`"The Southern Cross"

HERMANUS ASTRONOMY CENTRE NEWSLETTER

FEBRUARY2020

Monthly meeting This month, the AGM will place on **Monday 17 February** at the **Catholic Church Hall** starting at **19.00.**

Membership renewal for 2020

The 2020 fees rare unchanged and remain at:
Member: R160
Member's spouse/partner/child, student: R80

New members joining after 1 October 2018 will have membership until the end of 2019.

Payment can be made in cash (at meetings directly to the Treasurer), or via online transfer. The Standard Bank details, for the latter, are as follows:
Account name – Hermanus Astronomy Centre
Account number – 185 562 531
Branch code – 051001
If you make an online donation, please reference your name and 'subs' or 'membership', or it is not possible to attribute the payment to you.

Trip to Sutherland This is scheduled to take place from **Friday 21 – Sunday 23 February.** See below for more details.

2020 meeting dates For your diaries. Meeting dates will be: 17 February, 16 March, 20 April, 18 May, 15 June, 20 July, 17 August, 21 September, 19 October and 16 November.

WHAT'S UP?

Venus – the evening star Venus is the brightest object in the sky after the Moon. Like Mercury, its orbit is closer to the Sun than Earth's is. Although its brightness makes it visible throughout the day, it is best observed either near sunset or soon after sunrise. Until the planet's orbit was fully understood, for many centuries it was thought to be two different planets; the evening 'star' and the morning 'star'. This year, it is the evening star from January to May, and the morning star for the rest of the year. Venus is easily seen partly because it is close to Earth (about 50% closer than Mars), but mainly because the unbroken cover of white clouds of sulphuric acid and water surrounding the planet reflects so much light (its albedo is 0.65 v Mars's 0.15). The dense atmosphere is almost 97%

carbon dioxide. The runaway green house effect means that surface temperatures are around 460°C and the surface atmospheric pressure is 92 times greater than on Earth.

LAST MONTH'S ACTIVITIES

Monthly centre meeting At the meeting on 20 January, Centre member, John Saunders, gave an absorbing presentation on 'The story of British astronomer Patrick Moore: an amazing and fascinating man'. John's comprehensive and enthusiastic presentation showed that Sir Patrick Moore was a man of many parts. He was host of the long- running monthly BBC TV programme 'The Sky at Night' in the UK and holds the record for having hosted a TV programme for the longest time. From when the programme began in 1957, he presented all but one of over 600 programmes.

Much more than a TV presenter, he was also a dedicated active amateur astronomer. He joined the British Astronomical Association at the age of 11, and published his first non-fiction book 'A guide to the Moon' in 1953. He also compiled the Caldwell Catalogue, an extension of the Messier. Other non-fiction and space fiction books followed. In the 1960s he was involved in the refurbishment of astronomical facilities in Armagh and also reported live from the US during the Apollo and Voyager missions. During his career he met many luminaries including H G Wells, Orville Wright, Edwin Hubble, Yuri Gagarin, Neil Armstrong and Buzz Aldrin. He was also a close friend of Queen guitarist Bryan May. A talented xylophone player, he also composed three operas. In 2001, he was knighted, and the first amateur astronomer to be made an Honorary Fellow of the Royal Society.

Interest groups

Cosmology There was no meeting in January

Astro-photography At the meeting on 13 January members continued discussing processing of astro-images.

Other activities

Educational outreach

Hawston Secondary School Space Cadets No meetings took place during the school holidays.

Lukhanyo Youth Club Construction of the analemmatic sundial at Lukhanyo is complete, Work continues on others at other Overstrand schools.

Stargazing No events took place during January.

THIS MONTH'S ACTIVITIES

Monthly centre meeting This month's meeting, the Annual General Meeting, will take place on **Monday 17 February** in the **Catholic Hall** starting **19.00**.

Interest group meetings

The **Cosmology** group meets on the first Monday of each month. The next meeting is on **3 February** at the **Catholic Hall**, starting at **19.00.** The next two lectures in the DVD series 'Black holes, tides and curved spacetime: Understanding gravity' presented by Prof Benjamin Schumacher of Kenyon College will be shown. The topics are L5:'The art of experiment' and L6: 'Escape velocity, energy and rotation'

There is an entrance fee of R10 per person for members, R25 per person for non-members, and R10 for children, students and U3A members. For further information on these meetings, or any of the group's activities, please contact Derek Duckitt at derek.duckitt@gmail.com

Astro-photography This group meets on the second Monday of each month. There will be no meeting in February.

To find out more about the group's activities and the venue for particular meetings, please contact Deon Krige at astronomy.hermanus@gmail.com

Hermanus Youth Robotic Telescope Interest Group Developmental work on this will resume soon.

For further information, please contact Deon Krige at deonk@telkomsa.net

Other activities

Stargazing If arranged, details of events will be circulated to members.

