"The Southern Cross"

HERMANUS ASTRONOMY CENTRE NEWSLETTER

MAY 2019

Monthly meeting This month's meeting will take place on **Monday 20 May** at the **Catholic Church Hall** starting at **19.00.** The scheduled presentation on the upgraded HESS facility in Namibia by Centre member Herbert Poller has been postponed until October. The presenter for May is Dr Daniel Cunnama, Science Engagement Astronomer at the SAAO in Cape Town. The title of his presentation is 'Simulations of galaxies and galaxy clusters". See below for details.

Stargazing The next event is scheduled for **Friday 3 May** or **Saturday 4 May**, weather permitting. The venue will be Gearing's Point and the start time 19.00. Information on whether either date will allow for stargazing will be circulated to members closer to the time.

WHAT'S UP?

Lunar X The terminator on the Moon is the line separating the lit from the dark areas of its surface. At certain times during the lunar cycle, depending on the relative positions of Earth and Moon, the interplay of light and dark over particular parts of the Moon's very variable terrain, can produce interesting-looking shapes. This is an astronomical example of the 'clair-obscur effect', found in the visual arts, in which light and shadow contrasts are used to create a particular visual effect. Lunar X is the shape (among several found on the Moon) visible during first quarter this month. This shape is created by sunlight falling on the ridges between three adjacent craters: La Caille, Blanchinus and Purbach. When present, it is visible for around two hours, but there is particular time during which it is fully formed. For South Africa 11 May at 18.25 and 4 November at 19.18 are the optimal days and times to observe this phenomenon. Located about a fifth of the way down from the upper edge of the Moon (longitude +1.1°, latitude -25.8°), it is visible through binoculars.

LAST MONTH'S ACTIVITIES

Monthly centre meeting The presenter at the 15 April meeting was Dr Shazrene Mohamed from UCT and SAAO. A gifted presenter, she gave an informative and enjoyable talk titled 'Another one bites the dust'. She explained how interstellar dust, which is 10th the width of a human hair and whose closest neighbours in space are 100m away in all directions, punches above its size and volume. When concentrated in molecular clouds, the way it absorbs, reflects and re-emits incoming energy from stars creates the cool environment needed for star formation inside these stellar nurseries. Earth-based optical telescopes are not good sources of information about interstellar dust. However, other instruments reveal the clouds of dust present around many celestial objects. Space-based telescopes including the Hubble Space Telescope, the Spitzer Space Telescope the SOFIA airplane which flies at the edge of the atmosphere all undertake infrared astronomy and are invaluable sources of information about the location, character and behaviour of interstellar dust. Scientists like Chazrene are looking forward to the launch of the James Webb Space Telescope which will be a cutting-edge infrared instrument.

In addition to its role in the birth of new stars, interstellar dust also imparts important information on the past, from how solar systems and planets form to the ways in which stars, both small and large, behave when they reach the end of their lives. Solar system formation involves accretion of dust, while it is released when stars die, forming the s-called 'dust cycle'. Observation of the dust components of structures like planetary nebulae and supernova remnants helps scientists understand the processes involved. Shazrene finished by exploring a little of the role which dust may play in storing and transporting chemicals needed for life eg amino acids across space. A couple of space missions have attempted to capture dust particles in space, not an easy task as the particles of minute and widely scattered. However, a few have been trapped and successfully returned to Earth and the presence of complex as well as simple molecules confirmed.

Interest groups

Cosmology At the meeting on 1 April, Pierre Hugo presented the eighth part in the current series on 'Natural philosophy: science for non-scientists'. It was the second part of the topic "Fabric of space - inertia '.

Astro-photography At the 8 April meeting, attendees worked on images taken at the recent Southern Star Party.

Other activities

Educational outreach

Hawston Secondary School Space Cadets Weekly meetings have resumed.
Lukhanyo Youth Club Work continues on the construction of analemmatic sundials here and other schools in the Overstrand.

