# "The Southern Cross"

Hermanus Astronomy Centre Newsletter

## OCTOBER 2022

## *MONTHLY MEETING*

(The third Monday of each month)

**19th September – Chris Engelbrecht**

**Topic:** *" Asteroseismology: The Music of the Stars ".*

Chris delivered a most enlightening and entertaining presentation on The Interior Structure and Evolution of Stars. Explaining that music is nothing but vibrations, he illustrated the point with string and wind instruments and their wave and harmonic effects on our body's sensors which transmit sounds to the brain. These numerical relationships are comparable with not only the orbital relationships of planetary and stellar bodies but also their interior structures and their evolutions. By using telescopic methods, we can "listen to the sound that stars make" in the form of the vibrations of the light emitted (photometry and spectroscopy) which change in subtle ways and determine accurately the composition and the changes occurring within the stars.

YouTube: ( https://www.youtube.com/watch?v=wpwgBPEH-ZA )

**Next: 17th October – Prof Roger Deane** presents *"Horizon Telescope and the imaging of BHs".*

**2022 meeting dates:** For your diaries - the remaining monthly meetings of 2022 are scheduled for 17th October and 21st November.

## *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", to be spread over a period of time.

**5th September –***The History of the Universe*– part 2: What Was The Universe Like IMMEDIATELY After The Big Bang?

(https://www.youtube.com/watch?v=kEg7yJzGiV4&list=PLROBLlvnR7BEF9b1NOvRf_zhboibmywJb&index=3 )

next **3rd October -** *The History of the Universe*– part 3: Why Did Time Start Going Forward?

(https://www.youtube.com/watch?v=x9m0sz2sUfU&list=PLROBLlvnR7BEF9b1NOvRf_zhboibmywJb&index=4)

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

## *Astrophotography*

(The second Monday of each month)

**12 September**: no meeting held.

**Next: 10th October.** This meeting will only take place in accordance with group members' wishes. For further information, please contact Deon Krige: krige.deon44@outlook.com

## *Study Group*

(The last Monday of each month)

**26th September:** 1. Quantum Leaps take time and 2. Fusion Reactor to make electricity by 2024

**Next 31st October:** the topic will be advised in due course.

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

## *Stargazing*

No HAC Stargazing is currently planned but we shall let you know as soon as a suitable evening is scheduled. Please check our website calendar for HAC scheduled events: https://www.hermanusastronomy.co.za

## *Future Trips*

No outings are planned at present.

## *GEARING'S POINT ASTRONOMY EDUCATION DISPLAY (GPAED)*

*From Pierre De Villiers*:

All but the last 5 of the pre-cast mounting slabs have been installed.

The chemical etching of the educational tablets is in process. The attached photos show:

1. The last of the laser-cut SS info tablets awaiting cleansing

2. Chemical wash to prepare for etching

3. The chemical etching of four of the side-by-side tablets

4. Removing the excess ink

The project has been delayed considerably by the chemical etching, with final delivery expected only in the first week of November. This implies an extremely busy coordinating schedule for the project committee over the last three months of 2022 to ensure completion and maximal grant expenditure.

## *EDUCATIONAL OUTREACH*

From: Mick Fynn:

FIELD GUIDING INTEREST GROUP TOUR THE SOLAR SYSTEM

What could astronomy offer to interested tour and field guides? Their interests are normally how to get qualified and enter the job market in tourism. The excitement comes in showcasing the beauty of the wine farms, the amazing accommodation, and the natural beauty of Hermanus village and its surrounds.

This is definitely the fruits of tourism but to get to the roots of optimising these tourism opportunities we believe that the fundamental sustainability of this amazing piece of the planet is more to plant the seed of the bigger sustainability issues for the humans to take in and apply to the broader planet challenges of planet Earth!

To do that we need to give our tourists and guides the opportunity to understand: -

1, the relative size and distances in the solar system and

2. just how empty the solar system is!

So it was that last week the normal Thursday 11h00 Solar System model on the cliff path was brought forward to Wednesday 08h00 to fulfil the Tourism office request for Mick Fynn to oversee a planned tour for youth interested in a field guiding career.

18 delegates arrived at 08h00 promptly and were welcomed by the tourism manager, Freda, and then went straight into the astronomy solar system tour. The first dimension was to show the 2 metre display board with painted models of the planets by the Lukhanyo Primary school in relation to the size of the sun, The second phase is to go down to the amphitheatre and show the booklet with a 300mm sun and equivalently sized planets and make the delegates pace out the distance between each planet, thus realising that they are all so small in relation to the sun that they cannot be seen when that distance apart is paced out, They were then ready to tackle the third dimension of the 900mm sun as modelled just next to the playground and start the tour of the planets along the cliff path. By the time they got to Jupiter on the other side of the Marine Hotel on the cliff path and realised they had to go as far as grotto beach to see Pluto as the size of pea, they realised just how empty space is.