FUTURE TRIPS

Details have been circulated of a trip to **Sutherland** from **21-23 February**. Please contact Pierre de Villiers on pierredev@hermanus.co.za to book or obtain further information.

2019 MONTHLY MEETINGS

Unless stated otherwise, meetings take place on the **third Monday** of each month at the **Catholic Church Hall**, beginning at **19.00**. Details for the first part of the year are:

17 February	AGM
16 March	'Neutral gas in galaxies, and the MEERKAT'. Presenter: Dr Gyula Jozsa, Radio astronomer, SARAO, Cape Town
20 April	Topic: TBA Presenter: Dr Ros Skelton, SALT astronomer, SAAO, Cape Town
18 May	Topc: TBA Presenter: Dr Vanessa McBride, SAAO, CT

ASTRONOMY SELF-GUIDED EDUCATION CENTRE (ASEC)

Work continues on planning and administrative requirements for work to begin on the proposed Astronomy Self-guided Education Centre, to be located within the existing whale-watching area at Gearing's Point.

The **Friends of the Observatory campaign** was launched several years ago when preliminary work began on plans to construct an astronomical observatory in Hermanus. Over the years, members have been very generous, for which we are deeply grateful. It may seem logical to assume that, now money has been awarded by the National Lotteries Board, pledge monies are no longer needed. Unfortunately, that is not the case. NLC funds can only be used once the plans have been formally approved by the Municipality.

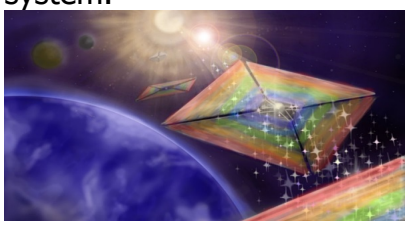
We would, therefore, be very grateful if members could either continue to contribute to the campaign or start becoming a contributor. Both single donations and small, regular monthly donations, of any amount, are welcome. Contributions can take the form of cash (paid at meetings), or online transfer, The Standard Bank details are as follows:

Account name – Hermanus Astronomy Centre
Account number – 185 562 531
Branch code – 051001

If you make an online donation, please include the word 'pledge', and your name, unless you wish to remain anonymous.

ASTRONOMY NEWS\

New light sail would use laser beam to ride through space 2 January: In long distance space travel, traditional rockets would eventually run out of fuel. There is an alternative. Since as early as the 19th century, scientists have dreamed of building spacecraft with light sails that can accelerate slowly, but for a much longer time, by catching the light from Earth's sun or, in more modern designs, powerful ground-based lasers. Researchers have now introduced a lab-tested design for a laser-driven light sail that can self-stabilise and could potentially ride a laser beam all the way out of our solar system.



M. Martin/Rochester Inst. of Tech.

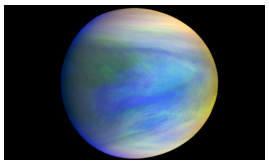
With a powerful enough laser, one can push a light sail away from Earth like a geyser of water would push a manhole cover. However, the slightest misalignment between the sail and the laser beam could send the spacecraft spiralling out of control. The new light sail reduces the chance of misalignment by changing the material used to convert the incoming laser into propulsion. Most light sail designs simply reflect the light to get a push, but the new design uses a different process known as diffraction that bends the incoming light to also generate a sideways force. If the sail is drifting away from the centre of the beam, this force naturally nudges it back. According to a report, the researchers have successfully built and tested a centimetre-wide prototype in their laboratory By: Yuen Yiu

The length of a day on Venus keeps changing 6 January: For over 50 years, humans have tried to pull back the thick clouds of Venus to study its surface. Most observations have tapped the long wavelengths of radar to pierce the cloud layers. Now, scientists have combined long-term radar observations of the planet's surface to try to clarify a longstanding mystery behind the length of Venus' day. On Earth, it is easy to measure how long a day lasts. You simply pick a feature and track how long it takes for the Sun to return to the same position. Venus is not so simple. On Venus, a day lasts about 243 Earth-days. That is longer than it takes the planet to complete an orbit around the Sun. So, a Venusian year actually spans just 225 Earth-days. The clouds make things even more challenging. They cover the surface and make it difficult to locate features.

Thanks to radar and spacecraft like NASA's Magellan mission, which spent four years visiting Venus in the early 1990s, astronomers thought they had a handle on the length of a Venus day. However, when the European Space Agency's Venus Express mission returned to the world, a team of scientists found something odd. In 2012, they showed that the planet's rotation seemed to have slowed down by a whopping seven minutes in the interim between spacecraft visits. The mystery makes it challenging to understand what is happening on the planet's surface, information that can help explain why a world that started out so much like Earth turned into an extreme hotbox. The lack of knowledge could also make it difficult to send a lander to Venus even though that goal has recently gained significant scientific support.