Stargazing No events took place in April

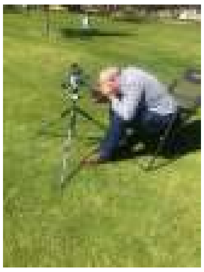
Southern Star Party Derek Duckitt reports: "Three members of the HAC attended the SSP from 5–7 April, our chairman Dr Pierre de Villiers, Bennie Kotze and myself. Pierre took his superb Williams Optics refractor and the solar scope kindly donated to the HAC by Johan Retief, Bennie had his fancy Go to which he controls by Wi Fi from his smart phone, and I had the Celestron 14" 'orange monster' donated to the HAC by UCT as well as a new camera tracking mount designed for astrophotography. Heavy rains had been predicted for Thursday, so we shifted our stay on by one day.

From Hermanus there are two roads to get to Leeuwenboschfontein, either by way of Worcester or via Bonnievale and Montague. I opted for the latter which gave me the opportunity to load up some of the superb cheeses at the Parmalat factory shop in Bonnievale!

There was an excellent turn out at the event, with 72 attendees and 46 telescopes. A wonderful venue with its dark skies, clear air and excellent facilities and scenic countryside, a great program arranged by the 'Starpeople' (mainly Ed and Lynette Foster and Auke Slotegraaf), and an opportunity to see and use some of the fantastic equipment brought along by the amateur astronomers all contributes to the popularity of this event. The weather played along with clear skies on Saturday and Sunday, and only a few clouds late on Friday evening.


The person on the left of the above photo is Clemence Thomas, a teacher from Touws River who was presented with a telescope by the outreach division of SAAO for the learners to use.


Bennie and I figuring out how to assemble the solar scope


Using the solar scope on my tracking mount

The evenings would start out with Auke doing a "What's up tonight" talk pointing out various objects in the sky in his usual humorous manner. I managed to get a prime focus image of the Orion nebula with my camera mounted directly on the C 14 telescope, something I tried without success in the past, but fixing the collimation in the previous month (with a great deal of help from Bennie and Pierre) made the following image possible:


I still need to perfect the focussing (also I need to improve the way the camera is mounted to the eyepiece holder), but this is a start!

The following images are a few of those I took with a 35 mm lens on my tracking mount. Each image represents a total exposure time of about 15 minutes' worth of stacked images. Now that the 14" is properly collimated I was able to see some of the best, pin sharp, views of objects such as Omega Centauri. Below are some other images we took.

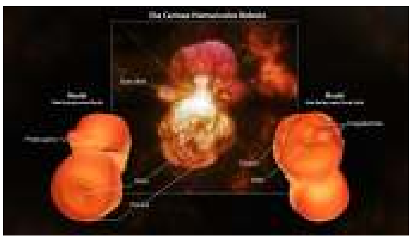

Eta Carina area of the Milky Way


Southern Cross, Coal Sack and the 2 Pointers below it


The bright object in the Milky Way is Jupiter


Large Mavvgellanic Cloud


Martin Lyons’ 18” telescope – we were able to see incredible views through this telescope. I was able to see the Homunculus Nebula in Eta Carinae in almost as much detail as the photo below.



Looking at the Leo triplet of galaxies, the following image is pretty much how you see it through the 18” telescope:

Dr David Cunnama, outreach officer for SAAO, and Dr Sally Macfarlan gave riveting lectures on Saturday morning, and in the afternoon various amateur astronomers gave inspiring talks on how they became involved in astronomy. In summary, the event lived up to expectations as one of the astronomy highlights of the year."

THIS MONTH'S ACTIVITIES

Monthly centre meeting This month's meeting, will take place on **Monday 20 May** at the **Catholic Hall** starting **19.00**. The presenter, Dr Daniel Cunnama is Science Engagement Astronomer at the SAAO in Cape Town. After completing a BSc in Computational physics at UKZN in 2005, he completed his Honours in Astrophysics and space science at UCT a year later. Back at UKZN, he obtained an MSc in Computational solid state physics in Then he enrolled at UWC, being awarded his PhD in Astronomy and astrophysics (2013) before being awarded an SKA Post-doctoral research fellowship. In 2017 he moved to SAAO, first as Outreach Astronomer, and currently as Science Engagement Astronomer.