## Astronomy News (compiled by Pieter Kotzé)

### Comet 67P has the building blocks of life — smells like mothballs and almonds

*A view of the Comet 67P/Churyumov-Gerasimenko from the Rosetta spacecraft as seen on Aug. 22, 2014. New research has found hints of the ingredients of life on the comet, along with surprising smells. (Image credit: ESA/Rosetta/NAVCAM, CC BY SA 3.0 IGO)*

The Comet 67P/Churyumov-Gerasimenko is much richer in complex organic molecules than scientists expected, and until now, some of those molecules had never been seen around a comet. Scientists from the University of Bern in Switzerland, conducted their research using data collected by the Rosetta spacecraft and analyzed by its mass spectrometer, ROSINA, between 2014 and 2016. From these data, the researchers identified a series of complex organic molecules on a comet for the first time. Because comets are believed to be responsible for seeding complex molecules essential for carbon-based life on Earth, the findings could have implications for how life was kick-started on our planet.

https://www.space.com/comet-67p-ingredients-for-life-smells

### Researchers detect dozens of new variable stars

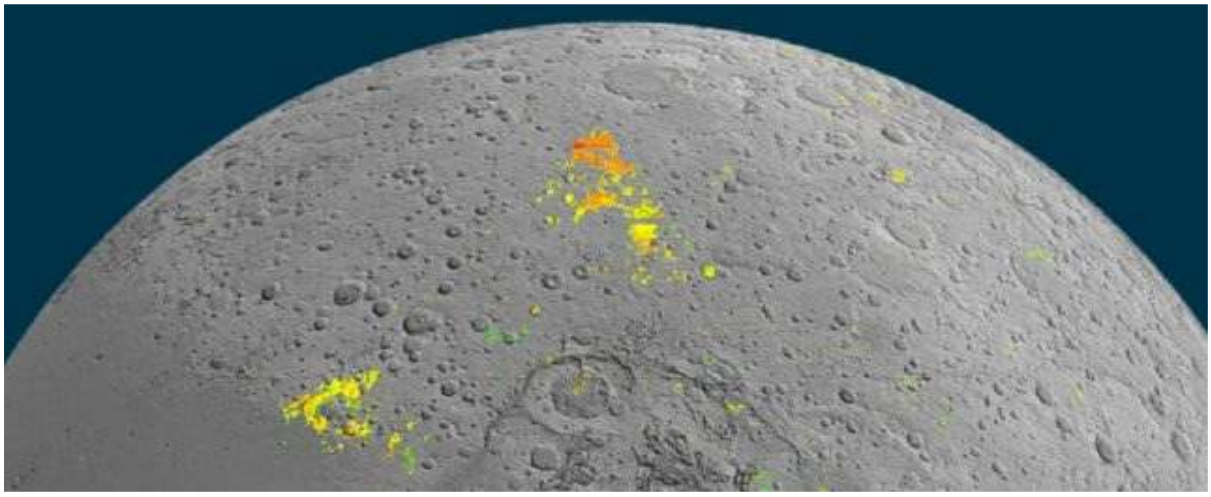
*Palomar 2 globular cluster. Credit: ESA/Hubble & NASA.*

By observing the field of globular cluster Palomar 2 with the Indian Astronomical Observatory (IAO), astronomers have discovered 32 new variable stars. The newfound variables are mostly RR Lyrae stars and cluster members. The finding is reported in a paper

published August 16 on the arXiv pre-print repository. Now, a team of astronomers led by Armando Arellano Ferro of the National Autonomous University of Mexico (UNAM) reports the detection of dozens of new variables. The discovery is a result of long-term observations of the field of Palomar 2 with IAO's 2.0-m telescope. Palomar 2 is a distant globular cluster located some 100,000 light years in the constellation of Auriga and so far no variables have been reported in this stellar grouping. Furthermore, based on the collected data, the researchers found that Palomar 2 is located approximately 86,000 light years away from the Earth, therefore nearer than previously estimated. The results also suggest that the cluster's metallicity is at a level of -1.39, which is in agreement with previous studies.

https://phys.org/news/2022-08-dozens-variable-stars.html

**Giant Map Reveals Ancient Traces of Water on Mars Everywhere We Look**

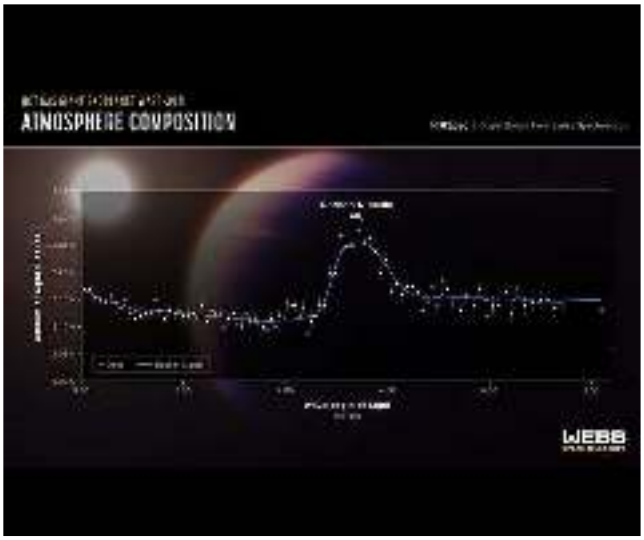


*Detail from new global Mars map of aqueous minerals. (ESA/Mars Express (OMEGA) and NASA/Mars Reconnaissance Orbiter (CRISM))*

