"The Southern Cross"

Hermanus Astronomy Centre Newsletter

FEBRUARY 2023

MONTHLY MEETING

Last meeting on **16th January - Johan Smit –-** *"The Eye as an Observing Instrument"*

Sadly, this presentation failed after about 20 minutes as a result of load shedding in Johan's area.

This presentation is now rescheduled to **Monday 13th February** at 18.30.

Following that is the Annual General Meeting on 20th February

2023 meeting dates: For your diaries – February 20, 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".

Last meeting on **6th February** -The History of the Universe, episode 6 -***What Really is Everything?*** https://www.youtube.com/watch?v=euNr9PozCmg&list=PLROBLlvnR7BEF9b1NOvRf_zhboibmywJb&index=6 - 42:58 minutes

Next: **6th March** - The History of the Universe, episode 7 – ***Why is the Universe Perfect?***

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

9th January - no meeting held.

The next scheduled date, 13th February 2023, has been replaced by *"The Eye as an Observing Instrument"* (see above).

Study Group

(The last Monday of each month)

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

Next up: **27th February** 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 if 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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The "Seasonal Get-together"

Originally and provisionally planned for 15th December, this is now postponed to possibly sometime in February. We shall advise you when this is finalised.

GPAED

The final approvals required from the NLC for the upgrading of the faded Swallow Park sundials has been received. Final orders are being placed so completion of the project should be end February/mid-March at the latest.

Outreach

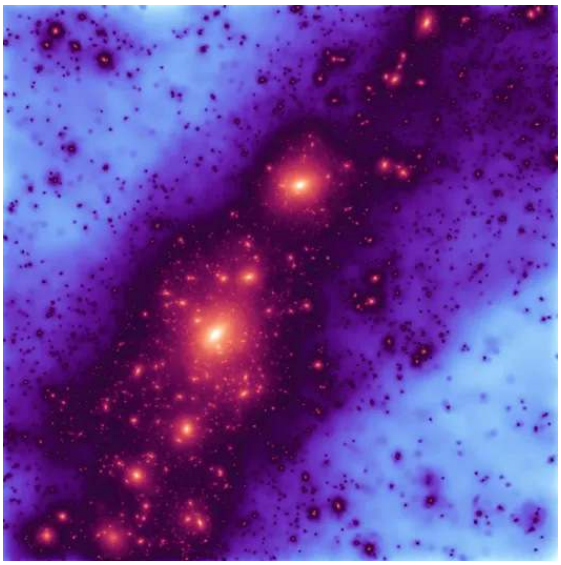
Educational outreach for 2023 has been initiated with Lukhanyo Primary, Mount Pleasant Primêr, Gansbaai Academia and Gansbaai Laerskool. Activities will vary from school to school, but will include Counting Sunspots, Stargazing (March or later), Solar System workshop, Guided Tour of the GPAED and Analemmatic sundials at the schools.

Training of three Tourist Office staff to conduct guided tours of the Solar System Model and the GPAED is being arranged.

ASTRONOMY NEWS for February 2023

(compiled by Pieter Kotzé)

Scientists Solve the Riddle of the Milky Way's Satellite Galaxies



One of the new high-resolution simulations of the dark matter enveloping the Milky Way and its neighbour, the Andromeda galaxy. The new study shows that earlier, failed attempts to find counterparts of the plane of satellites that surrounds the Milky Way in dark matter simulations was due to a lack of resolution. Credit: Till Sawala/Sibelius collaboration

Astronomers say they have solved an outstanding problem that challenged our understanding of how the Universe evolved – the spatial distribution of faint satellite galaxies orbiting the Milky Way. These satellite galaxies exhibit a bizarre alignment – they seem to lie on an enormous thin rotating plane – called the "plane of satellites". Now, new research jointly led by the Universities of Durham, UK, and Helsinki, Finland, has found that the plane of satellites is a cosmological quirk that will dissolve over time in the same way that star constellations also change. Now, new research jointly led by the Universities of Durham, UK, and Helsinki, Finland, has found that the plane of satellites is a cosmological quirk that will dissolve over time in the same way that star constellations also change. The researchers say this removes one of the main objections to the validity of the standard model of cosmology and means that the concept of dark matter remains the cornerstone of our understanding of the Universe.

https://scitechdaily.com/cosmic-conundrum-cracked-scientists-solve-the-riddle-of-the-milky-ways-satellite-galaxies/

A 15-metric ton meteorite crashed in Africa. Now 2 new minerals have been found in it

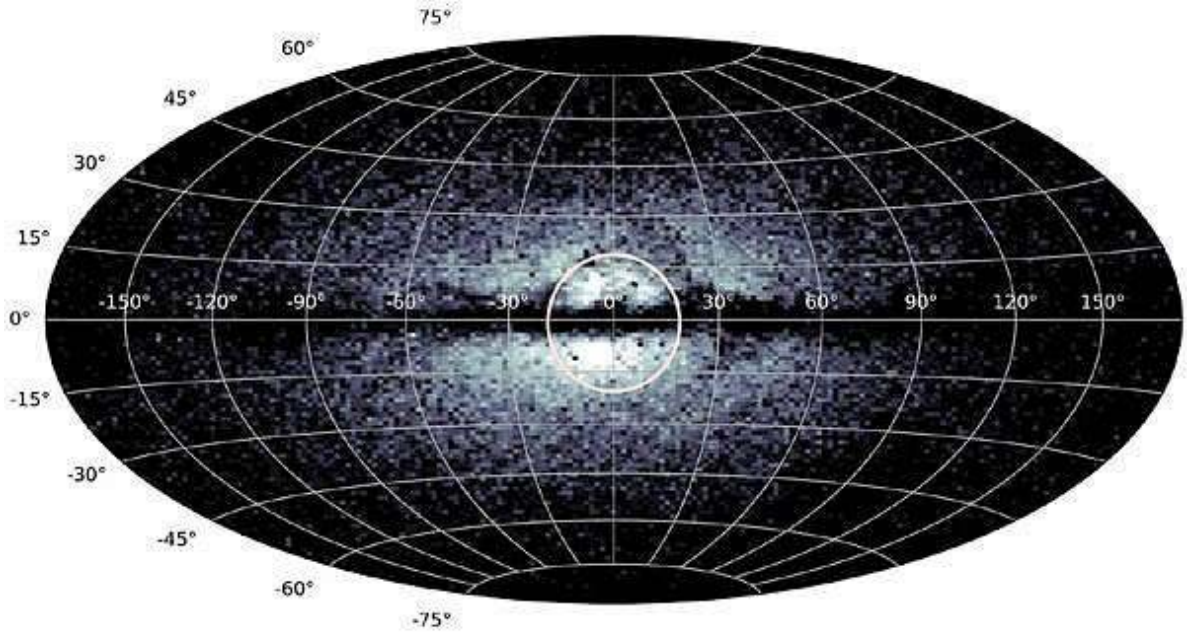
Pictured is a sample of the El Ali meteorite found in Somalia. The specimen contains two minerals that don't naturally form on Earth, scientists said.