As a member of the Galaxy research group at SAAO he stated, 'I completed my PhD in Computational Astrophysics at the University of the Western Cape in 2013 with a thesis entitled "Galaxy Evolution and Cosmology using Supercomputer Simulations". My work has been directed toward theoretical support for the Square Kilometer Array project and has led to tight collaborations with myself and theorists in Australia working on the SKA Project. My Postdoctoral research has continued in this line and together with my main collaborator Prof Chris Power(UWA, Perth) and Dr Andreas Faltenbacher (WITS) we aim to provide a wealth of simulated galaxy catalogues to scientists working on both the SKA and other large surveys. Details on his presentation will be circulated, in due course.

Interest group meetings

The **Cosmology** group meets on the first Monday of each month. The next meeting is on **Monday 6 May** at the **Catholic Hall**, starting at **19.00.** Pierre Hugo will lead the ninth session in the series 'Natural philosophy: science for the non-scientist'. The topic will be 'Gravity – spatial flow'

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 Pierre Hugo at pierre@hermanus.co.za

Astro-photography This group meets on the second Monday of each month. The next meeting will be on **Monday 13 May.**

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 The next event is scheduled for **Friday 3 May** or **Saturday 4 May**, weather permitting. The venue will be Gearing's Point and the start time 19.00. Members will be informed close to the time whether either date will allow for stargazing.

FUTURE TRIPS

Planning is underway for an outing this year. Members will be sent details once the arrangements have been made.

2018 MONTHLY MEETINGS

Unless stated otherwise, meetings take place on the **third Monday** of each month at the **Catholic Church Hall**, beginning at **19.00**.

20 May	'Simulations of galaxies and galaxy clusters'.Presenter: Dr Daniel Cunnama, Science Engagement Astronomer, SAAO, CT
24 June	'Star formation and the gas cycle in galaxies'. Presenter: Dr Moses Mogotsi, SAAO., CT
15 July	'Near-Earth asteroids: monitoring close approaches and mitigating objects'. Presenter: Dr Nicolaus Ersamus, SAAO, CT
19 August	'More unusual curvaceous geographical wonders of Earth'. Presenter: Jenny Morris, Centre member
16 September	Topic TBA. Presenter: Pierre de Villiers, Centre chairman
21 October	'The upgraded HESS facility in Namibia'. Presenter, Herbert Pioller, Centre member
18 November	'The Cassini family dynasty and their Saturnian legacy'. Presenter: Jenny Morris, centre member
9 December	Xmas party

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\

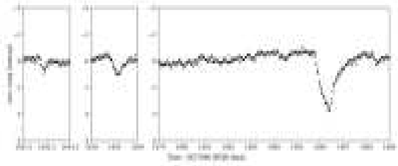
TESS spots its first exocomet around one of the sky's brightest stars 3 April: The planet-hunting TESS telescope has big shoes to fill - shoes that once belonged to Kepler. Before its retirement last October, the pioneering Kepler Space Telescope spent 10 years paving the way for the search for planets (and possibly life) outside the solar system. Of the nearly 4,000 exoplanets discovered around other stars to date, Kepler found more than half. Now, TESS is up to bat, and it is already off to a great start.


Astronomers have found clear observational evidence of an exocomet around the bright star Beta Pictoris, Seen here is anartist's concept. NASA/FUSE/Lynette Cook

Over the next two years, TESS is expected to find roughly 20,000 new exoplanets hiding in the glow of the sky's brightest stars. Additionally, according to NASA's exoplanet exploration website, "TESS will discover dozens of Earth-sized planets and up to 500 planets less than twice the size of Earth." What about the even smaller stuff? For instance, exocomets. Do not fret. TESS can find those too. According to a new study, astronomers have detected an exocomet passing in front of one of the sky's brightest stars, Beta Pictoris, located some 65 light-years away. Although other exocomets (and an exoplanet) have been detected around Beta Pic before, this is the first time astronomers have found a comet around the star using a light curve from TESS. "Other astronomers have seen hints of exocomets towards Beta Pic and other stars using an instrument called a spectrograph," Leiden University astronomer and co-author Matthew Kenworthy said. "But this light curve is very strong proof because it has the shape that was predicted by anotehr astronomer 20 years ago. The light curve we see matches the computer model he made very well."

