`"The Southern Cross"

HERMANUS ASTRONOMY CENTRE NEWSLETTER

MARCH 2020

Monthly meeting This month's meeting will take place on **Monday 16 March** at the **Catholic Church Hall** starting at **19.00.** Dr Gyula Józsa from the SA Radio Astronomy Observatory SARAO) in Cape Town will be talking on '**MeerKAT and neutral hydrogen in galaxies'.** See below for details.

Membership renewal for 2020 – final reminder

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.

New 'Did you know?' topic A series on 'Zodiac constellations' begins this month. After four general introductory parts, each of the thirteen astronomical zodiac constellations will be covered.

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

WHAT'S UP?

Canis Minor The large quadrilateral 'summer triangle' created by the stars Betelgeuse (Orion), Sirius (Canis Major) and Procyon (Canis Minor) is a prominent feature of the southern summer night sky. Canis Minor (small dog) is the smaller of the two constellations named for the dogs which followed Orion, the hunter, in Greek mythology. It ranks 71st in size of the 88 constellations. In contrast with its small size is its largest star. Alpha (α) Canis Minoris is the eighth brightest star in the sky. Its Greek name 'Procyon' means 'before the dog' because it rises earlier than the other celestial dog, Canis

Major. Procyon is 11.4 light years away and has a magnitude (brightness) or 0.4. It has a small, dense white dwarf companion, Procyon B, which orbits it every 41 years. Procyon B is so faint and so close to Procyon that it is only visible through very large telescopes.

LAST MONTH'S ACTIVITIES

Monthly centre meeting

The Centre's AGM took place on 17 February. In his report, Pierre de Villiers summarised the numerous regular and other activities which took place during 2019. After summarising the presenters and topics for the monthly meetings, he gave an overview of the activities of the interest groups. He identified a need to increase attendance at meetings and other activities, giving the example of the day trip to Cape Town, which only a small number of people attended. Adverse wreathes conditions, once again, limited the number of star-gazing events. Educational outreach included meetings with the Hawstson Space Cadets, science workshops for Overberg teachers and learners and continuing work on the erection of analemmatic sundials at several local schools. He also summarised progress with the astronomical display planned for Gearing's Point. After thanking the committee members, and others involved in leading Centre activities, he invited members to volunteer to join the committee. Pierre then presented a framed statement of appreciation to retiring committee member, Bennie Kotze, which recognised his substantial contribution to the Committee's work and the Centre's activities. The meeting ended with a useful discussion on possible strategies to increase attendance by members, and also on how to attract and involve younger people.

The treasurer, Laura Norris, then presented the summary finances for the year, which confirmed the healthy position of the Centre's finances.

Interest groups

Cosmology At the meeting on 3 February, Derek Duckitt presented the next two lectures in the DVD series 'Blackholes, tides and curved spacetime: Understanding gravity presented by Prof Benjamin Schumacher of Kenyon College. The topics were L5:'The art of experiment' and L6: 'Escape velocity, energy and rotation'

Astro-photography There was no meeting in February.

Other activities

Educational outreach

Hawston Secondary School Space Cadets This activity has been discontinued,.
Analemmatic sundials at schools , Work continues on others at several Overstrand schools.

Stargazing No events took place during February.
Sutherland visit A weekend trip to Sutherland was planned for 21 -23 February, but it was cancelled due to the very low response to the invitation.

THIS MONTH'S ACTIVITIES

Monthly centre meeting This month's meeting, will take place on **Monday 16 March** at the **Catholic Hall** starting at **19.00**. Dr. Gyula (Josh) Józsa, from the SARAO in Cape Town will be talking on **'MeerKAT and neutral hydrogen in galaxies'.** Dr Józsa, states: "Hydrogen is by far the most abundant element in the universe. Most of it is very hot, while a small fraction of it is cool enough to be in the "neutral" state. As there is such a lot of Hydrogen in the universe to begin with, even a small fraction of it is still a lot. It lives in gas clouds. And it is an important species, as cool gas clouds are the place where

stars are being born in galaxies. This means that radio telescopes, which are able to observe neutral Hydrogen in galaxies, make an important contribution to understanding the evolution of galaxies and the universe. South Africa has built the best radio telescope in the world to observe neutral Hydrogen in distant galaxies, MeerKAT. It will boost our knowledge about gas in galaxies. Not only that, observations of neutral Hydrogen do not only trace the whereabouts of the gas, but also its velocity, which in turn opens the possibility to trace the total mass distribution in galaxies, including Dark Matter.
In my talk I will discuss the importance of neutral Hydrogen in galaxy evolution and cosmology and introduce the best telescope to observe it, MeerKAT. Finally I will briefly discuss the near future of radio astronomy in South Africa."

