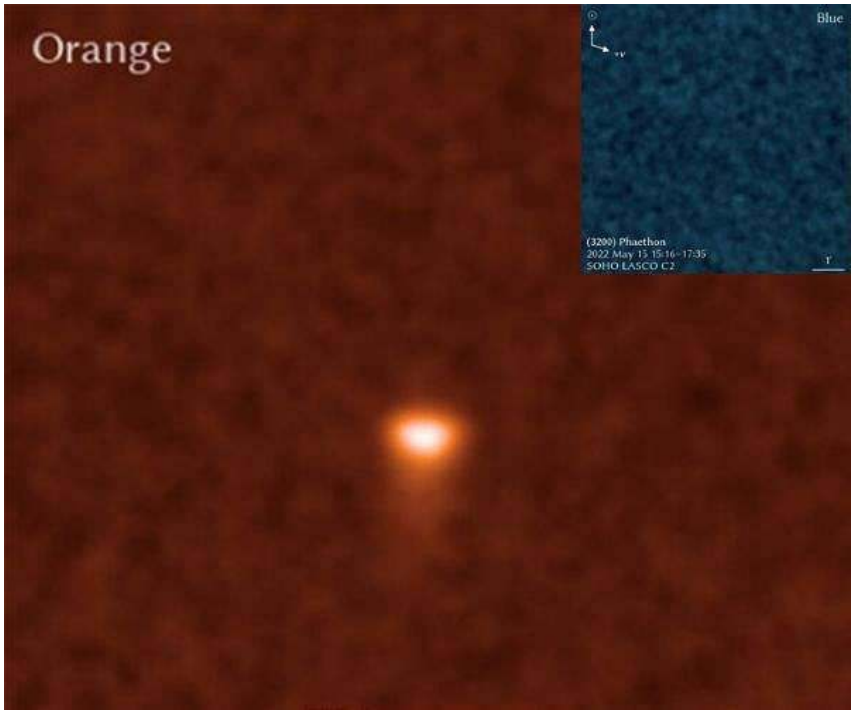
The planets circle HD 110067, a star similar to our Sun, with roughly 80 percent its size and mass. It is located in the constellation Coma Berenices, now visible in the early-morning sky in the east above Venus (in Virgo) in the hours before sunrise. Just 100 light-years away, HD 110067 has an apparent magnitude of 8.4. That makes it the brightest star now known to host four or more planets, outshining the famous red dwarf TRAPPIST-1 by some 10 000 times at optical wavelengths.

https://www.astronomy.com/science/astronomers-find-six-planets-orbiting-in-resonance/

Finnish team of researchers found out the composition of asteroid Phaethon

The asteroid that causes the Geminid shooting star swarm has also puzzled researchers with its comet-like tail. The infrared spectrum of rare meteorites helped to determine the composition of the asteroid. Asteroid Phaethon, which is five kilometres in diameter, has been puzzling researchers for a long time. A comet-like tail is visible for a few days when the asteroid passes closest to the Sun during its orbit.

However, the tails of comets are usually formed by vaporizing ice and carbon dioxide, which cannot explain this tail. The tail should be visible already at Jupiter's distance from the Sun.



In a recent study published in the journal Nature Astronomy by researchers from the University of Helsinki, the infrared spectrum of Phaethon previously measured by NASA's Spitzer space telescope is re-analyzed and compared to infrared spectra of meteorites measured in laboratories.

When the surface layer of an asteroid breaks up, the detached gravel and dust continue to travel in the same orbit and give birth to a cluster of shooting stars when it encounters the Earth. Phaethon causes the Geminid meteor shower, which also appears in the skies of Finland every year around mid-December. At least according to the prevailing hypothesis because that's when the Earth crosses the asteroid's path. Until now, theories about what happens on Phaethon's surface near the Sun have remained purely hypothetical. What comes off the asteroid? How? The answer to the riddle was found by understanding the composition of Phaethon. In a recent study published in the journal Nature Astronomy by researchers from the University of Helsinki, the infrared spectrum of Phaethon previously measured by NASA's Spitzer space telescope is re-analyzed and compared to infrared spectra of meteorites

measured in laboratories. The researchers found that Phaethon's spectrum corresponds exactly to a certain type of meteorite, the so-called CY carbonaceous chondrite. It is a very rare type of meteorite, of which only six specimens are known.

https://www.spacedaily.com/reports/Finnish_team_of_researchers_found_out_the_composition_of_asteroid_Phaethon_999.html

The Geminids are still a mystery:

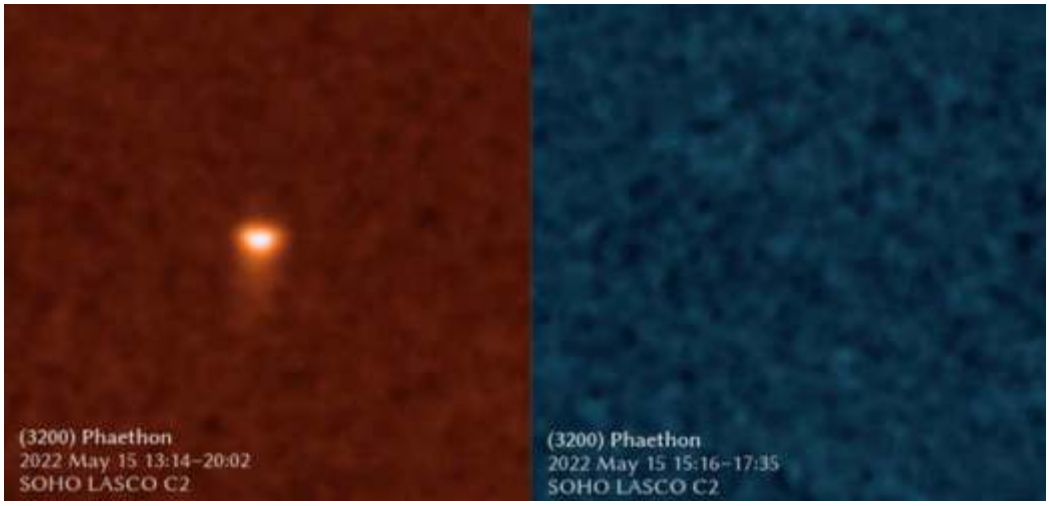
Every great mystery novel has an unexpected twist. Apparently the same is true of meteor showers. A paper published in the Planetary Science Journal reports a surprising new twist in the mystery of the Geminids, a strong annual meteor shower that has puzzled astronomers for more than a century.