In order to detect faint objects (such as exoplanets and exocomets) around bright stars, many planet-hunting telescopes like Kepler and TESS rely on the transit method of detection. Basically, astronomers plot how the brightness of a star changes over time, creating what is called a light curve. If they see a dip in the star's light curve, they analyse how long and deep the dip is, which provides them with information about what is causing the star's temporary drop in brightness. When searching for exoplanets, astronomers look for symmetrically shaped dips that repeat over time. These indicate a symmetrical body, such as a spherical exoplanet, is orbiting in front of the star. Then, by analysing the characteristics of the dips, researchers can tease out some of the exoplanet's properties, such as its mass and radius.

However, when searching for exocomets, astronomers do not look for symmetrical dips in the light curve. They hope to see the star's brightness drop quickly at first, then take its time returning to a baseline level. This is because comets are not perfectly round. Instead, they leave an extended tail of dusty debris behind them. Like the cometary body itself, these tails also block light, so they leave an imprint on the light curve too. Since comet tails thin out the farther you get from the comet itself, less and less light is blocked over time. In other words, the light-curve signature of a comet has a dramatic initial dip, followed by a tapered return to normal.

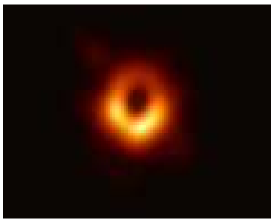


Light curves from three possible exocomet transits in front of the bright, young star Beta Pictoris. Zieba et al., arXiv, 2019

Astronomers discovered the new exocomet around Beta Pic using data collected by TESS (the Transiting Exoplanet Survey Satellite) between 19 October 2018 and 1 February 2019. Although it is difficult to determine many of the comet's characteristics because its orbital trajectory and composition are not well constrained, according to the study, if we assume it orbits at about 1 astronomical unit (an AU is the average Earth-Sun distance), then the comet's tail extends some 200 million km behind it. That means the comet's tail is about 1.3 AUs long.

Currently, it is thought that the disk of gas and dust around young stars (like Beta Pic, which is only about 20 million years old) should be primo locations for comets, as comets are believed to be the building blocks leftover from planetary formation. In fact, a 2014 study found spectroscopic evidence for thousands of exocomets in the Beta Pic system. However, if researchers find that other young stars don't seem to have as many exocomets as we expect, then we may be missing something rather important in our theories of planetary formation. By: Jake Parks

Event Horizon Telescope releases first ever black hole image 10 April: On Wednesday, astronomers revealed the first image ever taken of a black hole, bringing a dramatic conclusion to a decades-long effort. The iconic image offers humanity its first glimpse at the gas and debris that swirl around its event horizon, the point beyond which material disappears forever. A favourite object of science fiction has finally been made real on screen. Their target was a nearby galaxy dubbed M87 and its supermassive black hole, which packs the mass of six and half billion suns. Despite its size, the black hole is so far from Earth – 53 million light-years – that capturing the image took a telescope the size of the planet.



The first ever image of a black hole shows the supermassive black hole in the heart of galaxy M87.Event Horizon Telescope

This monumental accomplishment was only possible thanks to the Event Horizon Telescope (EHT). The image data was taken back in 2017 but scientists have spent two years piecing it together. That is because EHT is made of up eight independent observatories that are scattered across the globe, cooperating together to act as one enormous detector. Shep Doeleman, director of the EHT, announced, “We are delighted to report to you today that we have seen what we thought was unseeable.” Researchers made their grand announcement simultaneously in seven different countries this morning, accompanied by a series of scientific papers.

Black holes are so massive and dense, not even light can escape their pull. They are often referred to as a singularity, or a point source, because they take up zero actual space. This mysterious singularity is surrounded by the sphere of its event horizon, and anything that travels past it is doomed to fall into the black hole, with no hope of escape. That means the black hole itself is literally dark – it neither reflects nor gives off any light. So, there is nothing to photograph, no matter how advanced the technology. In the Event Horizon Telescope's image, it simply appears as a central dark blob, or what astronomers often call the black hole's 'shadow'.