Nick Gessler/Duke University

Scientists have identified two minerals never before seen on Earth in a meteorite weighing 15.2 metric tons (33,510 pounds). The minerals came from a 70-gram (nearly 2.5-ounce) slice of the meteorite, which was discovered in Somalia in 2020 and is the ninth-largest meteorite ever found, according to a news release from the University of Alberta. One mineral's name — elaliite — derives from the space object itself, which is called the "El Ali" meteorite since it was found near the town of El Ali in central Somalia. Herd named the second one elkinstantonite after Lindy Elkins-Tanton, vice president of Arizona State University's Interplanetary Initiative. Elkins-Tanton is also a regents professor in that university's School of Earth and Space Exploration and the principal investigator of NASA's upcoming Psyche mission — a journey to a metal-rich asteroid orbiting the sun between Mars and Jupiter, according to the space agency.

https://edition.cnn.com/2022/12/24/world/new-minerals-discovered-in-el-ali-meteorite-scn/index.html

Astronomers identify the ancient heart of the Milky Way galaxy



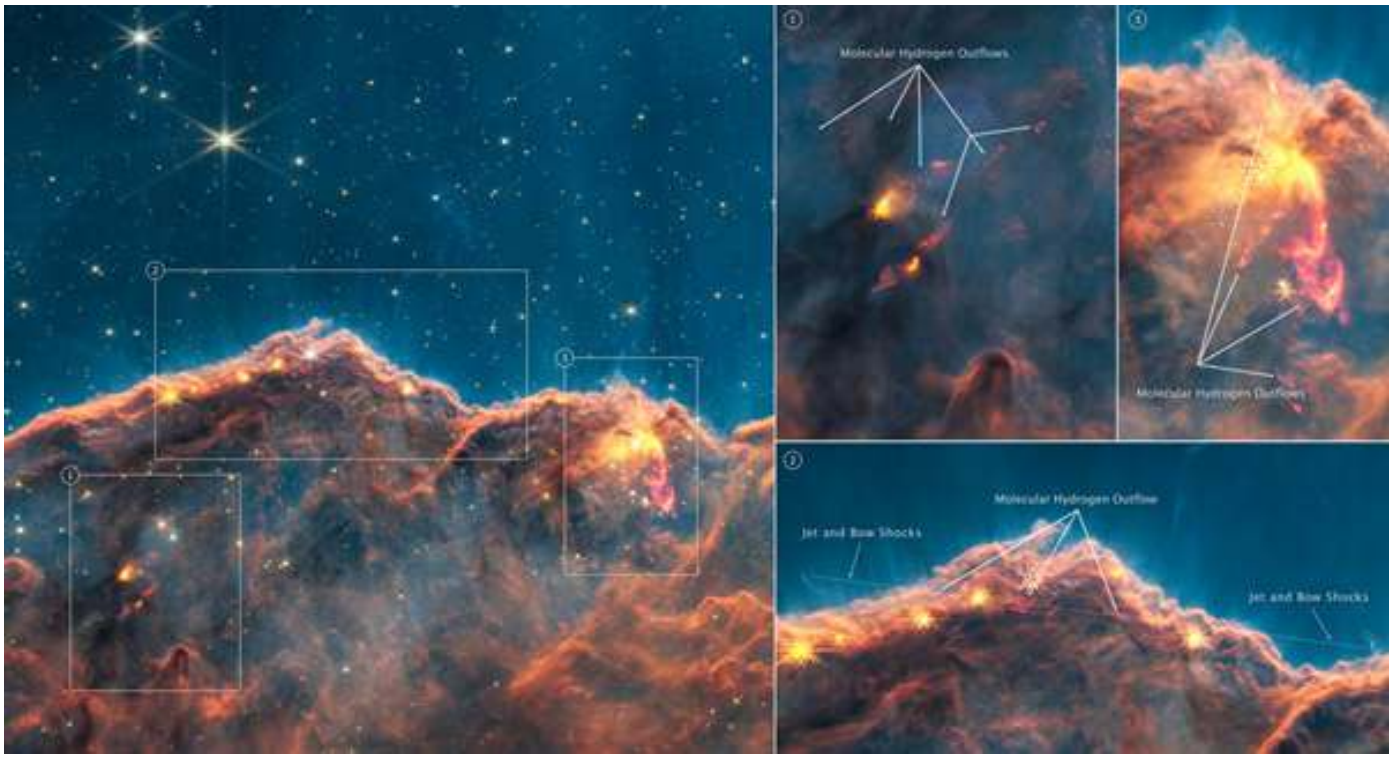
Map of especially metal-poor giant stars identified from Gaia DR3 data that shows, as a concentrated region (marked with a circle), the stars of the "poor old heart" of the Milky Way galaxy. The map shows the whole of the night sky in the same way that certain maps of the world show Earth's surface. In the center of the map is the direction towards the center of our home galaxy.

A group of MPIA astronomers has managed to identify the "poor old heart of the Milky Way" - a population of stars left over from the earliest history of our home galaxy, which resides in our galaxy's core regions. For this feat of "galactic archaeology", the researchers analyzed data from the most recent release of ESA's Gaia Mission, using a neural network to extract metallicities for two million bright giant stars in the inner region of our galaxy. The detection of these stars, but also their observed properties, provides welcome corroboration for cosmological simulations of the earliest history of our home galaxy. Our home galaxy, the Milky Way, gradually formed over nearly the entire history of the Universe, which spans 13 billion years. Over the past decades, astronomers have managed to reconstruct different epochs of galactic history in the same way that archaeologists would reconstruct the history of a city: Some buildings come with explicit dates of construction. For others, the use of more primitive building materials or older building styles implies that they have come before, as does the situation where remnants are found underneath other (and thus newer) structures. Last but not least, spatial patterns are important - for many cities, there will be a central old town surrounded by districts that are clearly newer. For galaxies, and in particular for our home galaxy, cosmic archaeology proceeds along very similar lines. The basic building blocks of a galaxy are its stars. For a small subset of stars, astronomers can deduce precisely how old they are. For example, this is true for so-called sub-giants, a brief phase of stellar evolution where a star's brightness and temperature can be used to deduce its age.

https://www.spacedaily.com/reports/Astronomers_identify_the_ancient_heart_of_the_Milky_Way_galaxy_999.html

New analysis of Webb's Cosmic Cliffs pinpoints stellar growth.

When NASA released the first science images from the James Webb Space Telescope (JWST) in July, one of the standouts was of the Cosmic Cliffs — a region at the edge of the star cluster NGC 3324 in the constellation Carina. Since then, researchers have been analyzing the data that went into that image, highlighting young star formation in the region. Located 7,600 light years from Earth, the region has been the subject of numerous studies since the Hubble Space Telescope captured it 16 years ago. Although the area is known for spawning stars, its abundant gas clouds absorb much of the light at visible wavelengths, making it difficult for Hubble to view the stars in detail. By analyzing data from JWST's Near-Infrared Camera (NIRCam) at a wavelength of 4.7 microns, researchers permeated the puffs and found 24 outflows, small and large, of molecular hydrogen jets throughout the region.