"Our work has upended years of belief about 3200 Phaethon, the source of the Geminids," says co-author Karl Battams of the Naval Research Lab. "It's not what we thought it was."

Geminids over the Czech Republic in 2018. Credit: Petr Horálek

The Geminids peak every year in mid-December, scattering hundreds of bright meteors across northern winter skies. Numerically it is the best meteor shower of the year. As meteor showers go, Geminids are newcomers. They first appeared in the mid-1800s when an unknown stream of debris crossed Earth's orbit. Surprised, 19th century astronomers scoured the sky for the parent comet, but they found nothing. The search would continue for another 100 years. Enter NASA. In 1983, the space agency's Infrared Astronomical Satellite (IRAS) found an object now called "3200 Phaethon." It was definitely the source of the Geminids. The orbit of 3200 Phaethon was such a close match to that of the Geminid debris stream, no other conclusion was possible. Yet here was a puzzler: 3200 Phaethon appeared to be a rocky asteroid. Asteroids are not supposed to make meteor showers. Unlike comets, they don't have tails and they don't spew meteoroids. Yet 3200 Phaethon was different. In 2009 and 2012, NASA's STEREO spacecraft caught 3200 Phaethon sprouting a tail when it passed close to the sun. Apparently, intense solar radiation was blistering meteoroids off 3200 Phaethon's rocky surface. Astronomers dubbed it a "rock comet," and the mystery was solved. Or was it?

Astronomer Qicheng Zhang, lead author of the new paper, was never convinced. For one thing, the Geminid debris stream is massive (1013 kg), while the tail of 3200 Phaethon is puny, providing less than 1% of the mass required to explain the Geminids. "The tail we see today could never supply enough dust to supply the Geminid meteor shower," says Zhang. Zhang, Battams, and colleagues decided to take a closer look. Using coronagraphs on the Solar and Heliospheric Observatory (SOHO), they monitored Phaethon as it passed by the sun in 2022. Color filters on the spacecraft revealed no dust or rock. Instead, Phaethon's tail is made of sodium gas.



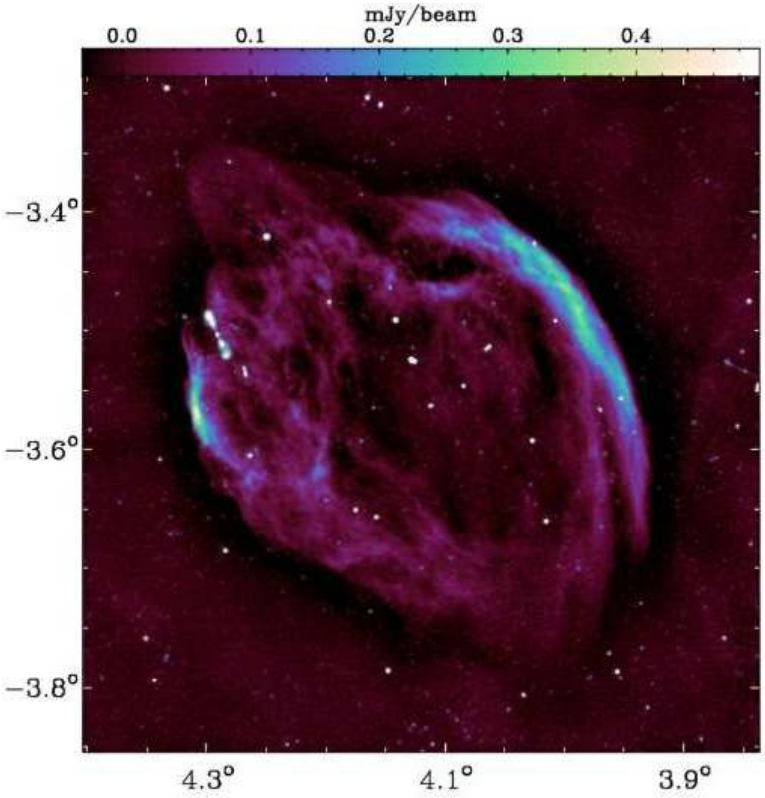
Above: SOHO's orange-filtered view, which can detect sodium, shows asteroid 3200 Phaethon glowing brightly.

And therein lies the twist. Meteor showers are made of meteoroids, not gas. Suddenly, the Geminids are a mystery again. "We're back to square one," says Zhang. "Where do the Geminids come from?" 3200 Phaethon is still the main suspect. At least one study suggests that Geminid meteoroids are 1 000 to 10 000 years old. Perhaps something hit the asteroid millennia ago. Phaethon's rapid rotation makes it susceptible to sudden episodes of mass loss, so even a relatively small impact could create the necessary meteoroids. The best way to test this idea is to look at the surface of Phaethon with a space probe. Japan plans to do just that. JAXA is building a spacecraft called DESTINY+ to fly by 3200 Phaethon for a closer look. Launch is scheduled for 2025.

Until then, the Geminids remain a beautiful mystery.

Astronomers inspect supernova remnants with MeerKAT

Using the MeerKAT radio telescope, astronomers from the National Radio Astronomy Observatory (NRAO) in Charlottesville, Virginia, and elsewhere have investigated a batch of 36 high latitude supernova remnants. Results of the observations campaign, published Nov. 20 on the pre-print server *arXiv*, deliver important insights into the properties of these remnants. Supernova remnants (SNRs) are expansive and diffuse formations formed as a consequence of a supernova's explosion. They harbor ejected material expanding from the explosion and other interstellar material that has been swept up by the passage of the shockwave from the exploded star.