Feryal Özel is an astrophysicist at the University of Arizona and an EHT collaborator. She explains the shadow as the black hole absorbing the light around it. The light stems from the hot gas that is swirling around it and gets heated as it falls into the black hole. "So, our telescopes are able to pick up the light as long as it comes not from the immediate vicinity of the black hole, but just outside it," Özel says. "When the light falls into the event horizon, that part is dark in the image. Whether or not shadow is the perfect word, it imprints this darkness on the surrounding emission." Taking an image of a shadow where a black hole should exist might not seem extraordinary, but black holes also are not strictly speaking proven to exist - at least not everywhere scientists expect them, like at the centres of most large galaxies. Seeing this shadow confirms that it really is a black hole, Özel says.

Like a whirlpool, the material spiralling around a black hole is mostly flat. Scientists call it an accretion disk. These disks can stretch across vast distances and give off incredibly bright energy that shines across the cosmos. However, capturing these beacons is like photographing a mushroom cloud during an atomic blast, when the real science is happening on the level of atoms at the heart of the explosion. Scientists have long desired to see inside the disk to where the material actually disappears into the black hole. Before EHT, that level of detail had eluded them. Occasionally, this semi-chaotic swirl of accretion disk material collides with itself, launching matter out in jets that extend thousands of light-years and travel at nearly the speed of light. Astronomers have already photographed M87's jets using more conventional instruments, like the Hubble Space Telescope.

The exact cause of these extreme speeds remains unclear. Scientists say that magnetic fields are a prime suspect. "We think the spin of the black hole interacting with the magnetic field is what causes the jets, but we don't have proof," says Özel. Imaging the central area of the black hole should give that proof. "If we see jet-like images or anything associated with it I think it increases our confidence that jets are formed very close to the black hole," Özel adds.

In addition to the jets, studying the swirl of material near M87 also gives astronomers the most accurate weight ever for this monster black hole, which is one of the most massive in the known universe. Astronomers can weigh the black hole at the centre of our Milky Way, called Sagittarius A* (pronounced A-star), by watching the motions of individual stars zooming around its perimeter. M87's black hole is much farther away, and the scale is likewise fuzzier and that's led to disagreements about its mass. "There are two discrepant measurements," Özel says. "Our uncertainty is much less than the difference between those two measurements."

The Event Horizon Telescope's eight partnering observatories are spaced around the world and linked together through a process known as interferometry. In fact, some those individual observatories, like the massive Atacama Large Millimeter Array, or ALMA, are themselves interferometers, arrays of telescopes spread across many miles. The idea behind interferometry is to create one telescope with an enormous collecting area out of many smaller telescopes. That increases the resolution of the final configuration of observatories. However, interferometry also has tradeoffs. There is space missing between each instrument –and a lot of it in EHT's case. This decreases the fidelity of the image, or how accurately the image can recreate the original object. Astronomers use the fact that they do have some idea of what a black hole should look like to narrow down the possibilities.

Another complication is just the logistics of moving around so much data. Each station takes data over a range of wavelengths, resulting in massive amounts of information, as much as 5,000 hours of mp3 music files – too much to transmit. For instance, to transport data back from the South Pole Telescope, scientists had to wait until Antarctic spring when the planes finally started flying out again. A shipping pallet packed with the hard drives had to be sent back to the Northern Hemisphere, where data analysis was done at processing centers at the Max Planck Institute in Bonn, Germany, and the MIT-Haystack Observatory in Westford, Massachusetts. There, the data was correlated, or matched between observing sites. And each individual telescope sees a different angle on the sky, so they observe at different times. That means the data must be matched up precisely to produce one unified image. "The calibrating and working with it took many months," Özel says. "And at the end we synthesise it into a single image. And then we spend another six months worrying about all the things you might have done wrong and ask yourself more and more questions, until finally, you can be certain that what you have is real."

Today's image is just the first astronomers expect EHT to produce. The observatory's other main target is the black hole at the centre of the Milky Way, Sagittarius A*. While it sits 1,000 times closer than M87, it is also roughly 1,000 times smaller, so it takes the same amount of observing power. Because it is smaller, the material swirling around its event horizon moves much faster, completing one circuit every few minutes, as opposed to a few days to circle M87. "It makes Sagittarius A* harder," Özel concedes. What's more, astronomers aiming at Sagittarius A* must look through the disk of the galaxy, and are subject to more dust and other interfering material. However, they still expect to release images of our galaxy's black hole in the near future. By: Korey Haynes

Now the methane's gone: A Martian mystery deepens 10 April: The European Space Agency's ExoMars spacecraft failed to find any traces of methane on the Red Planet during its hunt from April to August of 2018. This goes directly against recent positive reports of methane by EAS's own Mrs Express spacecraft and NASA's Curiosity rover, which both saw methane in 2013.