A new map, years in the making, reveals where we can find ancient traces of water on Mars. Using data collected over the past decade by ESA's Mars Express and NASA's Mars Reconnaissance Orbiter, both currently in orbit around the red planet, scientists have created the most comprehensive map yet of specific Martian mineral deposits. The deposits are aqueous minerals – those that have been altered by the presence of water, like clays.

https://www.sciencealert.com/giant-map-reveals-ancient-traces-of-water-on-mars-everywhere-we-look

**Webb telescope finds CO2 for first time in exoplanet atmosphere**




*A transmission spectrum of the hot gas giant exoplanet WASP-39 b captured by Webb's Near-Infrared Spectrograph (NIRSpec) July 10, 2022, reveals the first clear evidence for carbon dioxide in a planet outside the solar system. This is also the first detailed exoplanet transmission spectrum ever captured that covers wavelengths between 3 and 5.5 microns.*

The months-old James Webb Space Telescope has added another major scientific discovery to its growing list: detecting for the first time signs of carbon dioxide in the atmosphere of a planet outside our solar system. Although the exoplanet would never be able to support life as we know it, the successful discovery of CO2 gives researchers hope that similar observations could be carried out on rocky objects more hospitable to life. Their study of exoplanet WASP-39, a hot gas giant closely orbiting a star 700 light years away, will soon be published in the journal Nature. The detection of CO2 will also help scientists learn more about how WASP-39 formed, NASA said in a press release. The exoplanet, which orbits its star once every four Earth days, has a mass one-quarter that of Jupiter but a diameter 1.3 times bigger.

https://www.spacedaily.com/reports/Webb_telescope_finds_CO2_for_first_time_in_exoplanet_atmosphere_999.html

**‘Star factory' at Milky Way's heart seen for the first time**

New results indicate that star formation in our galaxy radiated out from its core as young stars drifted apart.

*The Sagittarius B1 region at Galactic Center, home to intense star formation. (Image credit: F. Nogueras-Lara et al. / MPIA)*

Astronomers have reconstructed the history of star formation at the center of the Milky Way for the first time, finding that starbirth radiated outwards from the galaxy's heart. The results also revealed that most young stars in the densely packed galactic center formed with only loose associations and drifted further apart over the course of millions of years. Using the HAWK-I infrared camera of the Very Large Telescope (VLT) located in Chile, astronomers conducted the GALACTICNUCLEUS survey, studying an area of 64,000 square light-years around the galactic center in greater detail than ever before.

*The central region of the Milky Way in infrared light, acquired by NASA’s Spitzer Space Telescope. Credit: NASA/JPL-Caltech/S. Stolovy (Spitzer Science Center/Caltech)*

https://www.space.com/star-factories-discovered-milky-way-center

https://www.universetoday.com/157361/star-formation-in-the-center-of-the-milky-way-started-at-the-core-and-then-worked-its-way-out/