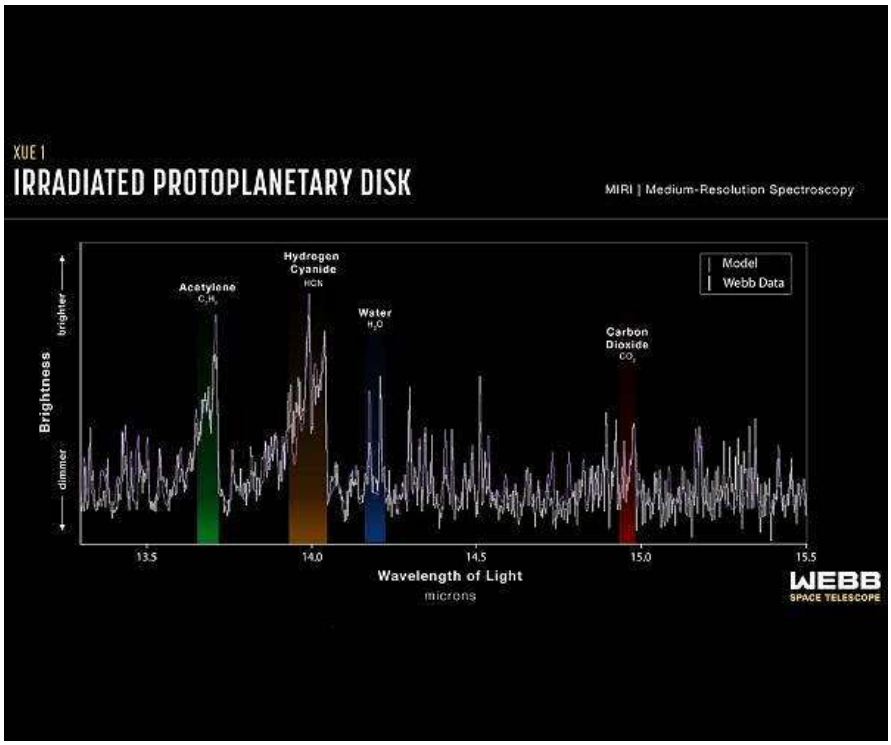
Total power MeerKAT image of one of the investigated SNRs, designated G4.2−3.5, at 1,335 MHz in Galactic coordinates. Credit: arXiv (2023). DOI: 10.48550/arxiv.2311.12140

Studies of supernova remnants are important for astronomers, given that they play a crucial role in the evolution of galaxies, dispersing the heavy elements made in the supernova explosion and providing the energy needed for heating up the interstellar medium (ISM). SNRs are also believed to be responsible for the acceleration of galactic cosmic rays. Recently, a team of astronomers led by NRAO's William Cotton chose 36 poorly studied Galactic SNRs to observe with MeerKAT, with the main aim of shedding more light on their properties. https://phys.org/news/2023-11-astronomers-supernova-remnants-meerkat.html

Webb study reveals rocky planets can form in extreme environments

An international team of astronomers have used the NASA/ESA/CSA James Webb Space Telescope to provide the first observation of water and other molecules in the inner, rocky-planet-forming regions of a disc in one of the most extreme environments in our galaxy.

These results suggest that the conditions for rocky-planet formation, typically found in discs in regions where low-mass stars are formed, can also occur in regions where massive stars are formed and possibly in a broader range of environments. These are the first results from the eXtreme UV Environments (XUE) James Webb Space Telescope programme that focuses on the characterisation of planet-forming discs in regions where massive stars are formed. These regions are likely representative of the environment in which most planetary systems formed. Understanding the impact of the environment on planet formation is important for scientists to gain insights into the diversity of the observed exoplanet populations. The XUE programme targets a total of 15 discs in three areas of the Lobster Nebula (also known as NGC 6357), a large emission nebula roughly 5500 light-years away from Earth in the constellation Scorpius. The Lobster Nebula is one of the youngest and closest star formation regions hosting some of the most massive stars in our galaxy. Massive stars are hotter, and therefore emit more ultraviolet (UV) radiation. This can disperse the gas in the disc, making their expected lifetime as short as a million years. Thanks to Webb, astronomers can now study the effect of UV radiation on the inner rocky-planet-forming regions of protoplanetary discs around stars like our Sun.



Graphic titled "XUE 1 Irradiated Protoplanetary Disc, MIRI Medium - Resolution Spectroscopy" shows a graph of brightness versus wavelength from 13.3 to 15.5 microns, with acetylene, hydrogen cyanide, water, and carbon dioxide peaks highlighted. NASA, ESA, CSA, J. Olmsted (STScI), M. C Ramirez-Tannus (MPIA)

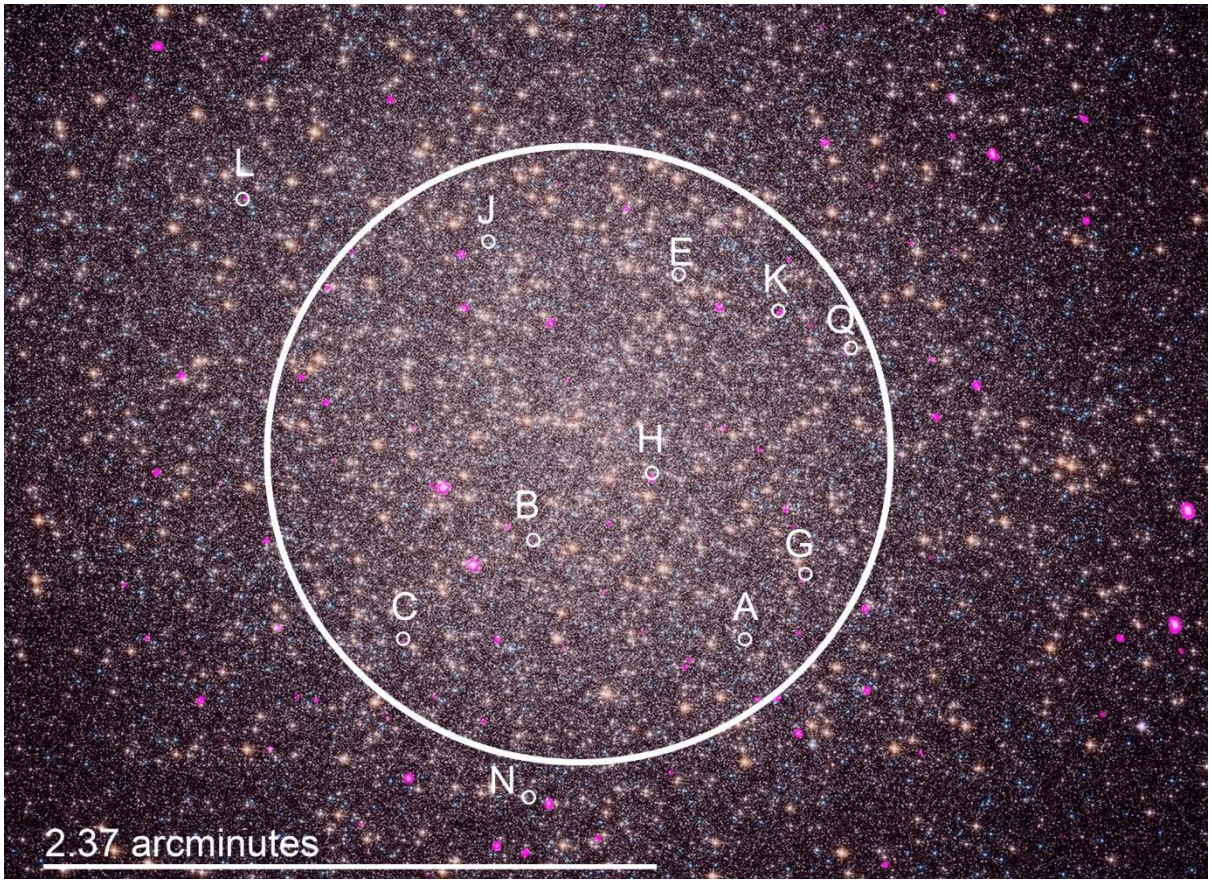
https://www.spacedaily.com/reports/Webb_study_reveals_rocky_planets_can_form_in_extreme_environments_999.html