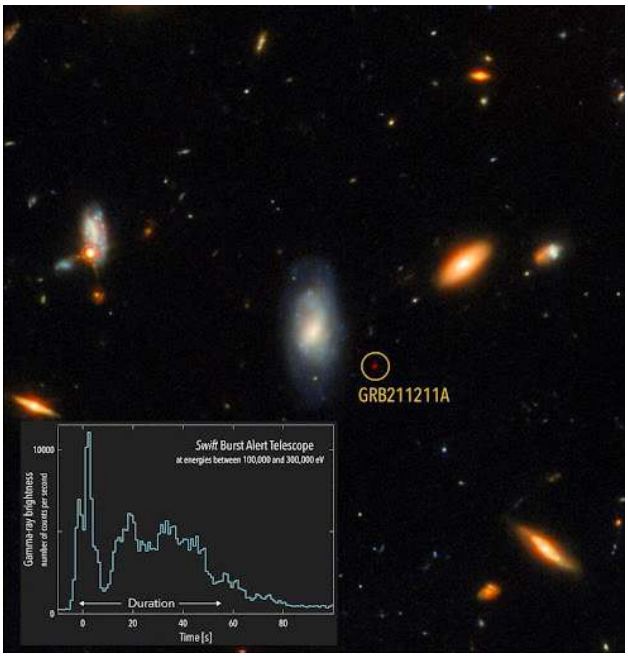
Jets, outflows, and bow shocks can be seen in these closeups. IMAGE: NASA, ESA, CSA, STScI; SCIENCE: Megan Reiter (Rice University); IMAGE PROCESSING: Joseph DePasquale (STScI), Anton M. Koekemoer (STScI)

The image captures activity that is key to understanding the early, fledgling days of stars similar to our Sun. Young stars suck up material and then emit some of it back in the form of jets and outflows. This period of a star's life is brief — only a few thousand years out of the millions of years it takes to form a star. As a release from NASA explains, this early stage of star formation was not well documented before JWST. "It opens the door for what's going to be possible in terms of looking at these populations of newborn stars in fairly typical environments of the universe that have been invisible up until the James Webb Space Telescope," says astronomer Megan Reiter of Rice University, who led the study published in *Monthly Notices of the Royal Astronomical Society* in December.

https://astronomy.com/news/2022/12/snapshot-jwst-finds-stars-on-the-edge-of-formation

Merging neutron stars trigger strange, long-lasting gamma-ray burst

A newly discovered gamma-ray burst is challenging astronomers' theories about these powerful cosmic explosions that make gold, uranium, and other heavy metals.



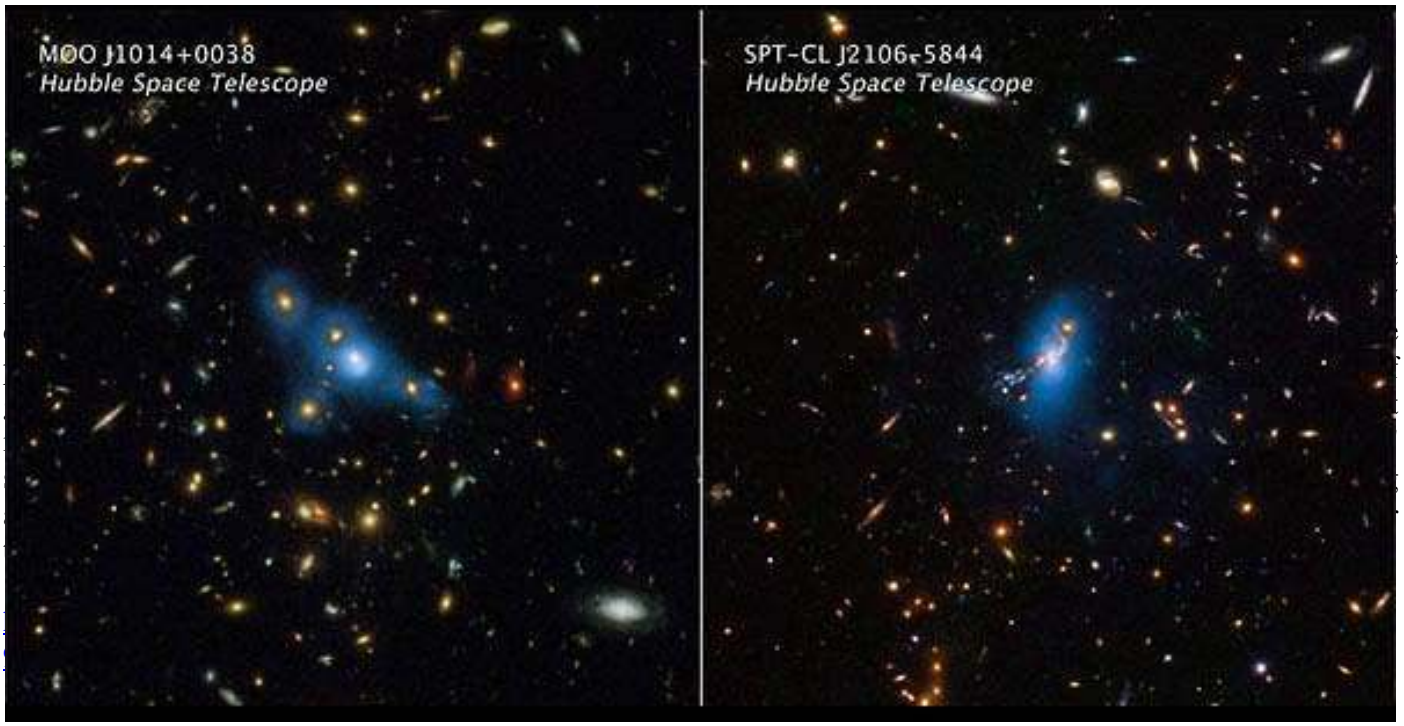
The unusual gamma-ray burst originated from the small red dot within the circle in this image. The graph shows how bright and long-lasting the burst was.

International Gemini Observatory/NOIRLab/NSF/AURA/M. Zamani/NASA/ESA/Eleonora Troja, CC BY-ND

When two neutron stars merge and create a black hole, they produce a powerful blast of gamma rays. A bright flash of gamma rays from the constellation Boötes that lasted nearly one minute came from a kilonova. This finding challenge what astronomers know about some of the most powerful events in the universe. The unusual cosmic explosion was detected by the Neil Gehrels Swift observatory on Dec. 11, 2021, as the satellite orbited Earth. When astronomers pointed other telescopes at the part of the sky where this large blast of gamma rays – named GRB211211A – came from, they saw a glow of visible and infrared light known as a kilonova. The particular wavelengths of light coming from this explosion allowed the team of astronomers to identify the source of the unusual gamma-ray burst as two neutron stars colliding and merging together.

https://astronomy.com/news/2022/12/merging-neutron-stars-trigger-strange-long-lasting-gamma-ray-burst