**Perseverance rover retrieves key rocky clues to Mars' geologic and water history**

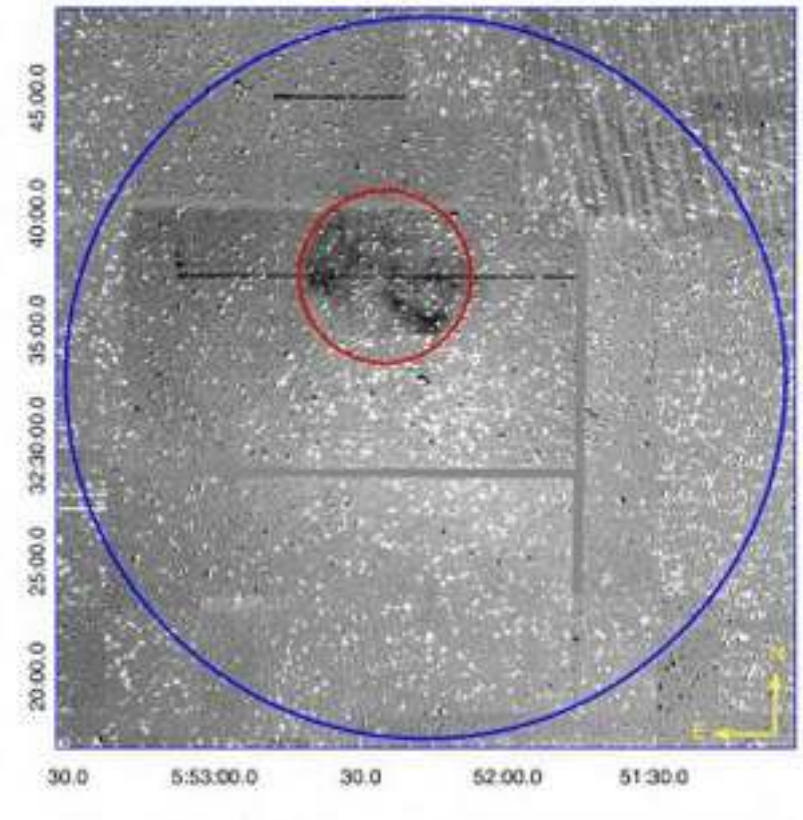

*Since NASA's Perseverance rover landed in Jezero Crater on Feb. 18, 2021, it has rolled around the margins of an area called Seitah, where it sampled the rocks in two places, and visited another area called Maaz, where it sampled two other rocks. Since then, it has traveled a circuitous path to one of the main features in the crater, a river delta (upper left). Red points indicate crater floor sampling locations; blue points indicate the present locations of the Perseverance Rover (at left) and the Ingenuity helicopter.*

In its first year exploring Jezero Crater on Mars, the Perseverance rover collected rock samples that scientists anticipate will provide a long-awaited timeline for the planet's geologic and water history.They'll just have to wait a decade to find out the answer, until the samples can be scooped up from the surface and returned to Earth for dating in 2033. Jezero Crater, just north of the Martian equator, was a target for NASA's Mars 2020 Mission and its Perseverance rover because it contained what looked like a river delta that formed inside a lake bed and thus could potentially tell scientists about when water flowed on the planet's surface. Rocks collected from the floor of the crater underlie the delta sediments, so their crystallization ages will provide an upper limit for the delta's formation.

https://www.marsdaily.com/reports/Perseverance_rover_retrieves_key_rocky_clues_to_Mars_geologic_and_water_history_999.html

https://www.marsdaily.com/reports/New_research_sheds_light_on_when_Mars_may_have_had_water_999.html

**Discovery of the oldest visible planetary nebula hosted by a 500 million year old galactic cluster**

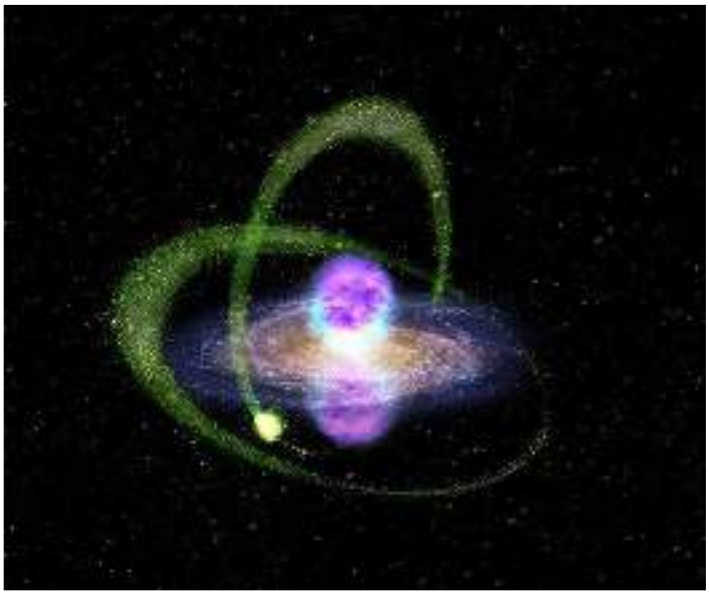



*Galactic open cluster M37*

An international team of astronomers led by members of the Laboratory for Space Research (LSR) and Department of Physics at The University of Hong Kong (HKU), have discovered a rare celestial jewel-a so-called Planetary Nebula (PN) inside a 500 million-year-old Galactic Open Cluster (OC) called M37 (also known as NGC2099). This is a very rare finding of high astrophysical value. PNe are the ejected, glowing shrouds of dying stars that shine with a rich emission line spectrum and display, as a result, their distinct colours and shapes that make them photogenic magnets for public interest. It was no coincidence that one of the first James Webb Space Telescope (the largest optical telescope in space) images released to the public was a PN!

https://www.spacedaily.com/reports/Discovery_of_the_oldest_visible_planetary_nebula_hosted_by_a_500_million_year_old_galactic_cluster_999.html

**Gamma rays from neighbouring galaxy related to millisecond pulsars**

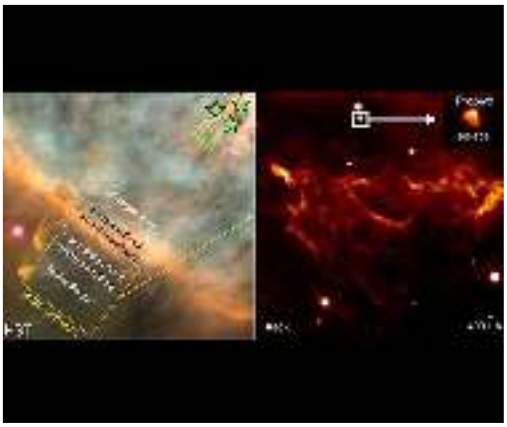


*A small satellite galaxy of the Milky Way - called the Sagittarius dwarf galaxy - has been observed from Earth through giant lobes of gamma radiation (the so-called Fermi bubbles). Although the dwarf galaxy is stuffed with dark matter, this is unlikely to be the cause of the observed emission.*