ExoMars hunted in vain for methane in Mars' atmosphere. ESA/ATG medialab

ExoMars has a sensitive detector that can pick up just one-tenth the amount of methane that Mars Express witnessed. That leaves two options: either one set of observations is in error, or something happened to the methane in the intervening time. The latter option is gaining traction. Given the years-long history of conflicting methane reports on Mars, it is looking more and more likely that the methane is real. However, some unknown process or force must be causing it to disappear inexplicably fast.

The new findings, like the old ones, make some scientists wary, especially given the possible implications of methane on Mars. It is commonly seen as a marker for biological activity, though it can also be produced by less exciting geologic processes. The latest conflict may simply add depth to a theory many researchers already held. The methane readings may be perfectly accurate, because the methane itself is there one day and gone the next. At the moment, that does not jive particularly well with researchers' understanding of Mars' atmosphere. Any methane released from the surface – by any means – should last for several centuries and mix into the atmosphere, where it can be spotted by orbiting spacecraft, no matter when or where they take their readings. Even the authors of today's findings suggest some unknown mechanism is removing the methane at low altitudes, before it can mix with the rest of Mars' atmosphere and spread over any large distance.

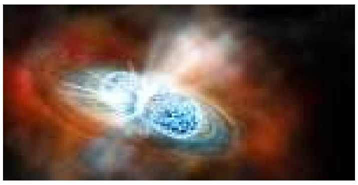
"Mars continues to confound us," says Manish Patel, who helps runNOMAD, one of the ExoMars instruments involved in the study. "The only way these results make sense with previous observations is if there is a new mechanism in the atmosphere, removing the methane at a rate far faster than thought possible. As always, Mars provides us with another mystery to solve." It will be up to future researchers to figure out what this mechanism is, and what substance or reaction between substances is able to remove or hide the methane from curious spacecraft studies. By: Korey Haynes

Israel's Beresheet lander crashes into Moon 11 April: Israel's Beresheet spacecraft, which was set to land on the Moon today, suffered an engine and communications failure, causing it to instead crash into the lunar surface. Details are still emerging about what exactly went wrong.


Beresheet sent back a selfie during descent 13 miles above the lunar surface, just before its engine problems started. SpaceIL

Within the last five minutes or so of the landing procedure, mission control reported temporarily losing telemetry data before regaining it again. Shortly after, the main engine shut off, but engineers managed to restart it. Then, they reported a communications failure, followed by a few tense minutes of waiting. Finally, they announced the loss of the spacecraft, bringing the mission to an undesired end. The control room gave a round of applause nonetheless, recognising the tremendous achievement they still accomplished. With the flight of Beresheet, Israel became the seventh nation to orbit the Moon, and technically the fourth to land on its surface, though not in the way they had hoped for. Benjamin Netanyahu, Israel's Prime Minister, was present in the control room for the event. He told those present, "If at first you don't succeed, try again." By: Korey Haynes

LIGO spots two gravitational waves in just two days 26 April: It took astronomers a century to make the first-ever gravitational wave detection, confirming a core prediction of Albert Einstein's theory of general relativity. This month, the floodgates have opened.On Friday, scientists with the Laser Interferometer Gravitational-Wave Observatory (LIGO) announced they have likely detected a second gravitational wave event in as many days. Detectors at three locations around the world caught the arrival of a probable ripple in space-time. It followed right on the heels of a gravitational wave detection on Thursday that sent astronomers racing to observe the event with their telescopes.


Two neutron stars merge into a kilonova. Illustration by Robin Dienel, courtesy of the Carnegie Institution for Science

In all, it is the fifth gravitational wave detection this month. The influx has astronomers excited about kickstarting the era of multi-messenger astronomy, where scientists can combine gravitational wave data with observations from conventional telescopes to gain new insights into extreme cosmic events like colliding black holes and neutron stars. Scientists suspect Thursday's event marked the second-ever gravitational wave detection of two colliding neutron stars, the collapsed cores left behind when giant stars go supernova. The merger would have likely spawned a new black hole. Astronomers spent Thursday searching for any signs of the collision on the sky. They are less certain about the celestial event that led to today's detection: There is about a one in seven chance that it was a false alarm caused by earthly vibrations. Its signal is right at the threshold of what LIGO can pick out. If this latest signal does turn out to be real cosmic collision, though, scientists say that there is a chance it may be the hallmark of a never-before-seen event: the collision of a neutron star and a black hole. However, the odds still favour it as a third neutron star merger.