https://www.astronomy.com/science/jwst-finds-earth-like-planets-can-form-in-harsh-galactic-environments/

Chandra Catches Spider Pulsars Destroying Nearby Stars

A group of dead stars known as "spider pulsars" are obliterating companion stars within their reach. Data from NASA's Chandra X-ray Observatory of the globular cluster Omega Centauri is helping astronomers understand how these spider pulsars prey on their stellar companions.

A pulsar is the spinning dense core that remains after a massive star collapses into itself to form a neutron star. Rapidly rotating neutron stars can produce beams of radiation. Like a rotating lighthouse beam, the radiation can be observed as a powerful, pulsing source of radiation, or pulsar. Some pulsars spin around dozens to hundreds of times per second, and these are known as millisecond pulsars.



A close-up image of Omega Centauri, in X-ray & optical light, shows the locations of some of the spider pulsars. Spider pulsars are a special class of millisecond pulsars, and get their name for the damage they inflict on small companion stars in orbit around them.
X-ray: NASA/CXC/SAO; Optical: NASA/ESA/STScI/AURA; Image Processing: NASA/CXC/SAO/N. Wolk

Spider pulsars are a special class of millisecond pulsars, and get their name for the damage they inflict on small companion stars in orbit around them. Through winds of energetic particles streaming out from the spider pulsars, the outer layers of the pulsar's companion stars are methodically stripped away.https://www.nasa.gov/image-article/chandra-catches-spider-pulsars-destroying-nearby-stars/

Hundreds of Dead Stars Discovered Pulsing Gamma Rays in Massive Sky Survey

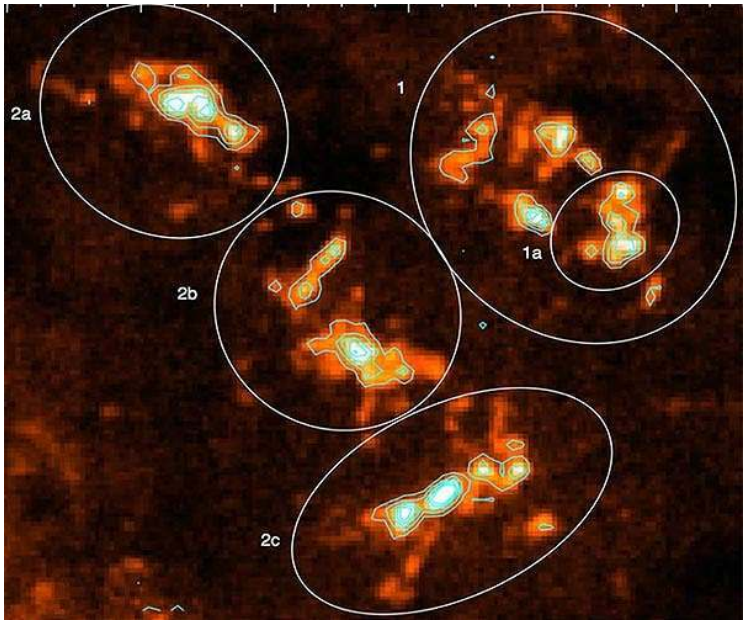
A space telescope scanning the skies for gamma rays has added hundreds of new powerful dead stars to its catalog. The addition of 294 previously unidentified stars means that the Fermi catalog of gamma-ray pulsars now contains more than 340 objects – a significant step up since the Fermi Large Area Telescope started observing in 2008, when there were fewer than 10 known such pulsars. The newly released Third Fermi Large Area Telescope Catalog of Gamma-Ray Pulsars is a real treasure trove of information that will help us understand these enigmatic objects. "Pulsars touch on a wide range of astrophysics research, from cosmic

rays and stellar evolution to the search for gravitational waves and dark matter," says astrophysicist David Smith of the Bordeaux Astrophysics Laboratory, which is part of the French National Centre for Scientific Research (CNRS). "This new catalog compiles full information on all known gamma-ray pulsars in an effort to promote new avenues of exploration."