A team of researchers, including UvA physicists and astronomers, has studied gamma rays caused by the Sagittarius Dwarf, a small neighbouring galaxy of our Milky Way. They showed that all the observed gamma radiation can be explained by millisecond pulsars, and can therefore not be interpreted as a smoking gun signature for the presence of dark matter. The center of our galaxy is blowing a pair of colossal bubbles of gamma radiation (the magenta structures in the image above) that span a whopping 50,000 light-years across. Discovered with the Fermi Gamma-ray Space Telescope about a decade ago, the source of this hourglass-shaped phenomenon remains unclear.

https://www.spacedaily.com/reports/Gamma_rays_from_neighboring_galaxy_related_to_millisecond_pulsars_999.html

**Massive stars' blasts hitting Orion's sword mapped in unprecedented detail**

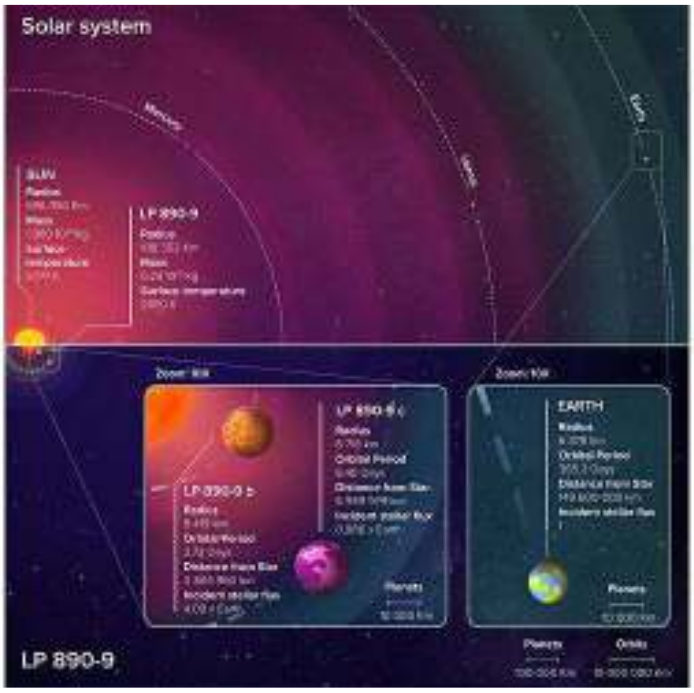


*Left: Hubble Space Telescope mosaic of the Orion Bar. Credit: NASA/STScI/Rice Univ./C.O'Dell et al. The NIRC2 wide camera Field of View is shown in the yellow square. Right: Infrared heat map of the Orion Bar obtained with Keck Observatory's NIRC2 instrument reveals substructures such as proplyds. Credit: Habart et al./W. M. Keck Observatory*

Astronomers using W. M. Keck Observatory on Hawaii Island have captured from Maunakea the most detailed and complete images ever taken of the zone where the famed constellation of Orion gets zapped with ultraviolet (UV) radiation from massive young stars. This irradiated neutral zone, called a Photo-Dissociation Region (PDR), is located in the Orion Bar within the Orion Nebula, an active star-forming site found in the middle of the "sword" hanging from Orion's "belt." When viewed with the naked eye, the nebula is often mistaken for one of the stars in the constellation; when viewed with a telescope, the photogenic nebula is seen as a glowing gaseous stellar nursery located 1,350 light-years from Earth.

https://www.spacedaily.com/reports/Massive_stars_blasts_hitting_Orions_sword_mapped_in_unprecedented_detail_999.html

**SPECULOOS discovers a potentially habitable super-Earth**



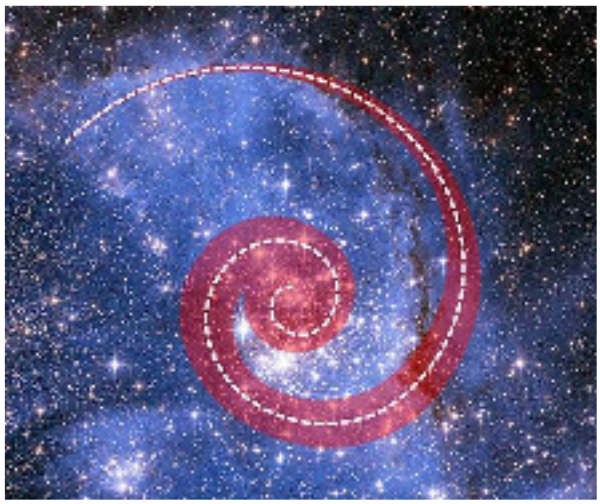

*Comparison between the LP 890-9 system and the inner Solar System. The LP 890-9 system is much more compact: its two planets could easily fit inside the orbit of Mercury, the innermost planet of our Solar System.*