Now, researchers have combined almost 30 years of Earth-based observations of Venus to calculate an average rotation rate for the planet. The new average is slower than the average calculated by Magellan over a significantly shorter observation period of 487 days.

"Venus Express only saw that, yes, there was a difference, but there was fairly large uncertainty," said planetary scientist Bruce Campbell of the Smithsonian Institution in Washington, D.C. "We've brought that uncertainty down to a much finer level." The new results suggest that, over the course of 29 years, from 1988 to 2017, the average rotation of Venus was 243 days 30.5 minutes. That contrasts with Magellan's average of 243 days 26.6 minutes.


Composite image of cloud-covered planet Venus using data from the Japanese probe Akatsuki. Institute of Space and Astronautical Science/Japan Aerospace Exploration Agency

"Ideally, you'd like to be able to measure things precisely year to year," Campbell said. "Of major interest is how [those measurements] affect the long-term prediction of where a point on the surface is going to be," he said. In other words, if you want to drop a robotic explorer in a region of the planet, you need to know how quickly that point is spinning. Both Magellan and Venus Express watched the planet in detail for only a few brief years. The new measurements take a step back to look at the orbit over decades using the Arecibo Observatory in Puerto Rico and the Green Bank Observatory in West Virginia. While they do not nail down how the planet's orbit changes from year to year, they provide a long-term average that can be useful for visiting spacecraft, one that fits both spacecraft measurements. "If, 20 years out, we want to land on a certain place on Venus, I want to be sure my prediction is as solid as possible," Campbell said. "I wouldn't want to predict 20 years out then find out that the landing site is 5, 10, 15 kilometres away."

Long before spacecraft visited Venus, Earth-based telescopes were already trying to unveil its mysteries. In the 1960s, scientists used radar to determine that the planet spins backward compared to its orbit, which astronomers call retrograde rotation. Over the next 20 years, astronomers kept tracking Venus' features in an effort to pin down the length of a day. When Magellan arrived at Venus, its measurement of the planet's day was already almost 5 minutes longer than the radar measurements. Nearly 20 years later, Venus Express set the day back 7 minutes, closer to the original calculations made by Earth-based instruments.

So what's changing the planet's rotation rate? Previous studies have shown that the heavy atmosphere, far thicker than Earth's, can create a drag on the surface, slowing the planet's spin. Gravitational tugs from Earth and the Sun may also play a role in changing the length of the day. That means any given day on Venus (which, again, lasts 243 Earth days) might be slightly longer or shorter than the one before, depending on the weather. These changes aren't necessarily permanent. While the new research reveals a different average day length from previous measurements, Campbell and his colleagues caution that their findings do not mean the planet will one day stop spinning. Overall, the atmosphere's drag is balanced by the tidal pull of the sun, causing the planet to spin faster some days than others. So, while the atmosphere might slow the planet's spin down at times, the sun keeps it from excessive slowing. In fact, according to Jean-Luc Margot, a planetary scientist at UCLA who was not involved in the new findings, the opposite could be true. "We do not know if Venus' rotation is slowing down or speeding up," Margot said. "In fact, Venus' spin rate may very well be speeding up at this time." By: Nola Taylor Redd

NASA telescope discovers its first planet orbiting two stars 7 January: Since its launch in 2018, NASA's space-based TESS (Transiting Exoplanet Survey Satellite) has discovered at least 37 confirmed exoplanets and identified more than 1,500 exoplanet candidates. Now, it has uncovered its first Tatooine-like circumbinary planet - a world that orbits two stars instead of one.

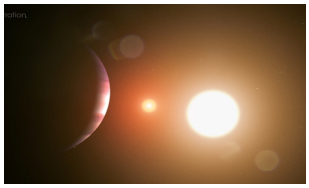


Illustration of planet TOI 1338 b orbiting two stars in a binary star system. NASA's Goddard Space Flight Center/Chris Smith

Astronomers have found only a handful of such circumbinary planets so far. The new discovery shows that many more of these exotic systems may be located around bright, nearby stars like those TESS is built to study. By finding and investigating more of these systems, astronomers hope to get a better understanding of how binary star systems form and evolve. Though TESS has already proven its worth over the last few years, it's now also uncovered a unique world dubbed TOI 1338 b, the first planet TESS has found orbiting a pair of binary stars. TOI 1338 b is about 1,300 light-years away in the constellation Pictor. Although one of its stars is slightly larger than our own Sun, the other is a tiny red dwarf only 30 percent of the Sun's mass. The two stars also are quite close together, orbiting each other once every 14.6 days. The planet TOI 1338 b traces a wider path around the pair, taking about 95 days to complete a single orbit.

Astronomers say that TOI 1338 b's orbit should remain stable for at least another 10 million years, but its orbital tilt changes over time. Although TOI 1338 b currently passes in front of its host stars from our point of view - which is how TESS was able to spot it - after November 2023, the planet's orbit will be too tilted to eclipse these stars for about eight years. That's not all that unusual, said Veselin Kostov, an astronomer from NASA's Goddard Space Flight Centre. This kind of changing orbital tilt is something that astronomers often see with circumbinary planets.