Hubble finds that ghost light among galaxies stretches far back in time



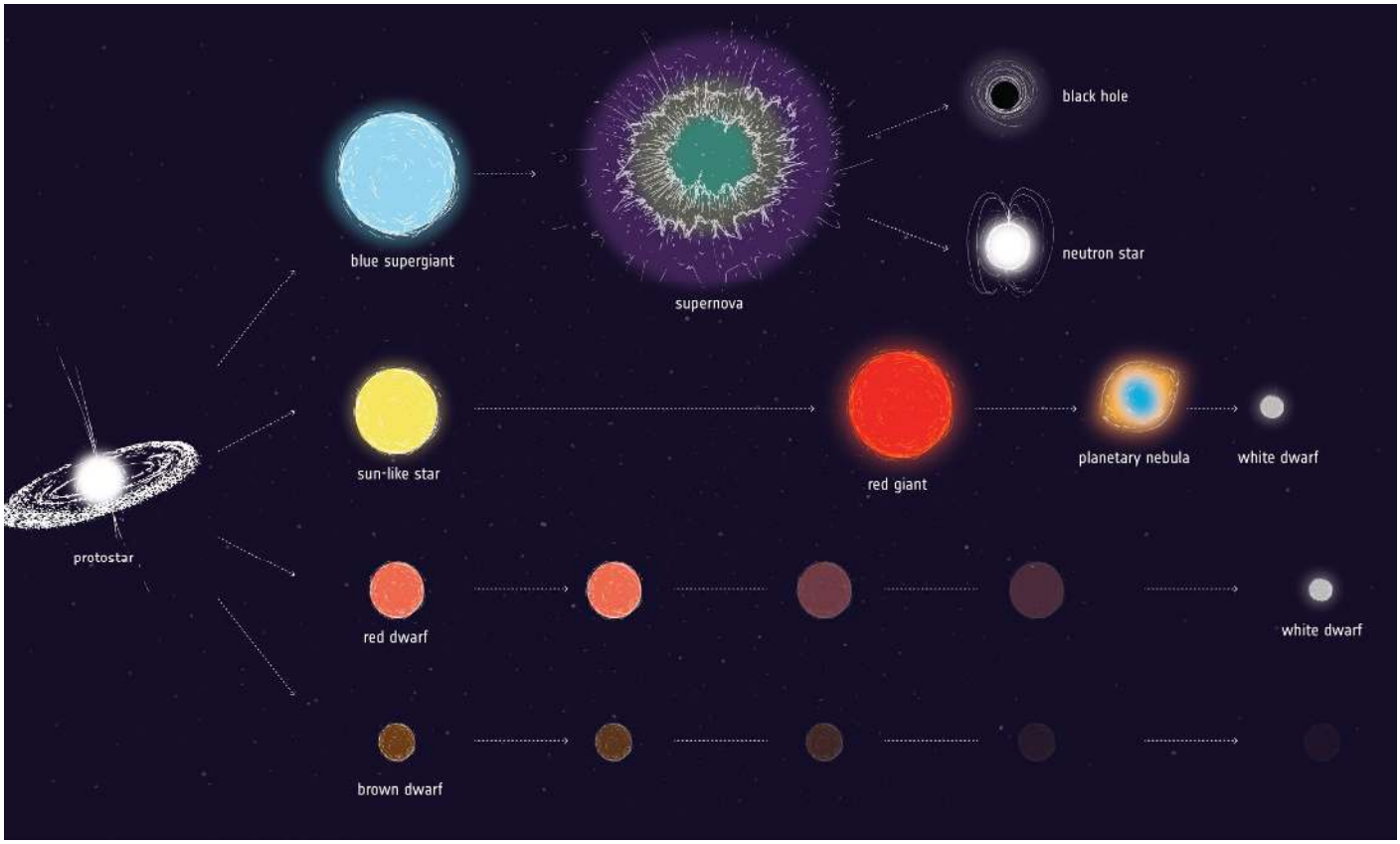
These are Hubble Space Telescope images of two massive clusters of galaxies named MOO J1014+0038 (left panel) and SPT-CL J2106-5844 (right panel). The artificially added blue color is translated from Hubble data that captured a phenomenon called intracluster light. This extremely faint glow traces a smooth distribution of light from wandering stars scattered across the cluster. Billions of years ago the stars were shed from their parent galaxies and now drift through intergalactic space. Credits: NASA, ESA, STScI, James Jee (Yonsei University); Image Processing: Joseph DePasquale (STScI).

Innumerable stars wander among the galaxies like lost souls, emitting a ghostly haze of light. These stars are not gravitationally tied to any one galaxy in a cluster. The nagging question for astronomers has been: how did the stars get so scattered throughout the cluster in the first place? Several competing theories include the possibility that the stars were stripped out of a cluster's galaxies, or they were tossed around after mergers of galaxies, or they were present early in a cluster's formative years many billions of years ago. A recent infrared survey from NASA's Hubble Space Telescope, which looked for this so-called "intra-cluster light," sheds new light on the mystery. The new Hubble observations suggest that these stars have been wandering around for billions of years, and are not a product of more recent dynamical activity inside a galaxy cluster that would strip them out of normal galaxies.

https://www.spacedaily.com/reports/Hubble_finds_that_ghost_light_among_galaxies_stretches_far_back_in_time_999.html

Thanks to Gaia we Know Exactly how and When the Sun Will die

Billions of years from now, the Sun will deplete its hydrogen fuel and swell to a red giant before becoming a white dwarf. It's a well-known story, and one astronomers have understood for decades. Now, thanks to the latest data from Gaia, we know the Sun's future in much greater detail.



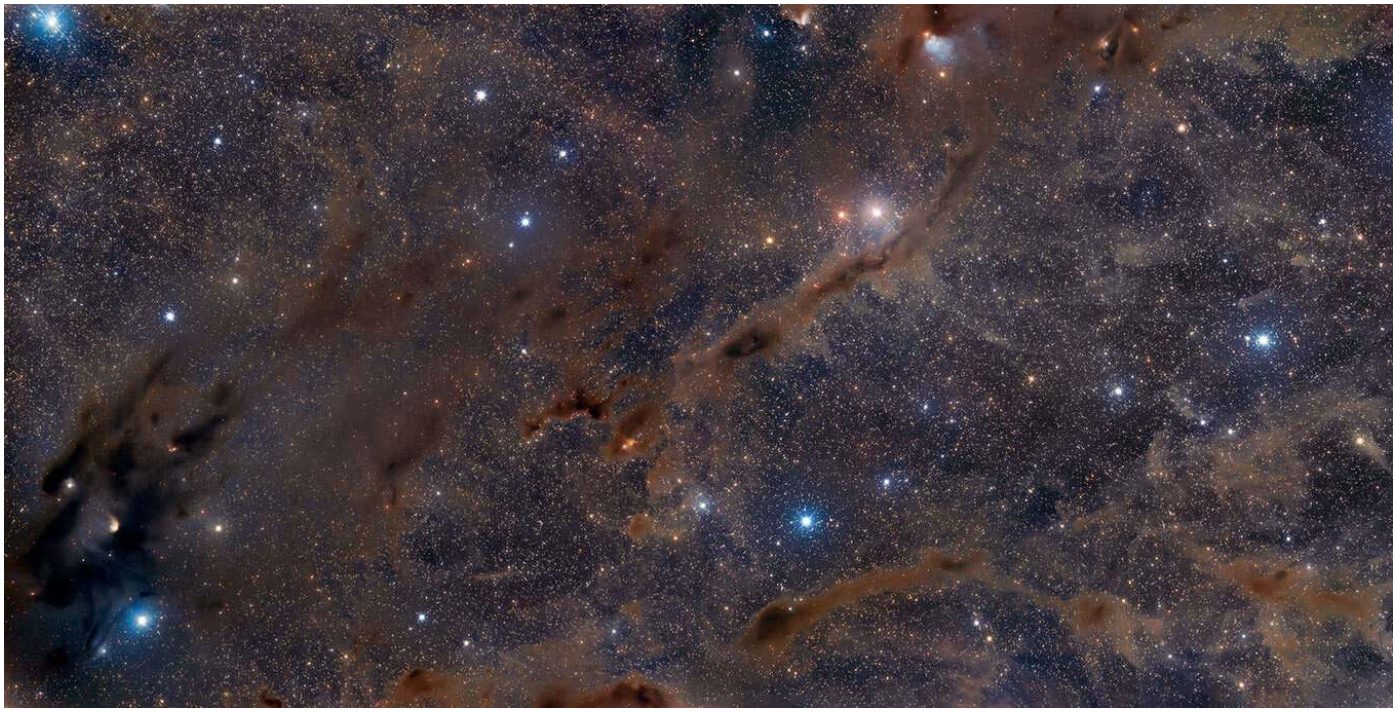
How different types of stars live and die. Credit: ESA