An international team of scientists, led by Laetitia Delrez, astrophysicist at the University of Liege (Belgium), has just announced the discovery of two 'super-Earth' type planets orbiting LP 890-9. Also known as TOI-4306 or SPECULOOS-2, this small, cool star located about 100 light-years from our Earth is the second coolest star around which planets have been detected, after the famous TRAPPIST-1.A first planet, LP 890-9b (or TOI-4306b), the innermost in the system, was initially identified by NASA's Transiting Exoplanet Survey Satellite (TESS), a space mission dedicated to the search for exoplanets orbiting nearby stars. This planet, which is about 30% larger than the Earth, completes an orbit around the star in just 2.7 days.

https://www.spacedaily.com/reports/SPECULOOS_discovers_a_potentially_habitable_super_Earth_999.html

https://www.spacedaily.com/reports/Two_new_rocky_worlds_around_an_ultra_cool_star_999.html

**Hubble finds spiralling stars, providing window into early universe**



*The massive star cluster NGC 346, located in the Small Magellanic Cloud, has long intrigued astronomers with its unusual shape. Now researchers using two separate methods have determined that this shape is partly due to stars and gas spiraling into the center of this cluster in a river-like motion. The red spiral superimposed on NGC 346 traces the movement of stars and gas toward the center. Scientists say this spiraling motion is the most efficient way to feed star formation from the outside toward the center of the cluster.*

Nature likes spirals - from the whirlpool of a hurricane, to pinwheel-shaped protoplanetary disks around newborn stars, to the vast realms of spiral galaxies across our universe.

Now astronomers are bemused to find young stars that are spiraling into the center of a massive cluster of stars in the Small Magellanic Cloud, a satellite galaxy of the Milky Way. The outer arm of the spiral in this huge, oddly shaped stellar nursery called NGC 346 may be feeding star formation in a river-like motion of gas and stars. This is an efficient way to fuel star birth, researchers say. The Small Magellanic Cloud has a simpler chemical composition than the Milky Way, making it similar to the galaxies found in the younger universe, when heavier elements were more scarce. Because of this, the stars in the Small Magellanic Cloud burn hotter and so run out of their fuel faster than in our Milky Way. Though a proxy for the early universe, at 200,000 light-years away the Small Magellanic Cloud is also one of our closest galactic neighbours.

https://www.spacedaily.com/reports/Hubble_finds_spiraling_stars_providing_window_into_early_universe_999.html

**New mineral found by Chinese scientists on the Moon**

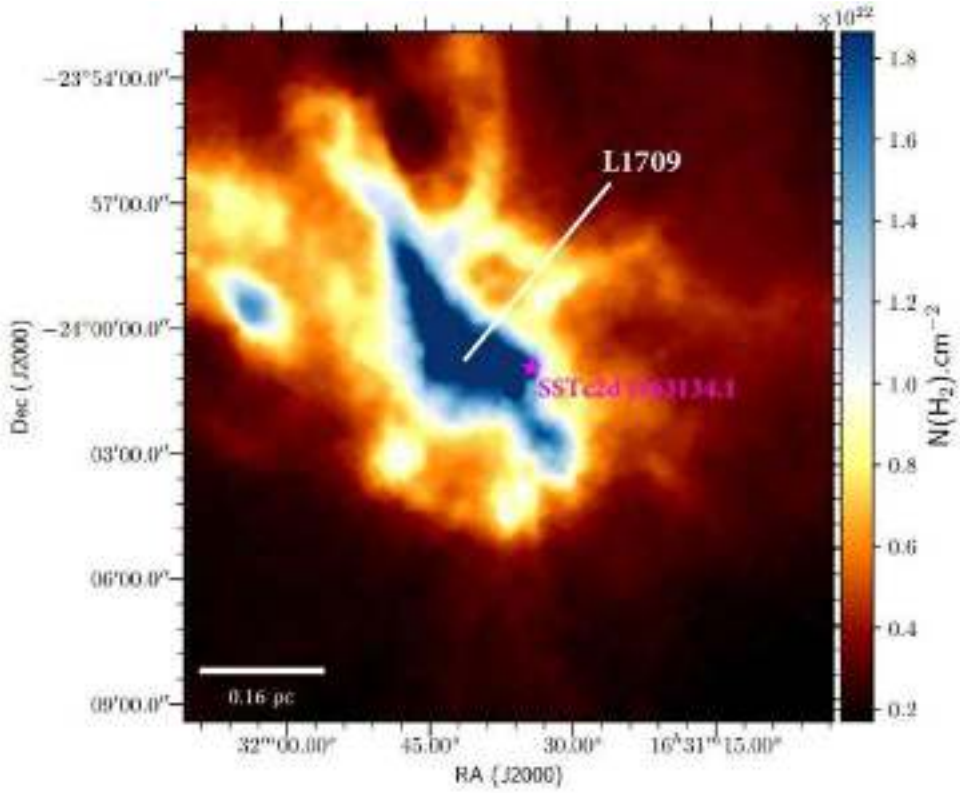

*Changesite-(Y) was discovered in soil sample brought from the moon*

Chinese scientists have achieved a remarkable new feat in their research of the moon as they have discovered and identified the sixth new lunar mineral.