Out of roughly two dozen known circumbinary planets, 12 were discovered by NASA's Kepler Stapce Telescope, a satellite that was ultimately responsible for finding more than 2,300 exoplanets. However, a disadvantage of Kepler's otherworldly catalogue is that many of the exoplanets it found are too distant for astronomers to study in detail. Unlike Kepler, TESS was designed to find exoplanets around the nearest and brightest stars. By identifying such worlds, TESS is setting the stage for future follow-up observations with more advanced telescopes, such as the upcoming James Webb Space Telescope, which is planned for launch in 2021. By: Erica K Carlson

A ring of gas discovered circling a galaxy 8 January: Saturn may be the most famous celestial object sporting a flashy ring, but planets aren't the only ones accessioning. Entire galaxies, too, can have massive rings encircling them. A team of researchers has found an enormous gas ring around a galaxy called AGC 203001 that is a couple hundred million light-years away. The gas ring is bigger than usual for a galaxy, and also presents another mystery: Though it is made of the stuff stars form from, there are very few stars being made there.

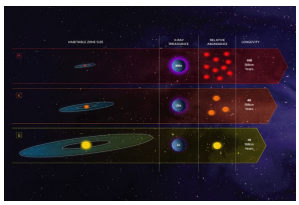
In galaxies, stars tend to form in dense clumps of cool, neutrally charged hydrogen gas. Gas made of atoms that are electrically charged, or ionised, tends to be too hot and energetic to clump into dense-enough patches to make stars. So when astronomers see galaxies that have a lot of neutral hydrogen gas, they usually expect to see lots of stars forming as well. That was not the case with AGC 203001. The researchers knew from previous observations the galaxy was not forming many stars, even though it has a lot of neutral hydrogen gas. They decided to take a closer look using the Giant Metrewave Radio Telescope, an array of 30 radio dishes located in India. They found this galaxy's neutral hydrogen was concentrated in a huge ring around the galaxy nearly 400,00 light-years across. That's about three or four times the diameter of the Milky Way's starry disk."The distribution of the gas in the form of a large and diffuse ring was very surprising," wrote Omkar Bait, an astronomer at the Tata Institute of Fundamental Research in India.

Astronomers think gas rings like this mau form around a galaxy when it collides with another nearby. Typically, they would expect such a collision to push gas together into denser clumps, encouraging new stars to form, but it seems as though that did not happen for AGC 203001. The researchers suggest several possible reasons for this. It is possible that a collision with another galaxy actually heated up AGC 203001's gas too much to clump together. Or it could be that the galaxy's gas was just so diffuse to begin with that a collision wasn't enough to clump the gas together. The team is working to observe more galaxies that have lots of hydrogen gas but not much star formation to try to find more galaxies like this. Running computer simulations to figure out how such rings of hydrogen gas might form will play a role in understanding these rare objects better, Bait says. By: Erica K Carlson

K dwarf stars may offer the best odds for hosting alien life 8 January: As researchers search the cosmos for extraterrestrial life, it is important to look for more than life-friendly planets. Another crucial factor in whether life can survive is the stars those planets orbit around. In recent years, some astronomers have suggested that a type of dwarf star called K dwarfs may be offer a 'sweet spot' for hosting life-friendly planets. Now, a group of researchers has studied a large batch of these red dwarfs to better understand their properties. They also evaluated how hospitable known exoplanets around K dwarfs may be for life.


Artist's impression of a planet orbiting a K-dwarf star. ESO/L. Calcada/Nick Risinger

They may actually be our best bet. The researchers suggest that K dwarfs may be the most promising type of star for hosting habitable planets. K dwarfs are a type of red dwarf - stars smaller and redder than our Sun and other 'G-type' stars. Among red dwarfs, they are the larger ones. Red dwarfs on the smaller end of the spectrum are called M dwarfs. The majority of stars in the Milky Way galaxy are red dwarfs. For that reason, astronomers have been very interested in learning what surface conditions - and thus the potential for hosting organisms - would be like for planets orbiting these stars. One big concern is that M dwarfs tend to give off a lot of high-energy X-ray and UV radiation, which can be harmful for life.


K dwarf stars may be 'Goldilocks' stars for extraterrestrial life, NASA, ESA, and Z. Levy (STScI)

K dwarfs, on the other hand, do not give off so much dangerous radiation. A group of researchers including Edward Guinan, an astronomer at Villanova University in Pennsylvania, found that planets orbiting K dwarfs would probably only get bombarded by one-hundredth the X-ray radiation that planets around M dwarfs would receive. The team also points out that K dwarfs have the added benefit of a longer stable lifetime than G-type stars like the sun. "There's nothing wrong with a G star," Guinan said during a press conference. "They just don't live too long."