Colour is a measure of a star's temperature, and absolute magnitude is a gauge of its size. We now know that while the mass of a star is an important aspect of stellar evolution, its chemical composition also plays an important role. Two stars similar in mass but different in composition can have very different lifetimes. This is where the Gaia survey comes in. Whereas early stellar surveys had hundreds or thousands of stars, Gaia has more than a billion. In the latest data release, the Gaia team created an HR diagram of more than 4 million stars within 5,000 light-years of Earth. For these stars, we know not only their size and spectral temperature but also know their chemical composition. This means the Gaia team could create an HR diagram of stars with a similar mass and composition to the Sun. The result traces the evolutionary path of Sun-like stars from the main sequence to the red giants. Based on the data, the Sun will reach its maximum temperature at an age of 8 billion years, then shift toward the red giant phase before finally dying at around 11 billion years old.

https://www.universetoday.com/157122/thanks-to-gaia-we-know-exactly-how-and-when-the-sun-will-die/

How Many Stars Formed Together With the Sun in Our Stellar Nebula?

Even though our Sun is now a solitary star, it still has siblings somewhere in the Milky Way. Stars form in massive clouds of gas called Molecular Clouds. When the Sun formed about five billion years ago, other stars would've formed from the same cloud, creating a star cluster. How many other stars formed in the cluster?

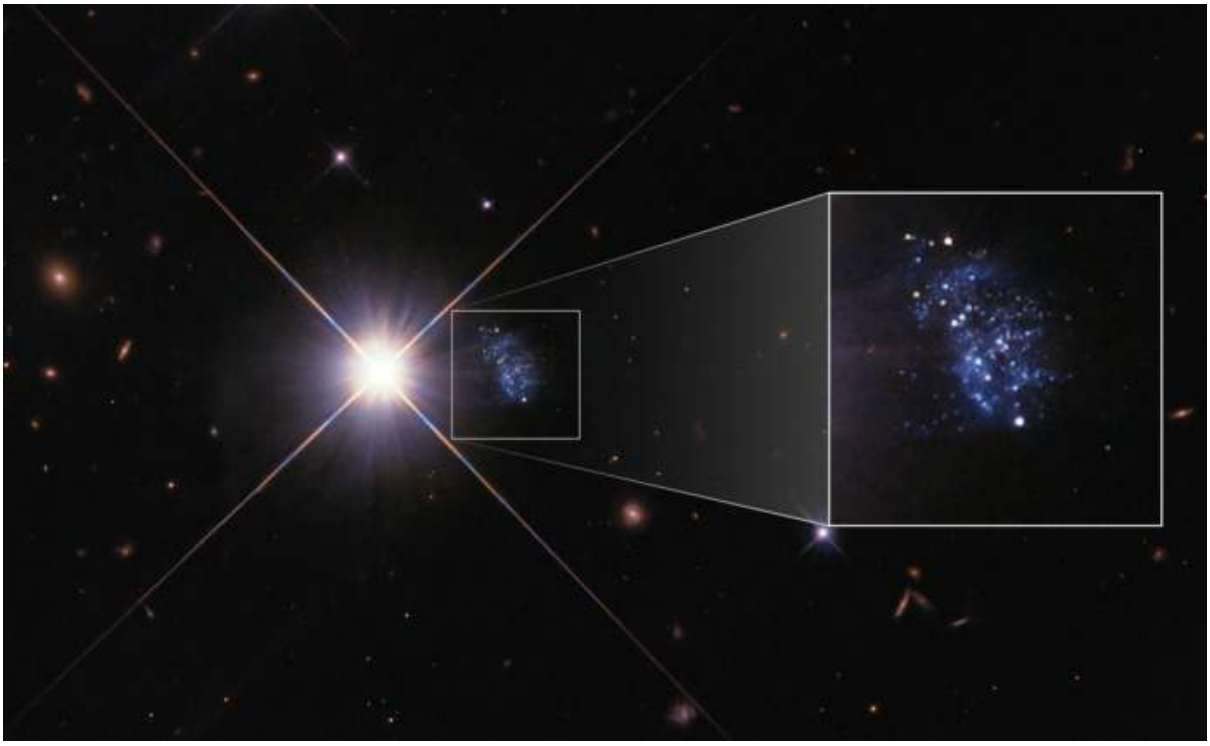


This is a two-panel mosaic of part of the Taurus Giant Molecular Cloud, the nearest active star-forming region to Earth. The darkest regions are where stars are being born. Image Credit: Adam Block /Steward Observatory/University of Arizona

Molecular clouds are called that because they're dominated by molecular hydrogen, two atoms of hydrogen bonded together. There are other components, but hydrogen is king. The Sun and the other stars that formed in the same cloud formed a star cluster. Over time, the cluster broke up due to the gravitational interference of other molecular clouds. Once a star cluster breaks up, the stars are called a stellar association since they move in broadly the same direction in space. In 2014, a team of astronomers published a paper showing that they'd found the Sun's first sibling. It's called HD 162826, and it's about 110 light-years away. The researchers identified it based on its chemical metallicity and its dynamical conditions. But the Sun could have hundreds or even thousands of siblings, and each one would've formed in its own core in the cloud. In a new paper, a pair of Japanese researchers tried to understand how many siblings the Sun has. The massive stars that end their lives as core-collapse supernova (CCSN) explosions don't live nearly as long as the Sun. They may live only a few million years, meaning they can form, explode, and die while other solar systems are still forming. When they explode, they inject nearby solar systems with short-lived radionuclides (SLRs,) including ^{26}Al. In our Solar System, there's evidence that a CCSN occurred late enough to inject SLRs like ^{26}Al into the circumstellar disk while the Sun was a young stellar object (YSO). A 2018 study showed that a CCSN could be responsible for the misalignment between the Sun's equator and the ecliptic.

https://www.universetoday.com/159444/how-many-stars-formed-together-with-the-sun-in-our-stellar-nebula/