The China National Space Administration and the China Atomic Energy Authority jointly announced in Beijing on Friday that the new mineral-Changesite-(Y)-was found by scientists at the Beijing Research Institute of Uranium Geology from surface samples returned by the country's Chang'e 5 robotic mission and has been certified by the International Mineralogical Association and its Commission on New Minerals, Nomenclature and Classification. Changesite-(Y), which falls in the category of lunar merrillite, has become the first lunar mineral discovered and identified by Chinese scientists, making China the third nation in the world, after the United States and Russia, to have achieved such a feat, officials from the two agencies said at a news conference in Beijing. In addition to the new mineral, scientists at the institute have also measured the content and traits of helium-3, an ideal fuel for future nuclear fusion power plants, from the Chang'e 5 samples. The results will facilitate the prospecting and assessment of the resource on the moon, Li said. It is estimated there are 15 to 20 metric tons of helium-3 on Earth that can be exploited by humankind, but the reserve of this substance on the moon could be at least 1 million tons, experts have suggested.

https://www.moondaily.com/reports/New_mineral_found_by_Chinese_scientists_999.html

**Astronomers discover new brown dwarf with quasi-spherical mass loss**

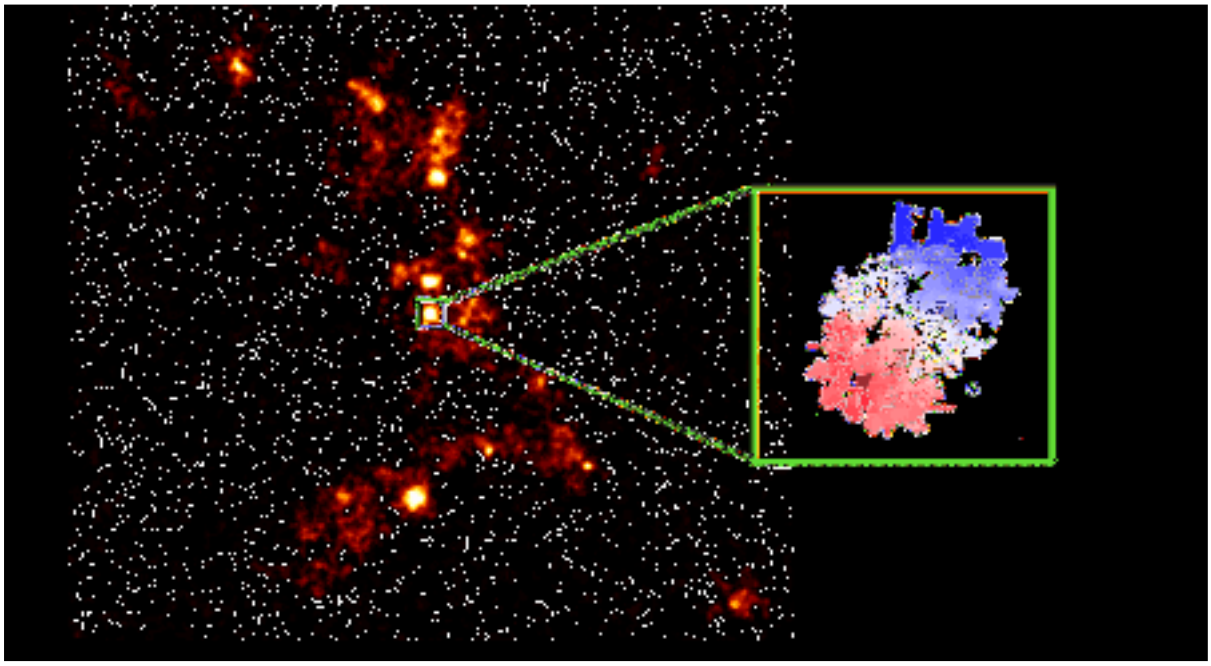



*Herschel column-density map of the Ophiuchus molecular cloud. The magenta star indicates the location of SSTc2d J163134.1. The Lynds L1709 dark cloud in the region is indicated. Credit: Ruiz-Rodriguez et al., 2022.*

Astronomers report the detection of a new brown dwarf as part of the Ophiuchus Disk Survey Employing ALMA (ODISEA) program. The newfound object, designated SSTc2d J163134.1-24006, appears to be experiencing a quasi-spherical mass loss. Brown dwarfs are intermediate objects between planets and stars, occupying the mass range between 13 and 80 Jupiter masses (0.012 and 0.076 solar masses). They can burn deuterium but are unable to burn regular hydrogen, which requires a minimum mass of at least 80 Jupiter masses and a core temperature of about 3 million K. First of all, the team serendipitously discovered an expanding shell of carbon monoxide ejected from an object, with a temperature below 3,000 K, located in the direction of the Ophiuchus Molecular Cloud. Further observations revealed that this shell is associated with SSTc2d J163134.1.