According to the new catalog, around 10 percent of known pulsars are now gamma-ray emitters. Although what we are able to detect may be subject to some selection bias – the limitations of our technology, for example – this is a significant enough sample to tease out what makes a pulsar a gamma emitter, compared to the radio population. And there are other uses for the new population, too. Pulsars are often extremely precise in their timings, especially those with rotation rates on millisecond scales, 144 of which are included in the catalog. This means that they can be used for applications like space navigation, which is important as more missions take to the stars.

https://www.sciencealert.com/hundreds-of-dead-stars-discovered-pulsing-gamma-rays-in-massive-sky-survey

Astronomers determine the age of three mysterious baby stars at the heart of the Milky Way



Through analysis of high-resolution data from a ten-metre telescope in Hawaii, researchers at Lund University in Sweden have succeeded in generating new knowledge about three stars at the very heart of the Milky Way. The stars proved to be unusually young with a puzzling chemical composition that surprised the researchers. The study, which has been published in The Astrophysical Journal Letters, examined a group of stars located in the nuclear star cluster that makes up the heart of the galaxy. It concerns three stars that are difficult to study because they are extremely far away from our solar system, and hidden behind enormous clouds of dust and gas that block out light. The fact that the area is also full of stars makes it very complicated to discern individual stars. In a previous study, the researchers put forward a hypothesis that these specific stars in the middle of the Milky Way could be unusually young. "We can now confirm this. In our study we have been able to date three of these stars as relatively young, at least as far as astronomers are concerned, with ages of 100 million to about 1 billion years. This can be compared with the sun, which is 4.6 billion years old," says Rebecca Forsberg, researcher in astronomy at Lund University.

https://www.spacedaily.com/reports/Astronomers_determine_the_age_of_three_mysterious_baby_stars_at_the_heart_of_the_Milky_Way_999.html

James Webb telescope discovers dark secret of 'The Brick,' a gas cloud flipping assumptions about how stars are born

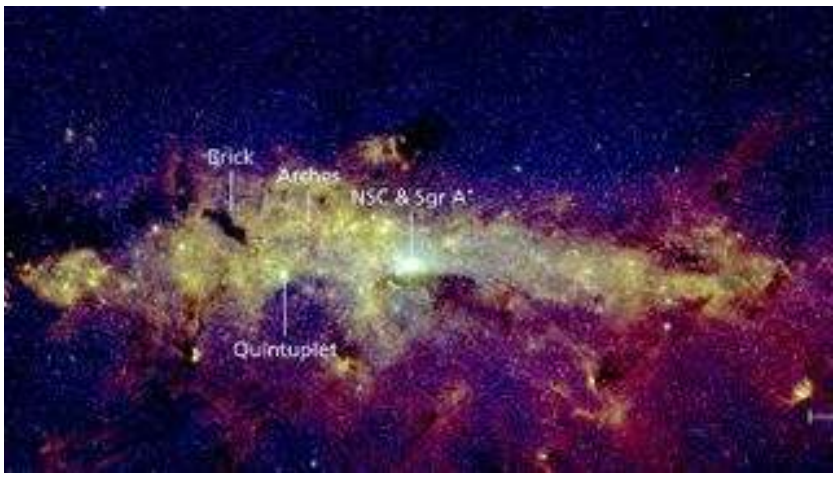
An image of the Milky Way's central region, showing our supermassive black hole (Sgr A), The Brick, and other key structures.(Image credit: Henshaw / MPIA)*

Astronomers using the James Webb Space Telescope (JWST) have peered deep into "The Brick," a dark, dense region near the heart of the Milky Way, revealing what appears to be a paradox: It's simultaneously warm and icy. The discovery could shake up our theories of star formation.

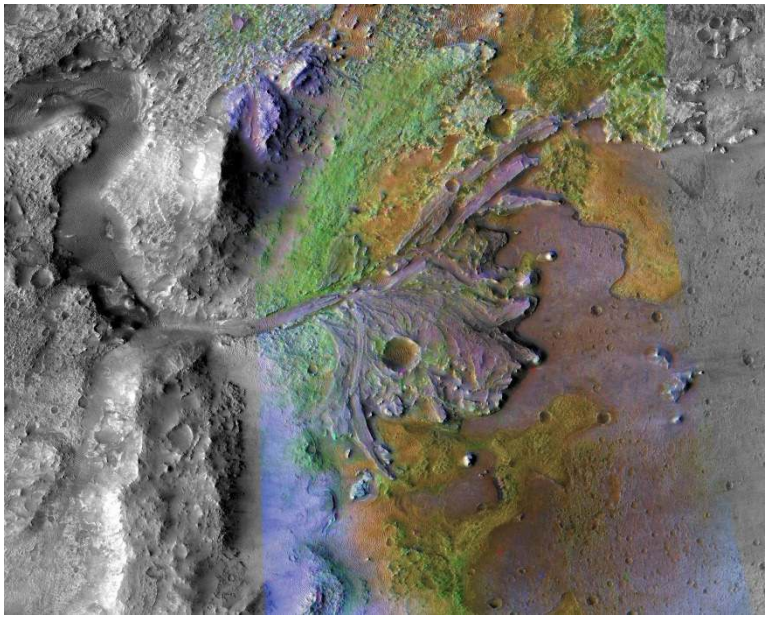
The Brick, officially known as G0.253+0.016 is a rectangular shaped, turbulent, near-opaque cloud of gas with a mass equivalent to around 100 000 suns in an estimated length of around 50 light-years and width of around 20 light-years, making it incredibly dense. Part of a complex of gas called the Central Molecular Zone, which is 1 000 to 2 000 light-years wide, the Brick has long fascinated astronomers because, despite being replete with cool, dense gas — the building blocks of stars — stellar birth is unexpectedly low in the region.

Now, the infrared observing power of JWST has shown that The Brick is rich in frozen carbon monoxide, meaning that ice at the heart of the Milky Way is more prevalent than astronomers previously thought. The presence of carbon monoxide ice in The Brick should make it the ideal cool region to form new stars, yet it isn't engaged in intense star birth. Ginsburg and colleagues found that, despite this prevalent ice, the gas in the Brick is warmer than expected The observations challenge assumptions of how much carbon monoxide is located at the galactic center. And because this molecule is present as dusty ice flecks, it shows a critical measure for astronomers — the ratio of gas to dust — is lower than expected, too.https://www.livescience.com/space/astronomy/james-webb-telescope-discovers-dark-secret-of-the-brick-a-gas-cloud-flipping-assumptions-about-how-stars-are-born

NASA's Perseverance Rover Deciphers Ancient History of Martian Lake



Marking its 1 000th Martian day on the Red Planet, NASA's Perseverance rover recently completed its exploration of the ancient river delta that holds evidence of a lake that filled Jezero Crater billions of years ago. The six-wheeled scientist has to date collected a total of 23 samples, revealing the geologic history of this region of Mars in the process.