SAAO's SALT and NASA's Hubble Space Telescope Discover New Dwarf Galaxy



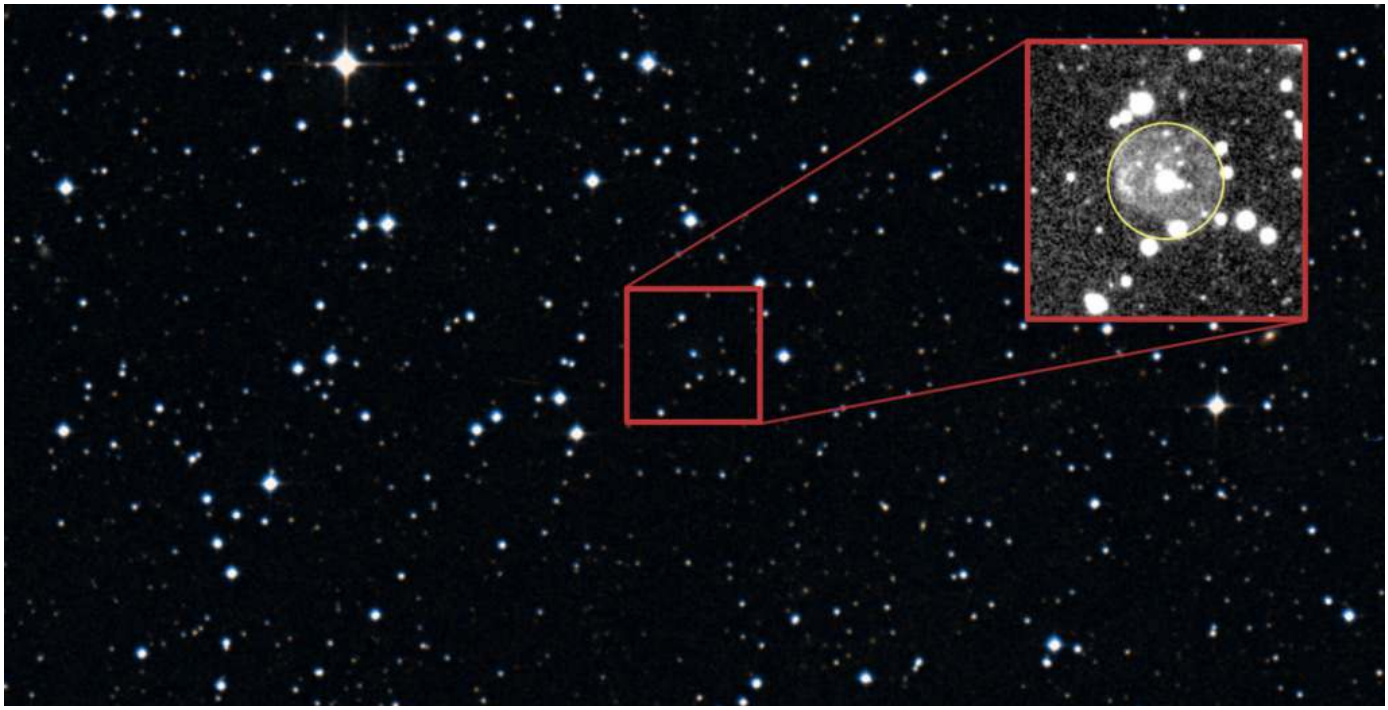
An image of Peekabo Galaxy. Source: Wikipedia

While observing data from the Hubble Space Telescope (HST) and long-slit spectroscopy using the Southern African Large Telescope (SALT), scientists discovered the Peekaboo dwarf galaxy (HIPASS J1131–31) is exceptionally metal-poor. Detailed in the recently published Monthly Notices of the Royal Astronomical Society collaborators and the South African Astronomical Observatory's (SAAO) Astronomer Alexei Kniazev, the team named the dwarf galaxy, Peekaboo due to its shy nature and its potential importance. As the team specifies, Peekaboo hides in the halo of a bright foreground star of magnitude 10.4.

https://africanews.space/saaos-salt-and-nasas-hubble-space-telescope-discovers-new-dwarf-galaxy/

International Team Announces Discovery of Super-Hot Stars Using Southern African Large Telescope

Using the largest single optical telescope in the Southern Hemisphere, an international team of astronomers has discovered eight of the hottest stars in the universe, all with surfaces hotter than 100,000 degrees. The study describes how a survey of helium-rich subdwarf stars led to the discovery of several very hot white dwarf and pre-white dwarf stars, the hottest of which has a surface temperature of 180,000 degrees Celsius. For comparison, the Sun's surface is a mere 5,800 degrees.



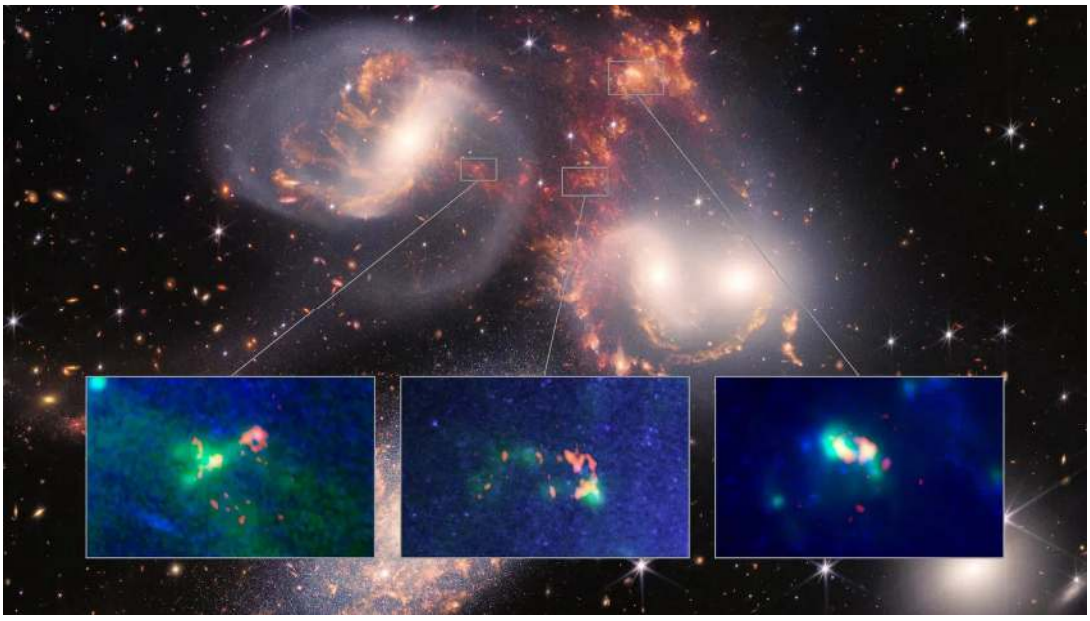
Caption: A sky survey image centred on the newly-discovered O(H) star SALT J203959.5-034117 (J2039).Credit: Tom Watts (AOP), STScINASA, The Dark Energy Survey

One of the stars identified is the central star of a newly discovered planetary nebula, which is one light year in diameter. Two of the others are pulsating, or 'variable' stars. All of these stars are at an advanced stage of their life cycle and are approaching the end of their lives as white dwarfs. Due to their extremely high temperatures, each of these new discoveries is more than one hundred times brighter than the Sun, which is considered unusual for white dwarf stars. White dwarfs are roughly the same size as planet Earth, but a million times more massive, with masses closer to that of the Sun's. They are the densest stars in existence that consist of normal matter. Pre-white dwarfs are a few times bigger and will shrink to become white dwarfs within a few thousand years.

https://www.saao.ac.za/2023/01/10/astronomers-discover-eight-new-super-hot-stars/

Violent Galactic Shockwave: Webb Space Telescope Reveals Sonic Boom Bigger Than the Milky Way

Shockwaves resulting from the violent collision between an intruder galaxy and Stephan's Quintet are helping astronomers to understand how turbulence influences gas in the intergalactic medium. New observations with the Atacama Large Millimeter/submillimeter Array (ALMA) and the James Webb Space Telescope (JWST) have revealed that a sonic boom several times the size of the Milky Way has kickstarted a recycling plant for warm and cold molecular hydrogen gas. What's more, scientists uncovered the break-up of a giant cloud into a fog of warm gas, the possible collision of two clouds forming a splash of warm gas around them, and the formation of a new galaxy. The observations were presented on Monday, January 9, 2023, in a press conference at the 241st meeting of the American Astronomical Society (AAS) in Seattle, Washington.