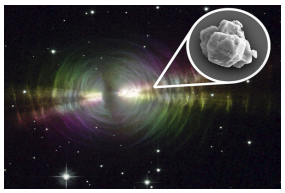
Stars like our sun spend about 10 billion years in the stable, 'main sequence' phases of their lives before ballooning into red giants. However, K dwarfs can live for 15 to 45 billion years before growing into red giants, giving planets around them much more time to potentially evolve life and then to keep living things around for longer. This combination of long life, relatively large numbers and low levels of dangerous radiation make K dwarfs a kind of 'Goldilocks' star for scientists searching for extraterrestrial life. By: Erica K Carlson

Scientists find meteorite pieces older than the solar system 13 January: In pieces of a meteorite, scientists have found tiny mineral grains that are older than the Sun and the solar system, which formed about 4.6 billion years ago. Some of these 'presolar grains', the researchers found, are between five and seven billion years old, making them the oldest known materials on Earth. The grains initially formed in interstellar space out of material ejected from mature stars that condensed into dust. The researchers who identified the grains think many of them likely were created following a boom in star formation the Milky Way experienced some seven billion years ago. If confirmed, the new finding demonstrates that researchers can study meteorites to better understand the history of star formation in our galaxy.

When small to medium stars (from about 0.5 to 5 times the mass of the Sun) approach the ends of their lives, they expand into red giant stars and blow off their outer layers. This results in beautiful, expanding clouds of material that astronomers call planetary nebulae. Over time, the material in these planetary nebulae cools and condenses into grains of dust and minerals. Some of these grains are then incorporated into clumps of interstellar gas, helping form new generations of stars, planets, asteroids and so on. Any presolar grains that were present when Earth first formed are now long gone, changed by our planet's geologic processes like volcanoes and plate tectonics. But meteorites that fall to Earth from space rocks preserve these cosmic time capsules. Ever since researchers began finding presolar grains in meteorites in 1987, they have studied these ancient relics to find out how old they are and where they came from.

In this latest research, a team of researchers led by the cosmochemist Philipp Heck of the Field Museum in Chicago analysed 50 presolar grains containing a mineral called silicon carbide. The samples came from the famous Murchison meteorite, which fell to Earth in Australia in 1969. When tiny, energetic particles called cosmic rays zip through space, they can strike minerals within rocks like tiny space bullets. This, in turn, causes some of the

silicon and carbon atoms in these minerals to fragment into other elements like helium and neon. By measuring how many of these minerals from the Murchison meteorite were transformed into helium and neon, researchers were able to determine how long they had been exposed to cosmic rays, and thus, how old they are.


The Egg Nebula, a cloud of material that blew off of a matured star, has large dust grains that may be like the silicon carbide minerals found in meteorites. Image of Egg Nebula: NASA, W. Sparks (STScI) and R. Sahai (JPL); Inset image: Janaína N. Ávila

The researchers found that the ages of the silicon carbide grains they studied ranged from roughly the age of the Sun to about three billion years older. Most of these grains were on the younger side, though - just four million to 300 million years older than the Sun. Heck and his team think the abundance of these relatively young presolar grains might be further evidence that the Milky Way underwent a burst in star formation some seven billion years ago. Through other methods, astronomers have found clues that the Milky Way probably experienced more star formation than average about seven billion years ago. So if you factor in the time it would have taken these stars to evolve into red giants and planetary nebulae, there should be an increase in dust grains that formed just millions of years before the Sun formed, Heck said. By Erica K Carlson

Second terrestrial planet found around closest star to the Sun 15 January: Our nearest celestial neighbour, the star Proxima Centauri, likely has a second planet. The planet, dubbed Proxima c, is at least about 6 times the mass of Earth and orbits its tiny red dwarf host once every 5.2 years. If confirmed, the newly discovered super-Earth would be the second terrestrial world found in the Proxima Centauri system, which is located just 4.2 light-years from Earth. According to the researchers, the discovery of Proxima c could provide insights into how low-mass planets around low-mass stars form, especially when the planets begin their lives well beyond a star's 'snow line', where water turns to solid ice.


Artist's conception showing Proxima Centauri system, inc. roughly Earth-sized planet Proxima b (left) and super-Earth planet Proxima c (right). Lorenzo Santinelli

The star Proxima Centauri has long captivated the astronomical community. This is largely due to the fact that the red dwarf is the nearest star to the Sun, meaning that future interstellar missions like Breakthrough Starshot will likely start by venturing to the Proxima Centauri system first. Furthermore, in August 2016, the discovery of a terrestrial planet orbiting in the middle of Proxima Centauri's habitable zone was announced. The Earth-sized world, dubbed Proxima b, raised hopes that a potentially life-firendly planet could be hiding right next door, (cosmically speaking, of course).