LIGO consists of two L-shaped observatories - one in Louisiana and another in Washington state - that work by shooting a laser beam down the long legs of their 'L' and watching for tiny disturbances caused by passing gravitational waves. Italy's similar Virgo detector makes up the third part of the trio. LIGO first detected gravitational waves in 2016, winning its scientists the Nobel Prize in Physics. The collaboration then caught its first binary neutron star merger in 2017.

Unlike yesterday's detection, which happened as one of the detectors was off line for 40 minutes, all three observatories caught today's probable find. That makes it much easier to triangulate the event's location in the sky and let astronomers train their telescopes on it. This time, the gravitational waves came from a location roughly 1.2 billion light-years away from Earth, astronomers say. That is more than twice as far as the gravitational waves LIGO spotted Thursday. Thursday's observation kicked off a frantic effort by astronomers to find a sign of the corresponding collision in the night sky with telescopes. When neutron stars collide, the explosion is called a kilonova - a celestial event some 1,000 times brighter than a normal nova that astronomers can easily detect if LIGO tells them where to point their telescopes. The ensuing high-energy mix of particles spawns enormous quantities of heavy elements, like gold and platinum. So, watching the event in its first moments - and then seeing it evolve over time - can give scientists new insights into the aftermaths of these cosmic collisions.

Astronomers around the world joined in and identified two potential candidates for Thursday's neutron star merger. Their task was complicated by the fact that with just two detectors online, they could only narrow their search to about a quarter of the sky. One of the potential candidates turned out to be a likely supernova, and it is still unclear whether astronomers actually managed to find the source of the gravitational waves. Some astronomers may attempt to observe the source of today's gravitational waves as well, though the associated uncertainty as to whether it is a real gravitational wave event makes that a more difficult decision.

Until this latest observing run, the LIGO collaboration kept its detections secret before they were peer-reviewed and published. That's now changed. The public can follow along with the events in real time as detections come through. The team is posting each new gravitational wave observation online as a 'circular', where astronomers around the world can follow up with the results of their efforts to observe the event across the electromagnetic spectrum. By: Staff

Surprise 4,000-mile 'ice corridor' found on Saturn's moon Titan 30 April: NASA's Cassini spacecraft surveyed the moon (along with Saturn and its other moons) for 13 years, and even deployed a lander, Huygens, to Titan's surface. Although Cassini's mission ended in 2017, its data lives on, and planetary scientists continue to learn more about the history and surface features of this strangely Earth-like moon. They have spotted surprisingly diverse landscapes on Titan, from broad planes to sandy dunes and even rivers and lakes. Since the world is so cold, these features are made up of liquid methane and other organic compounds that slosh over a bedrock of solid, rock-hard ice. Even though the dense atmospheric haze makes makes it tough to observe Titan and get good data, researchers have shown how useful a new analysis technique can be in mapping titan and understanding its subtle surface features. Almost as a bonus, it also spotted an entirely unexpected feature: a ribbon of exposed bedrock ice that wraps nearly halfway around the moon.


NASA's Cassini spacecraft used infrared cameras to map beneath the surface of Saturn's moon Titan. NASA/JPL-Caltech/University of Nantes/University of Arizona

The new technique is called principal components analysis (PCA), and it could be a game-changer for Titan-ophiles. Instead of examining individual pixels from Cassini images and scouring them for details and data, PCA looks at all the pixels in a given area to spot trends in the landscape. This not only results in more refined data, but also turns out to be much less time-consuming than the leading alternatives, which do have to go one pixel at a time. To test their new tool, and try to answer questions about why some patches of bedrock ice are exposed in the first place, the international team of researchers applied PCA to half of Titan's surface, from 30° S to 30° N. They targeted the tropics in part because there was already relatively good data from this area, including first hand from the Huygens lander. That made it easy to check their results.