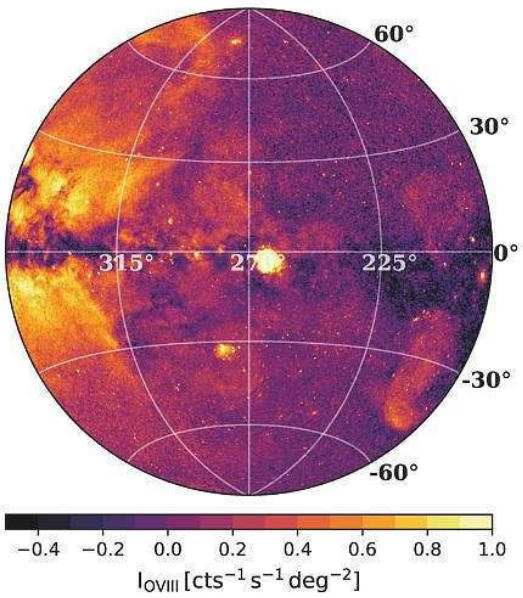


This image of Mars' Jezero Crater is overlaid with mineral data detected from orbit. The green colour represents carbonates – minerals that form in watery environments with conditions that might be favourable for preserving signs of ancient life. NASA's Perseverance is currently exploring the green area above Jezero's fan (centre).NASA/JPL-Caltech/MSSS/JHU-APL

One sample called "Lefroy Bay" contains a large quantity of fine-grained silica, a material known to preserve ancient fossils on Earth. Another, "Otis Peak," holds a significant amount of phosphate, which is often associated with life as we know it. Both of these samples are also rich in carbonate, which can preserve a record of the environmental conditions from when the rock was formed. The discoveries were shared Tuesday, Dec. 12, at the American Geophysical Union fall meeting in San Francisco."We picked Jezero Crater as a landing site because orbital imagery showed a delta – clear evidence that a large lake once filled the crater. A lake is a potentially habitable environment, and delta rocks are a great environment for entombing signs of ancient life as fossils in the geologic record," said Perseverance's project scientist, Ken Farley of Caltech. "After thorough exploration, we've pieced together the crater's geologic history, charting its lake and river phase from beginning to end."

https://www.nasa.gov/missions/mars-2020-perseverance/perseverance-rover/nasas-perseverance-rover-deciphers-ancient-history-of-martian-lake/

eROSITA finds hot gas all around the Milky Way - closer than expected



This image shows the entire Western Galactic hemisphere observed by the eROSITA telescope in soft X-rays. In particular, it traces the emission from highly ionised oxygen, thus revealing the distribution of the hot gas all around the Milky Way. J. Sanders, MPE/eROSITA

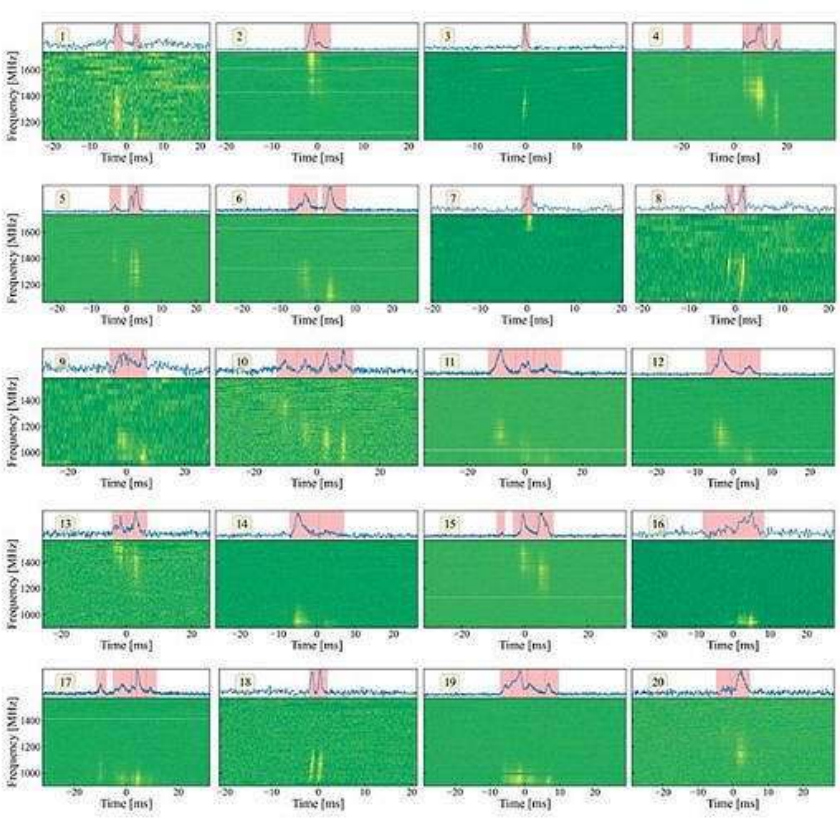
A new all-sky map by the eROSITA telescope reveals X-rays emitted by million-degree hot plasma in and around the Milky Way. Analysing this data, the team at the Max Planck Institute for Extraterrestrial Physics found that

the very hot, ionized gas shows a disk-like distribution similar to the stellar disk, possibly embedded in a much larger spherical halo. This discovery sheds light on the shape and size of a large portion of the Milky Way circumgalactic medium, providing a large reservoir of gas to fuel future star formation.

https://www.spacedaily.com/reports/eROSITA_finds_hot_gas_all_around_the_Milky_Way__closer_than_expected_999.html

Unlocking the Secrets of Fast Radio Bursts: Scientists Find More Pieces to the Puzzle of Mysterious Space Signals

A team of SETI Institute scientists have unveiled new insights into a cosmic mystery known as Fast Radio Bursts (FRBs). The discovery and detailed observation of the repeating FRB 20220912A, made at the SETI Institute's upgraded Allen Telescope Array (ATA), shed light on the nature of these space signals. FRBs are brief, intense flashes of radio waves from deep space. While most happen only once, some "repeaters" send out signals more than once, adding to the intrigue of understanding their origin. Over 541 hours of observation, researchers detected 35 FRBs from repeater FRB 20220912A. The observations, made using the ATA, covered a wide radio frequency range and revealed fascinating patterns. All 35 FRBs were found in the lower part of the frequency spectrum, each with its unique energy signature.