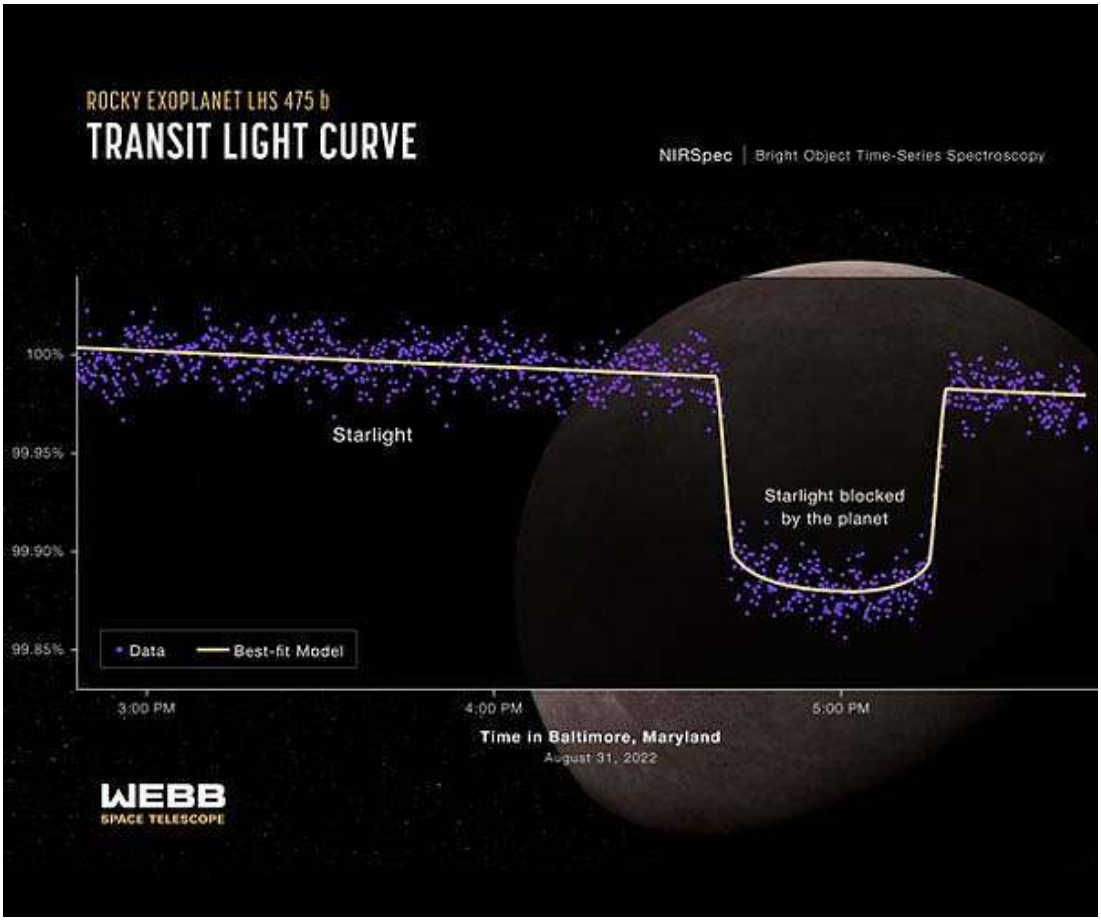


A team of astronomers using the Atacama Large Millimeter/submillimeter Array (ALMA) and the James Webb Space Telescope (JWST) discovered a recycling plant for warm and cold molecular hydrogen gas in Stephan's Quintet, and it is causing mysterious things to happen. At left: Field 6, which sits at the center of the main shock wave, is recycling warm and cold hydrogen gas as a giant cloud of cold molecules is stretched out into a warm tail of molecular hydrogen. At centre: Field 5 unveiled two cold gas clouds connected by a stream of warm molecular hydrogen gas characterized by a high-speed collision that is feeding the warm envelope of gas around the region. At right: Field 4 revealed a steadier, less turbulent environment where hydrogen gas collapsed, forming what scientists believe to be a small dwarf galaxy in formation. Credit: ALMA (ESO/NAOJ/NRAO)/JWST/ P. Appleton (Caltech), B.Saxton (NRAO/AUI/NSF)

https://scitechdaily.com/violent-galactic-shockwave-webb-space-telescope-reveals-sonic-boom-bigger-than-the-milky-way/

NASA's Webb confirms its first exoplanet

Researchers confirmed an exoplanet, a planet that orbits another star, using NASA's James Webb Space Telescope for the first time. Formally classified as LHS 475 b, the planet is almost exactly the same size as our own, clocking in at 99% of Earth's diameter. The research team is led by Kevin Stevenson and Jacob Lustig-Yaeger, both of the Johns Hopkins University Applied Physics Laboratory in Laurel, Maryland. The team chose to observe this target with Webb after carefully reviewing targets of interest from NASA's Transiting Exoplanet Survey Satellite (TESS), which hinted at the planet's existence. Webb's Near-Infrared Spectrograph (NIRSpec) captured the planet easily and clearly with only two transit observations. "There is no question that the planet is there. Webb's pristine data validate it," said Lustig-Yaeger. "The fact that it is also a small, rocky planet is impressive for the observatory," Stevenson added. These first observational results from an Earth-size, rocky planet open the door to many future possibilities for studying rocky planet atmospheres with Webb," agreed Mark Clampin, Astrophysics Division director at NASA Headquarters in Washington. "Webb is bringing us closer and closer to a new understanding of Earth-like worlds outside our solar system, and the mission is only just getting started."LHS 475 b is relatively close, at only 41 light-years away, in the constellation Octans.