Biography: "Dr. Gyula István Géza Józsa was born in 1972 close to Aachen in Germany and spent his childhood in Cologne. After his matrik (or Abitur since it was in Germany) at the Georg-Büchner Gymnasium zu Köln, Dr. Józsa studied physics and philosophy the University of Bonn. He graduated in Astrophysics in 2002 at the University of Bonn and finished his postgraduate studies in 2006 at the Argelander-Institut für Astronomie at the University of Bonn, handing in a graduation thesis about the disk structure of warped galaxies. After that Dr. Józsa stayed for a short while as scientist in Bonn, to change to the Dutch radio astronomy observatory ASTRON in 2008. His tasks at ASTRON included radio-astronomical research and the scientific support of the Westerbork Radio Synthesis Telescope (WSRT). In 2014 Dr. Józsa changed to the South African Radio Astronomy Observatory (SARAO), a business unit of the National Research Foundation (NRF). Among others, SARAO operates the MeerKAT radio telescope, whose commissioning and scientific exploit keeps Dr. Józsa busy today."

Interest group meetings

The **Cosmology** group meets on the first Monday of each month. The next meeting is on **2 March** 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 L7:'Stars in their courses: orbital mechanics' and L8: 'What are tides? Earth and beyond'.

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. The next meeting is on **Monday 9 March.** Members will continue to discuss image processing.

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 There is no update on this group.

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

No outings are being planned, at present.

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:

16 March	'MeerKAT and neutral hydrogen in galaxies'. 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.

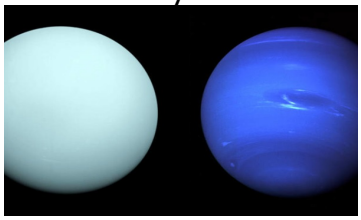
We would, therefore, be very grateful if members could either continue to contribute to the campaign or start becoming a contributor. Both single donations and small, regular monthly donations, of any amount, are welcome. Contributions can take the form of cash (paid at meetings), or online transfer,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

Uranus and Neptune's differences might boil down to collisions 4 February: Because the ice giant planets Uranus and Neptune have similar masses, sizes, and distances from the Sun, scientists often thought they formed in a similar way. However, the two planets also have many differences, indicating they might not be as similar as they seem at first blush.Instead, each ice giant could have experienced its own unique, traumatic event in its past, putting them on two different evolutionary tracks. And in order to create a more complete picture of how the early solar system formed, scientists need to know exactly how our outermost planets came to be.



The Voyager 2 mission photographed the two ice giants, Uranus (left) and Neptune (right). Left: NASA/JPL-Caltech; Right: NASA

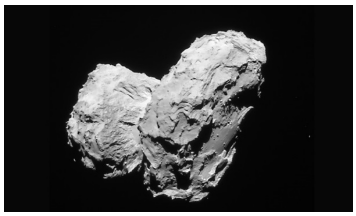
A team of researchers has used computer simulations to show that collisions with large, rocky bodies could have led to the two planets' diverging histories, possibly explaining

their differences. Perhaps the most obvious difference between the ice giants is their rotation angles. The spin of the planet Uranus is tilted by about 98 degrees compared to its orbital plane. Meanwhile, Neptune and most of the solar system's other planets have rotations that are more or less aligned with their orbits (though Venus likewise rotates the 'wrong' way). The two ice giants have other major differences too, like the fact that Neptune seems to have some heat source warming it from the inside, while Uranus probably does not. Past studies have suggested that giant impacts might explain the tilted spin of Uranus, while also accounting for other differences between the ice giants. So Christian Reinhardt of the University of Zurich and other researchers decided to test whether today's state-of-the-art 3D simulations would support these ideas.