Dynamic spectra (or "waterfall" plots) for all the bursts from FRB 20220912A detected using the Allen Telescope Array, the frequency-averaged pulse profiles, and the time-averaged spectra. The red-shaded regions in the time series plots denote the time span of the defined sub-bursts, with red vertical lines demarcating adjacent sub-burst.

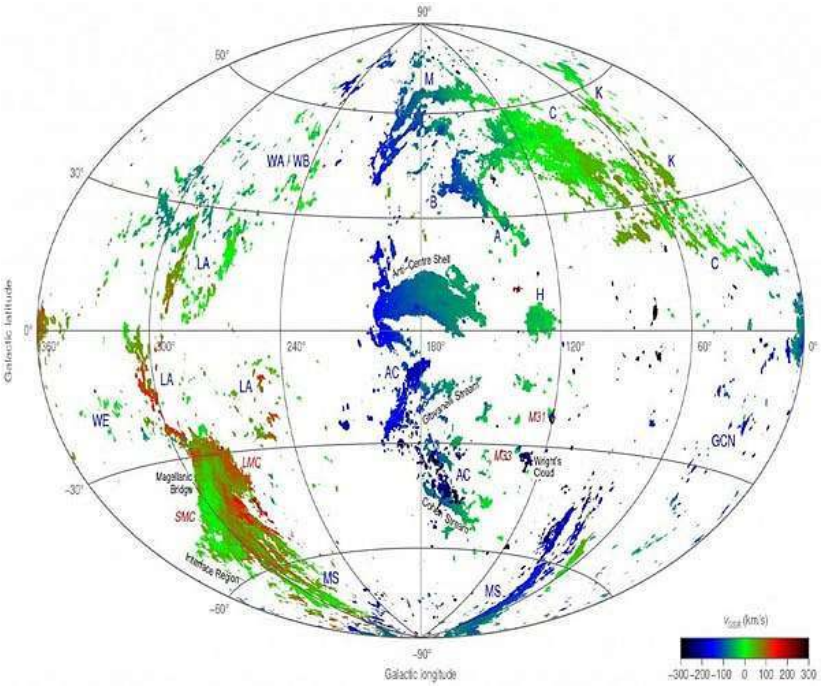
"This work is exciting because it provides both confirmation of known FRB properties and the discovery of some new ones," said the SETI Institute's Dr. Sofia Sheikh, NSF MPS-Ascend Postdoctoral Fellow and lead author. "We're narrowing down the source of FRBs, for example, to extreme objects such as magnetars, but no existing model can explain all of the properties that have been observed so far. It has been wonderful to be part of the first FRB study done with the ATA - this work proves that new telescopes with unique capabilities, like the ATA, can provide a new angle on outstanding mysteries in FRB science."

https://www.spacedaily.com/reports/Unlocking_the_Secrets_of_Fast_Radio_Bursts_Scientists_Find_More_Pieces_to_the_Puzzle_of_Mysterious_Space_Signals_999.html

Chinese scientists build largest-ever neutral hydrogen catalog in deep space

Using the Five-hundred-meter Aperture Spherical Radio Telescope, or the "China Sky Eye," a team of Chinese astronomers built the largest-ever high-quality catalog of neutral hydrogen (HI) sources beyond our Galaxy.Hydrogen, the most abundant element in the universe, is a key component of galaxies. Within disk galaxies, the HI is a significant component of the interstellar medium.The measurement of its abundance and kinematics via the 21-centimeter emission line could potentially address a number of astrophysical issues, such as the possible properties of dark matter, faint unknown galaxies, as well as the cosmic structure and evolution.

The new catalog contained a total of 41,741 HI sources discovered between August 2020 and June 2023, outnumbering similar ones around the world in both quantity and quality.



All-sky map showing radial velocity of neutral hydrogen gas in the Milky Way and Magellanic Clouds (file illustration only).

https://www.spacedaily.com/reports/Chinese_scientists_build_largest_ever_neutral_hydrogen_catalog_in_deep_space_999.html

Hubble telescope reveals a gorgeous, detailed new view of the Veil Nebula

With new processing techniques, NASA's Hubble space telescope has captured the beautiful Veil Nebula in the finest detail ever. (Image credit: NASA/ESA/Hubble/Z. Levay)

NASA's Hubble Space Telescope has snapped a stunning photo of the Veil Nebula in more exquisite detail than ever before.The new image, released by NASA on April 2, was captured using new processing techniques that highlight small details like the nebula's delicate thread and filaments of ionized gas, NASA said in a statement. Observations were taken by Hubble's Wide Field Camera 3 using five different filters. New post-processing methods were used to further enhance emissions from doubly ionized oxygen (seen in the image in blue), ionized hydrogen and ionized nitrogen (seen in red).

https://www.space.com/veil-nebula-amazing-hubble-telescope-2021

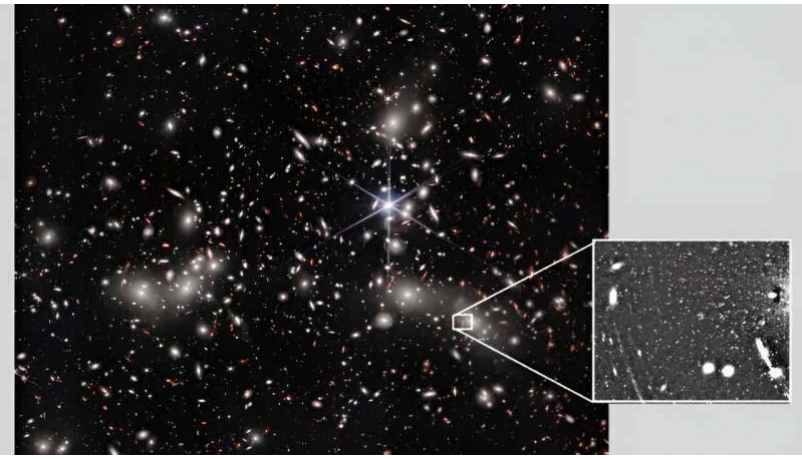
https://www.space.com/veil-nebula-photo

Scientists find record-breaking collection of molecules in 2 extremely ancient galaxies

The NOEMA radio telescope array that detected the molecules in the distant universe.(Image credit: © IRAM/DiVertiCimes)