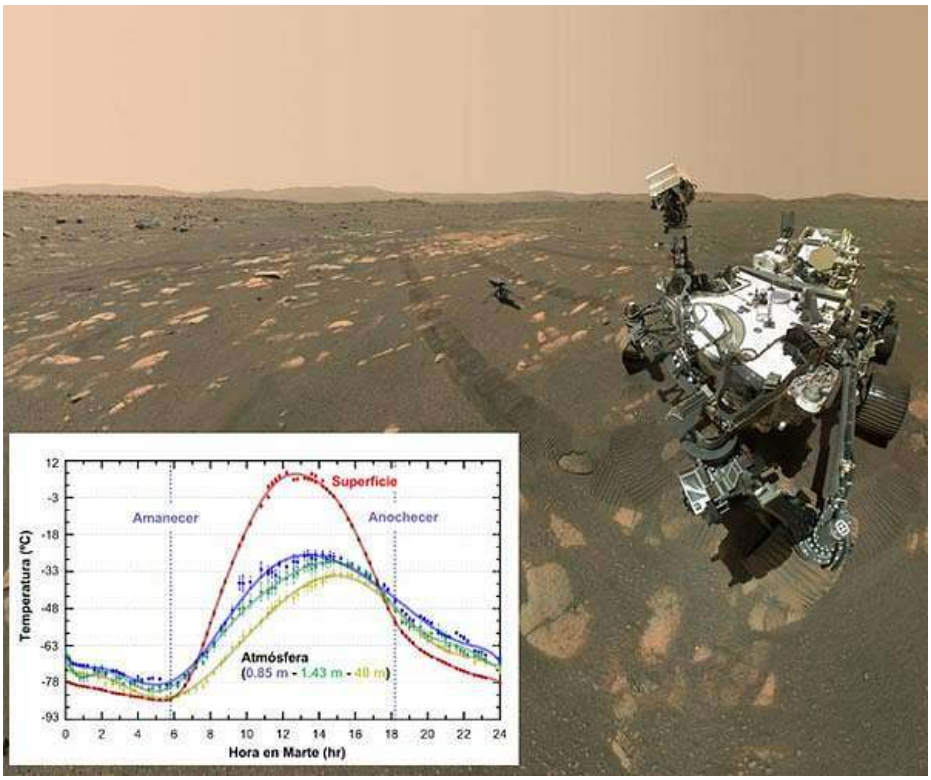


How do researchers spot a distant planet? By observing the changes in light as it orbits its star. A light curve from NASA's James Webb Space Telescope's Near-Infrared Spectrograph (NIRSpec) shows the change in brightness from the LHS 475 star system over time as the planet transited the star on August 31, 2022. LHS 475 b is a rocky, Earth-sized exoplanet that orbits a red dwarf star roughly 41 light-years away, in the constellation Octans. The planet is extremely close to its star, completing one orbit in two Earth-days. The planet's confirmation was made possible by Webb's data.

https://www.spacedaily.com/reports/NASAs_Webb_confirms_its_first_exoplanet_999.html

The rich meteorology of Mars studied in detail from the Perseverance rover

Perseverance is a NASA autonomous vehicle that arrived at the Jezero Crater (the bed of an ancient, now dried-up lake on Mars) on 18 February 2021. The rover is equipped with seven novel, complex scientific instruments dedicated to exploring the planet's surface in search of signs of possible past life, collecting and depositing samples to be brought back to Earth, testing new technologies for use in human exploration, and studying the planet's atmosphere in detail. Perseverance has now completed its investigation of the atmosphere throughout the first Martian year (which lasts approximately two Earth years).



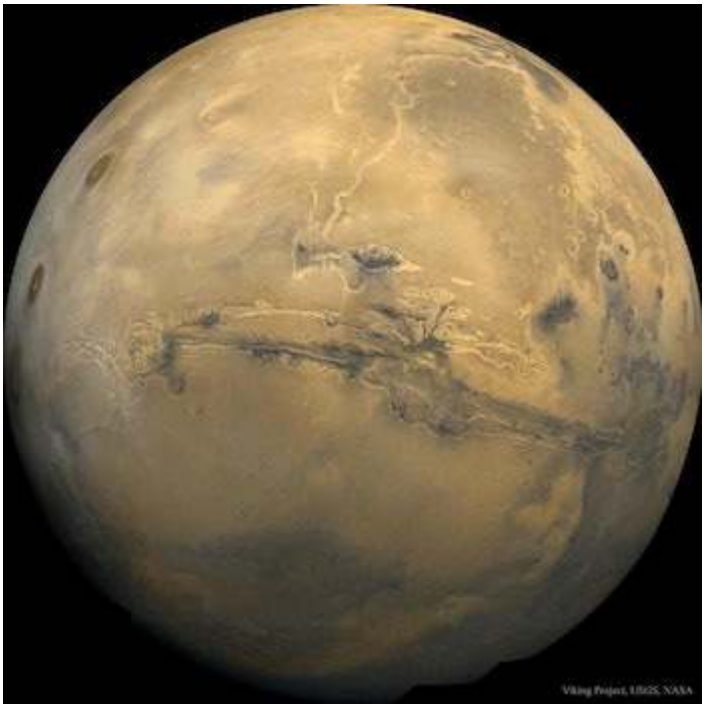
Daily temperature cycles at the Jezero Crater on Mars measured by the MEDA instrument

A preview of the results, which appears on the cover, is published in the January issue of the journal Nature Geoscience. Specifically, the UPV/EHU team, formed by Agustin Sanchez-Lavega, Ricardo Hueso, Teresa del Rio-Gaztelurrutia and the PhD student Asier Munguira, has led the study of the seasonal and daily cycles of temperature and pressure, as well as their significant variations on other time scales resulting from very different processes. Throughout the seasons, the average air temperature at the Jezero Crater, located near the planet's equator, is around minus 55 degrees Celsius, but varies greatly between day and night, with typical differences of around 50 to 60 degrees. In the middle of the day, the heating of the surface generates turbulent movements in the air as a result of the rise and fall of air masses (convection) which cease in the evening, when the air settles.

https://www.marsdaily.com/reports/The_rich_meteorology_of_Mars_studied_in_detail_from_the_Perseverance_rover_999.html

Astronomers find a surprise layer of volcanic rock in Mars' massive canyon

Plagioclase feldspar doesn't often turn up in volcanic rocks on Mars — but scientists just found a huge deposit in the walls of Mars' largest canyon. One of the largest canyons in our Solar System carved its way through several layers of ancient volcanic eruption debris, a recent study reports. Valles Marineris is a titanic network of deep cracks in the crust of Mars, stretching a quarter of the way around the planet, or roughly 4,000 kilometres (2,500 miles), near the equator. The canyons are eight kilometres (five miles) deep at some points. A recent study discovered traces of an ancient volcanic eruption in the walls of Valles Marineris, made of a mineral rarely seen on Mars in such large amounts. The ancient volcanic deposit could add an unexpected new chapter to the tumultuous history of the planet.



Here on Earth, the only canyon systems on the same scale as Valles Marineris are formed where two tectonic plates pull apart, causing the crust to rip into networks of roughly parallel cracks, like the ones along the Mid-Atlantic Ridge or the East African Rift Valley. Something similar probably happened on Mars, too; scientists who study Mars aren't completely sure, but the most popular explanation for now is that Valles Marineris is a rift system that formed when Mars' crust pulled apart. Erosion later widened the cracks and caused some of the walls to collapse, turning the fault system into a monstrous wound in Mars' side.Flowing water, or even flowing lava, may have played a part in widening the canyons.NASA

Volcanic rock on Mars is no surprise; we already know the planet has an eventful geologic history, and it's home to the largest volcano in the Solar System, Olympus Mons. But plagioclase feldspar, in particular, is a rare find — one that could tell us some interesting things about what Mars' crust is made of and how it formed.

Why It Matters — The newly-discovered feldspar layer lies beneath several kilometers of other lava flows in the walls of Valles Marineris. Their chemical spectra suggest that they're made mostly of a volcanic rock called basalt, which is the cooled, solid version of what was once very fluid lava rich in magnesium and iron. Most of the volcanic rock on Earth and on the Moon is basalt, so it's not surprising to find layers of it on Mars, too, especially in an area like Valles Marineris, where there was so much violent geological upheaval in the distant Martian past.

https://www.inverse.com/science/mars-volcanoes

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