Once everything was correlated and indeed found to be accurate, the team was left with a hi-definition distribution of water ice on Titan. Curiously, it formed in a noticeable pattern. "Our PCA study indicates that water ice is unevenly, but not randomly, exposed across Titan's tropical surface. Most of the exposed ice-rich material follows a long, nearly linear, corridor that stretches 6,300 kilometres". That's about 40% of Titan's entire circumference. "This corridor is puzzling because it does not correlate with topography or measurements of the subsurface," the authors write. They also point out that the only other areas of Titan that have lots of exposed bedrock ice are spots "excavated by craters or exposed by erosion." So, basically, there is no known pattern going on, and they do not know how to explain this gigantic new feature of an alien world.

The team says it is possible that the icy corridor formed sometime in the past billion years when Titan was still geologically active. They specifically wonder if it is tied to a "major cryovolcanic event" - a kind icy volcanism - that astronomers have speculated was happening during that time. To really answer this question, along with the rest of Titan's mysteries, additional studies are necessary. By: Bill Andrews

Source of these and further astronomy news items: www.astronomy.com/news

DID YOU KNOW

Astronomical catalogues Part 7: Charles Messier's catalogue – designed to avoid cometary misidentification


Charles Messier


M1 – Crab nebula


M31 – Andromeda galaxy


M45 – Pleiades cluster

Charles Messier's (1730 – 1817) name is embedded in the language of stargazing. In 1744, when he was 14, his interest in astronomy was started by the appearance of a spectacular 6-tailed comet. Astronomy became his career, and comet-hunting was a lifelong interest. Four years after his first observation, he became an astronomer and hydrographer in the French navy, based in Paris. He was taught how to keep detailed records of observations, a skill which enhanced his standing as an astronomer. Overall, he discovered 13 comets, and was co-discoverer of another six.

During comet searches, he noted various objects (nebulae and star cluster) which could be mistaken for comets with the low quality telescopes in use at the time. When he decided to compile a list of non-cometary objects which some observers saw as comets, he became the first astronomer to write a catalogue aimed not at objects to seek and observe, but rather to ignore in order to avoid wasting time on them.

He compiled the list with his observer assistant Pierre Mechain. The first list was published in 1771, but was re-issued as a proper catalogue in 1774. Its title, in French, translates as *Catalogue of Nebulae and Star Clusters.* It contained 45 objects, prefixed with the initial M, from M1-M45. A revised catalogue with another 23 objects was published in 1780, and the final list of 103 objects in 1781. The revisions included object observed with better instruments.

The catalogue includes spectacular examples of 5 types of deep-sky objects visible from the northern hemisphere, specifically from Paris. The objects include diffuse nebulae (7), planetary nebulae (5), open clusters and globular clusters (55) and galaxies (39). Almost all are the closest to Earth in their classes. Later observers extended the catalogue beyond its 103 objects to include other objects also thought to have been observed by Messier. What is now known as the *Messier Cataolgue* currrently contains 110 objects. Almost all these objects also have other numbers, as part of larger whole-sky surveys. However, event today, they are invariably identified by their Messier numbers.

M numbers are so deeply embedded in astronomical observation, that, in the northern hemisphere spring, astronomers gather for 'Messier marathons', aiming to observe all the objects during a single night. Many Messier objects are also visible from the southern hemisphere.

Messier objects include the following well-known objects: M1 - Crab nebula (supernova remnant), M6 - Butterfly cluster (open), M7 - Ptolemy cluster (open), M8 - Lagoon nebula (nebula with cluster), M20 - Trifid nebula (nebula with cluster), M22 - Sagittarius cluster (globular), M24 - Sagittarius star cloud (Milky Way star cloud), M31- Andromeda galaxy, M42 - Orion nebula, M44 -Beehive cluster (open), M45 - Pleides (open cluster), M51- Whilrpool galaxy and M57 - Ring nebula (planetary).

Sources: Chapman, A (2017) Charles Messier: the 'ferret of comets' in www,astronomy.com, Ridpath, I (Ed) (2012) Oxford dictionary of astronomy 2nd ed rv, www.en.wikipedia.org

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

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