Finding a second planet around Proxima Centauri not only increases the appeal of exploring the system more closely, it also raises some important questions about a feature

of planetary systems called the snow line. The snow line refers to the minimum distance from a star at which molecules (such as water, methane, or carbon dioxide) 'freeze out' and become solids. According to most planet formation models, it is easier to create a super-Earth planet when it forms near the snow line, as icy grains tend to glom together more quickly and easily. As the authors of the new study state: "The formation of a super-Earth well beyond the snow line challenges formation models according to which the snow line is a sweet spot for the accretion of super-Earths, due to the accumulation of icy solids at that location, or it suggests that the protoplanetary disk was much warmer than usually thought." However, before the researchers can draw any sweeping conclusions about how Proxima c formed, they say they need additional evidence to completely confirm its existence. By: Jake Parks

Four strange new objects found around the Milky Way's huge black hole 17 January: Astronomers have discovered four new and mysterious objects orbiting the Milky Way's supermassive black hole, Sagittarius A*. The bizarre objects look a lot like common clouds of gas and dust, but they surprisingly manage to stay compact like stars as they run laps around our galaxy's gargantuan black hole.

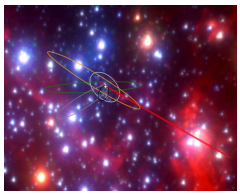


Illustration of the orbital paths of the six known G-objects around the supermassive black hole in Milky Way centre. Anna Ciurlo, Tuan Do/UCLA Galactic Center Group

The quartet of new objects share striking similarities with two others, dubbed G1 and G2, that were found in the past 15 years or so. This has led researchers to conclude the four new bodies likely belong to the same class of objects as G1 and G2, which are simply referred to as G-sources or G-objects. Researchers do not yet know exactly what these G-objects are, but they think the strange bodies may be binary stars in the process of merging.

The team that spearheaded the new work has been studying the centre of the Milky Way for decades. In the past, they have studied the motions of stars that orbit treacherously close to Sagittarius A* to better understand the supermassive black hole and its properties. In a recent project, they investigated the gases near the centre of our galaxy with near-infrared light, which can penetrate the dust that surrounds our galaxy's core. This is how they noticed what appeared to be four clumps of gas orbiting Sagittarius A*, which has a mass of some 4 million suns. However,instead of Sagittarius A*'s intense gravity stretching out the gas clouds as expected, the clumps stayed compact as they travelled around the black hole, said Anna Ciurlo, an astronomer at UCLA. Ciurlo and other researchers concluded that the four clumps were likely the same type of object as the two other gassy-looking objects - G1 and G2 - previously found orbiting the galaxy's core. Therefore, they dubbed the new objects G3, G4, G5 and G6.

The researchers are not sure what these G-objects are yet, but the fact that the gas clouds stay compact suggests that they'are hiding stars within their murky depths, Ciurlo said. As for why stars might have such big, cloudy layers of gas and dust around them, the researchers propose they are binary star systems - in which two stars circle each other - in the process of merging. Binary stars are common throughout the galaxy, and they sometimes merge into a single object. This process wouldn't happen instantaneously,

though; it could take millions of years, Ciurlo said. As a pair of stars spiral toward one another, they pull layers of material from each other, which could form big clouds of gas and dust around the pair. In order to confirm whether this is what's happening with the G-objects, the researchers say they'll have to collect more information about these enigmatic bodies. By: Erica K Carlson

Meteorite impact 2 billion years ago might have ended an ice age 21 January: Yarrabubba crater in western Australia stretches roughly 64 km across. Since its discovery in 2003, scientists have speculated it is one of Earth's oldest meteorite craters. Now, a team of researchers has pinned down the crater's precise age, revealing it's about 2.23 billion years old. This officially makes Yarrabubba the oldest known crater on Earth, surpassing the age of Vredefort crater by about 200 million years.


A powerful, ancient impact created Yarrabubba crater in western Australia, and new research found the strike occurred some 2.2 billion years ago, making the crater the oldest known on Earth. James Thew/iStock/Thinkstock

The meteorite impact that created Yarrabubba would have slammed into our planet at the end of one of our 'Snowball Earth' ice ages, the researchers say, and it is possible that the impact heated up our planet and ended that icy episode in Earth's history. Researchers think that meteorite impacts have had dramatic effects on Earth's climate throughout our planet's history. However, scientists have only been able to measure precise ages for a handful of impact craters so far, so it is tricky to connect meteorite impacts to historic climate events.

To put a precise age on Yarrabubba crater, researchers analysed minuscule features within tiny zircon and monazite minerals in rocks near the crater. These rocks, they say, must have formed by melting in the shock of the meteorite impact before recrystallizing afterwards. The recrystallised minerals contain some uranium, which naturally decays into lead over time. So, by measuring exactly how much of the uranium has decayed into lead, the scientists were able to precisely pin down age of the minerals, and thus, when the impact occurred. Through this measurement, the scientists found that the meteorite that formed Yarrabubba crater crashed into Earth 2.23 billion years ago. "It gives me hope that we can determine more ages using this technique," said Timmons Erickson, a researcher at NASA's Johnson Space Centre.