https://phys.org/news/2022-09-astronomers-brown-dwarf-quasi-spherical-mass.html

**A Galaxy Ten Times the Mass of the Milky Way is Preparing to Become a Quasar**



*The massive, hyper-luminous galaxy W0410-0913 and its surroundings, seen 12 billion years back in time. Credit: M. Ginolfi & G. Jones / VLT / ESO.*

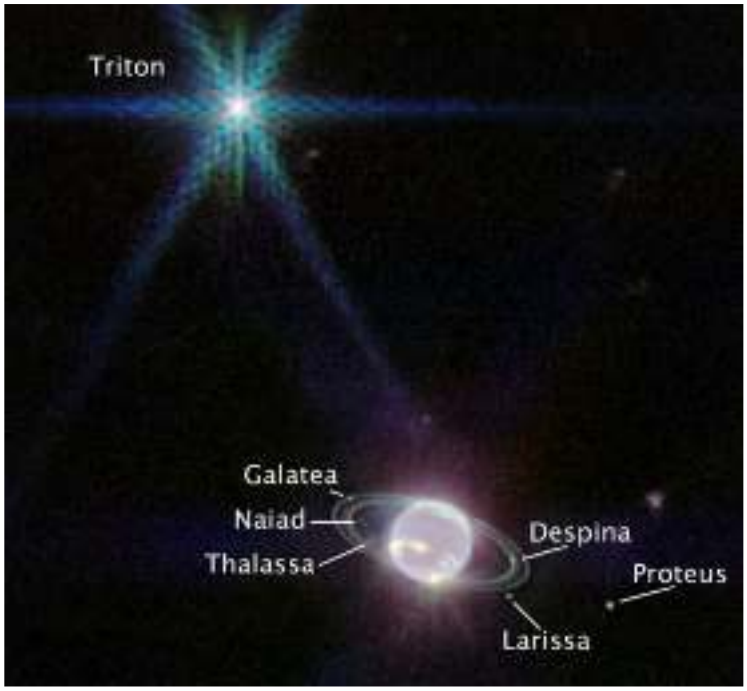
One of the fundamental questions in astronomy is how galaxies formed over 13 billion years ago and have evolved ever since. A common feature that astronomers have noted is that most galaxies appear to have supermassive black holes (SMBHs) at their center – like Sagittarius A*, the ~4 million solar mass SMBH at the center of the Milky Way. These monster black holes occasionally swallow up nearby gas, dust, and stars and emit excess energy as powerful relativistic jets. This phenomenon, where the center of a galaxy outshines the stars in the disk, is known as an Active Galactic Nucleus (AGN) or quasar. In a recent study, an international team of astronomers led by the European Southern Observatory (ESO) discovered a galaxy in the early Universe that could reveal more about this evolution. Using the Very Large Telescope (VLT) and the Atacama Large Millimeter/submillimeter Array (ALMA) in Chile, they observed a swarm of galaxies orbiting a very bright and vigorously star-forming galaxy in the early Universe. These observations provide fresh insight into how exceptionally bright galaxies grow and evolve into quasars and emit powerful jets of light across the observable Universe.

https://www.universetoday.com/157596/a-galaxy-with-ten-times-the-mass-of-the-milky-way-is-preparing-to-become-a-quasar/

**Webb captures clearest view of Neptune's rings in decades**

*Webb's Near-Infrared Camera (NIRCam) images objects in the near-infrared range from 0.6 to 5 microns, so Neptune does not appear blue to Webb. In fact, the methane gas so strongly absorbs red and infrared light that the planet is quite dark at these near-infrared wavelengths, except where high-altitude clouds are present. Such methane-ice clouds are prominent as bright streaks and spots, which reflect sunlight before it is absorbed by methane gas.*

NASA's James Webb Space Telescope shows off its capabilities closer to home with its first image of Neptune. Not only has Webb captured the clearest view of this distant planet's rings in more than 30 years, but its cameras reveal the ice giant in a whole new light.Most striking in Webb's new image is the crisp view of the planet's rings - some of which have not been detected since NASA's Voyager 2 became the first spacecraft to observe Neptune during its flyby in 1989. In addition to several bright, narrow rings, the Webb image clearly shows Neptune's fainter dust bands. Webb also captured seven of Neptune's 14 known moons.




Dominating this Webb portrait of Neptune is a very bright point of light sporting the signature diffraction spikes seen in many of Webb's images, but this is not a star. Rather, this is Neptune's large and unusual moon, Triton. Covered in a frozen sheen of condensed nitrogen, Triton reflects an average of 70 percent of the sunlight that hits it. It far outshines Neptune in this image because the planet's atmosphere is darkened by methane absorption at these near-infrared wavelengths. Triton orbits Neptune in an unusual backward (retrograde) orbit, leading astronomers to speculate that this moon was originally a Kuiper belt object that was gravitationally captured by Neptune.

https://www.spacedaily.com/reports/Webb_captures_clearest_view_of_Neptunes_rings_in_decades_999.html

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|---|---|---|
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