A treasure trove of molecules has turned up in two galaxies that we see as they were over 12 billion years ago, revealing information about how the ancient realms form stars.One of the distant galaxies, APM 08279+5255, is home to a quasar — an active supermassive black hole at its core swallowing huge amounts of gas — while the other galaxy, NCv1.143, is a more "normal" galaxy. Both, however, are seen to be forming stars at a ferocious rate, hundreds of times more stars than the Milky Way galaxy is currently generating. The two galaxies were targeted by astronomers using NOEMA, the Northern Extended Millimetre Array, in France. NOEMA is able to detect millimeter and submillimeter radio waves. Fascinatingly, the team, led by Chentao Yang of the Chalmers University of Technology in Sweden, detected emissions from a whopping 13 different molecules in these two galaxies. All of these molecules are commonly found in interstellar gas in our Milky Way galaxy, and each provides clues about the environment in which they are found in — an environment we see forming lots of stars. https://www.space.com/deep-space-molecules-massive-star-formation-distant-galaxies

Astronomers look billions of years into the past to study Pandora's Cluster

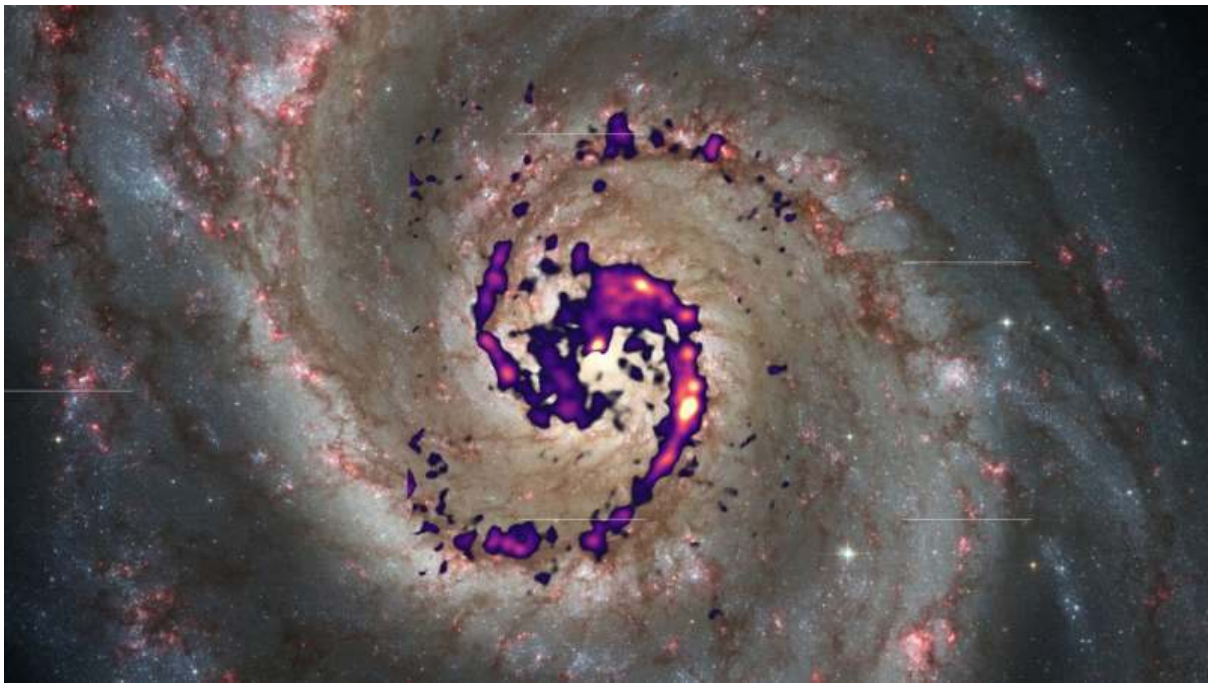


James Webb Space Telescope image of Abell 2744 ("Pandora's Cluster"), a giant cluster of galaxies 3.5 billion light years away. Inset image at right: A magnified portion of the region, showing hundreds of small, point-like objects that are some of the globular star clusters belonging to the Abell 2744 galaxies. Credit: NASA

Two McMaster astronomers have used recent deep imaging data from the James Webb Space Telescope to look 3.5 billion years into the past to study a remote giant cluster of galaxies.

https://phys.org/news/2023-12-astronomers-billions-years-pandora-cluster.html

Research charts stellar birthplaces in the Whirlpool galaxy for the first time



This illustration depicts the distribution of diazenylium molecule radiation (false colors) in the Whirlpool Galaxy, compared with an optical image. The reddish areas in the photograph represent luminous gas nebulae containing hot, massive stars traversing dark zones of gas and dust in the spiral arms. The presence of diazenylium in these dark regions suggests particularly cold and dense gas clouds. Credit: Thomas Müller (HdA/MPIA), S. Stuber et al. (MPIA), NASA, ESA, S. Beckwith (STScI) und das Hubble Heritage Team (STScI/AURA)

An international research team led by the Max Planck Institute for Astronomy (MPIA) and involving the University of Bonn has mapped the cold, dense gas of future star nurseries in one of our neighbouring galaxies with an unprecedented degree of detail. The data will enable the researchers for the first time to mount an in-depth study of the conditions that exist within the gas during the early stages of star formation outside the Milky Way at the scale of individual star-forming regions.

Paradoxically, hot stars begin to form in some of the coldest regions of the universe, specifically in thick clouds of gas and dust that straddle entire galaxies. "To investigate the early phases of star formation, where gas gradually condenses to eventually produce stars, we must first identify these regions," says Sophia Stuber, a doctoral student at the MPIA in Heidelberg and the first author of the research paper.

"For this purpose, we typically measure the radiation emitted by specific molecules that are particularly abundant in these extremely cold and dense zones." Astronomers generally use molecules such as HCN (hydrogen cyanide; also known as prussic acid) and N2H+ (diazenylium) as chemical probes for this purpose. Thanks to the large-scale observation program known as SWAN (Surveying the Whirlpool at Arcseconds with NOEMA), the researchers have now been able to undertake these measurements across a vast area across another galaxy, having previously been restricted to our own Milky Way.

https://phys.org/news/2023-12-stellar-birthplaces-whirlpool-galaxy.html

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