The new age measurement puts the Yarrabubba impact at the end of one of Earth's global ice ages. To investigate how it might have affected Earth's climate, the researchers ran computer simulations of an impact big enough to create a 64km-wide crater like Yarrabubba on a continent-sized glacier. They found that the crash would have instantaneously vaporised huge amounts of ice, potentially releasing as much water vapour as about 2 percent of what is currently in Earth's atmosphere. Despite water being necessary for life, water vapour is a powerful greenhouse gas, so it is possible that injecting so much extra water vapour into the atmosphere could have helped warm the planet and brought about the end of the 'Snowball Earth' period that occurred roughly 2.2 billion years ago. By: Erica K Carlson

Celebrating the legacy of the Spitzer Space Telescope 23 January: On the Tuesday 28 January, Spitzer will carry out its final day working on science missions, which it will spend gathering data on the cosmos. On Thursday, the space telescope will be placed into a 'hibernation mode', leaving it to drift through space forever. Unlike the Hubble Space Telescope, Spitzer will not be deorbited and burn up in Earth's atmosphere. This is because Spitzer does not orbit Earth; it is in an Earth-trailing orbit around the Sun about 158 million miles behind the Earth to keep it away from interfering heat. In about 53 years, Spitzer's orbit will take it past our planet. But, once the telescope flies by Spaceship Earth, Spitzer will drift off in the opposite direction into the emptiness of space, said Joseph Hunt, the current Mission Manager for Spitzer,


The Spitzer Spcae Telescope - the space observatory that discovered the planet-rich Trappist system, studied some of the most distant galaxies in the universe, and captured countless breathtaking photos of the cosmos.

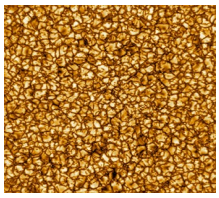
"You have to be proud when you look back," said Joseph Hunt, the current Mission manager for the Spitzer mission. During a press conference held by NASA on 22 January, scientists reflected on the legacy Spitzer will leave behind. According to Suzanne Dodd, the former Mission Manager, much of the team working on Spitzer has been involved with the project since its launch in 2003. Throughout the press conference, many reflected on the pride they felt working on the mission, describing how they wanted to share their work with family and friends, continually spreading the knowledge that Spitzer helped unlock."The team is what makes the science matter," said Hunt.

Throughout 2020, team members will be archiving the data Spitzer gathered throughout its life to aid in future research. Over its lifetime, Spitzer has captured interstellar wonders through its infrared vision, but recently it has become more difficult to operate. Originally, Spitzer was supposed to retire in 2018 when its successor, the James Webb Space Telescope, was expected to launch. However, due to delays that have plagued the new space observatory, Spitzer's mission was extended until 2020. After a life dedicated to serving science, now Spitzer's watch has ended.

Because it sees in infrared, AKA heat, Spitzer's capabilities have been crucial for NASA's observing missions. The instruments have allowed scientists to collect data from areas of our universe normally clouded by interstellar gas and dust. The telescope has certainly earned its keep over the course of its decade-and-a-half-long mission. Spitzer peered through gas and dust clouds to image some of the most distant galaxies, parsed the chemical makeup of dust clouds in the universe and even found a few planets. In the last year and a half of Spitzer's mission, it spent a lot of time studying the universe for exoplanet systems, a mission it was not designed to do. Even so, the telescope discovered a number of exoplanets, including the Trappist-1 system, the closest group of exoplanets to Earth. By Hailey Rose Maclaughlin

See the most detailed picture of the Sun's surface ever taken 31 January: A new solar telescope in Hawaii has taken its first photo and movie of the Sun. The shots are the

highest resolution views of our star yet, showing details on the Sun's surface as small as about 29 km in size.


Bubbling convection cells, each about the size of Texas, rise and fall across the Sun's surface. NSO/AURA/NSF

The Daniel K Inouye Solar Telescope is located on the Haleakala volcano on the island of Maui. A primary mirror that's 4 metres wide makes this the biggest solar telescope on Earth, and it will be able to resolve smaller details on the Sun than ever before. With the telescope's sophisticated instruments and high resolution, scientists hope to better understand remaining mysteries about our nearest star.

The grainy pattern in the telescope's 'first light' image is the mark of plasma cells on the Sun's surface. Hot plasma from within the Sun rises to the surface, cools and sinks back down in a process called convection, like bubbling water in a boiling pot. The hotter parts where new plasma has just risen up from below appear bright in the photo, while the places where cooler plasma sinks back down appear dark. The grains in this first image from the telescope are roughly the size of Texas.

The bubbling motions of hot plasma in the Sun are tied to some of the greatest remaining mysteries about our star. Because plasma is electrically charged, its motions can create magnetic fields. The Sun's magnetic fields are responsible for a lot of its most dynamic behaviour, like solar storms that can disrupt satellites and power grids on Earth. "Most solar storms originate in places on the Sun where there's strong magnetism, strong concentrations of magnetic forces," Rebecca Centano Elliott, a solar scientist at the National Centre for Atmospheric Research, said By: Erica K Carlson

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DID YOU KNOW?

Astronomical catalogues Part 16: Some final titbits

Lalande catalogue

Joseph Lalande (1732 – 1807), a French astronomer and mathematician. In 1751, while Nicolas-Louis de Lacaille was in the Cape, they undertook a project, measuring the position of the Moon simultaneously from Berlin and Cape Town to obtain an accurate value of the lunar distance. Lalande was also involved in several other aspects of 19th century astronomy including calculating solar parallax.

In 1801, he published *Histoire Celeste Francaise.* Among other material, it included a full-sky catalogue of 47,390 stars down to 9th magnitude. The observations had mainly been made from Paris, so the catalogue included mainly northern hemisphere stars. It was the most complete catalogue at that time. One of the stars, observed in 1795, turned out, in 1846, to be the planet Neptune. The catalogue was revised in 1846, adding reference numbers what are still used to refer to some stars. Its reasonable accuracy meant that this catalogue was a standard reference worldwide throughout 19th century.

Gliese Catalogue

As a student, the German astronomer Wilhelm Gliese (1915 – 1993) was encouraged to study nearby stars. He worked in this speciality until his death, aged 78, even after he had formally retired 13 years earlier.

The first edition of the *Gliese Catalogue of Nearby Stars* was published in 1957. It included 65 stars within 65 ly (20 parsecs) of Earth. Ordered by right ascension, it listed the known properties of each star. They were labelled Gl followed by the list number. Listed stars include red dwarfs, lone stars etc. The 1969 updated second edition contained 1,529 stars; all known stars to 72 ly (22 parsecs). Gliese published the *Third Catalogue of Nearby Stars* (CNS3) in 1991. Its range was 25 parsecs (82 ly) and contained over 3,800 stars. Although designed as a preliminary, it is the version still in use. Some stars are still primarily known by this catalogue's number eg Gliese 581, Gliese 71. The most recent update was published in 2010, in electronic format.

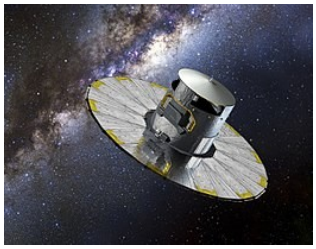
Herschel 400 Catalogue

This is a modern derivative of the William Herschel's original 19th century *Catalogue of Nebulae and Clusters of Stars.* Items in this 1980 subset were elected by members of the Ancient City Astronomy Club in St Augustine, Florida. It was a response to a suggestion in Sky and Telescope magazine that this old 2,500 item catalogue would be an excellent basis for deep sky object selection by amateur astronomers seeking a challenge after the Messier Catalogue.

The objects are listed by NGC numbers and M and/or C numbers, where appropriate. The 400 objects are all visible from mid-northern latitude with 6" or larger telescopes. The 400 include 17 Messier objects. Although it predates the *Caldwell Catalogue,* it includes 44 Caldwell objects. It includes galaxies (231), globular clusters (34), nebulae (6), star clusters (100), star clusters and nebulae (5) and planetary nebulae (24). The objects are located in 49 constellations.

Astronomical catalogues have come a long way from their modest beginnings. Many contemporary catalogues reflect the growth in data- generating capacity of astronomical satellites and land-based facilities. Several are linked to particular space missions and the large volumes of data derived from these eg *Gaia Catalogue*

Gaia Catalogue



The Gaia astrometry spce observatory was launched in 2013. Stationed at the L2 Lagrangian point 1.5 million km from Earth, facing away from the Sun, it is bulding up a 3-D image of the Milky Way. CCD cameras measure positions, proper motions and parallaxes while other detectors do multicolour photoemtry of the same stars.

From July 2014 to May 2016 it undertook a 22 month full sky survey. Among many other variables, the positions, motions, distances, magnitudes and colour of 1.7 billion star were recorded. 450 scientists and software engineers manage and catalogue the massive amount of data on these stars and a myriad other celestial objects. The *Gaia Catalogue* is being relieased in stages, each part incorporating increasing amounts of information. Apart from providing huge amounts of new information about what is in the Milky Way, it

is hoped that this data will also facilitate understanding of the formation and evolution of the galaxy.

Sources: Ridpath, I (Ed) (2012) Oxford dictionary of astronomy 2nd ed rev, www.astronomy.com, www.en.wikipeda.org

For more information on the Hermanus Astronomy Centre and its activities, vvisit our website at www.hermanusastronomy.co.za

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