The researchers found that if Neptune experienced a head-on collision with some large rocky body in its past, it could have deposited some extra energy deep inside the planet that's been slowly seeping out as heat over time. This, they think, could be the source of the extra warmth that's radiating out of Neptune's interior. For Uranus, the models show that a grazing or oblique impact from another rocky object could explain the planet's tilt, as well as the odd orbital properties of its moons. Researchers think that the moons of Uranus likely formed out of a disk of debris that was once around the planet, and the new models show that such a debris disk could have been the by-product of a glancing blow.

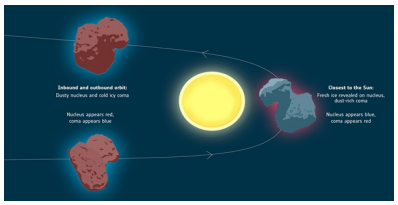
It' i exciting that the new models show support for collision hypotheses, Reinhardt wrote in an email. He also notes they still have plenty more work to do for this project. For example, the researchers still need to connect these potential collisions to simulations of the solar system's formation, as well as model how the planet's insides would have evolved over longer periods of time."Understanding the formation and evolution of Uranus and Neptune is not only a missing puzzle piece when trying understand how 'our' planets formed," Reinhardt wrote, "but also provides a better understanding of the formation of the many observed exo-planets in this mass regime." By: Erica K Carlson

Scientists chart the shifting colors of a comet's 'seasons' 5 February: The European Space Agency's Rosetta spacecraft was the first to orbit a comet when it circled Comet 67P/Churyumov-Gerasimenko from 2014 to 2016. Rosetta's up-close look at 67P has given scientists an unprecedented chance to understand what these small, icy worlds are like. Now, a team of researchers has unlocked another one of the comet's secrets. As the comet zooms around the Sun, clouds of gas and dust billow and settle, surrounding the comet in a haze of shifting colours visible to telescopes. Different parts of the comet tend to reflect different colours of light depending on where the comet is in its orbit, and the researchers have figured out that seasonal cycles of dust and ice on the comet are causing these colour changes.


Comet 67P/Churyumov-Gerasimenko ESA/Rosetta/NAVCAM

The team of researchers, led by Gianrico Filacchione of the National Institute for Astrophysics (INAF) in Italy, analysed observations of Comet 67P from Rosetta's VIRTIS instrument. VIRTIS measured the light the comet reflected in various colours, letting scientists puzzle out what chemical compounds are inside. They looked at more than a

year of data from VIRTIS and found that the wavelengths, or colours, of light the comet reflected changed as the comet got closer to and then farther from the Sun. As the comet approached its closest point to the Sun, the atmosphere, or coma, of the comet got redder while the nucleus of the comet appeared bluer. Then, when the comet was moving further away from the Sun in its orbit, the coma got bluer while the nucleus got redder.

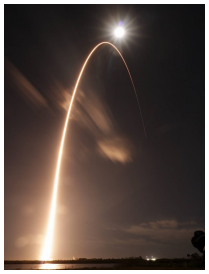


The shifting colors of Comet 67P are the result of seasonal processes, as seen in this illustration. ESA

With careful analysis and computer simulations, the researchers deduced that the colour changes all came down to dust and ice. Water-ice tends to reflect bluer light, while dust grains made of carbon and organic compounds reflect more reddish light. As the comet approached the Sun in its orbit, the Sun's rays heated the comet and lifted lots of dust grains off of the comet's surface and into the coma. This made the coma appear redder, while removing dust from the nucleus revealed more ice on its surface, making the nucleus look bluer. The process flipped when the comet was in the part of its orbit that took it farther from the Sun: dust settled back onto the nucleus, making the nucleus look redder. And the particles lifted off the nucleus in this part of the orbit tended to be richer in water-ice, making the coma look bluer.

Capturing these simultaneous changes in both the coma and nucleus of Comet 67P would not have been possible with observations from Earth, Filacchione wrote in an email. By sending a spacecraft to the vantage point of the comet's orbit, scientists have gained a clearer picture of this icy world than ever before. By: Erica K Carlson

Solar Orbiter is on its way to study the Sun 10 February: Last night, the European Space Agency (ESA) and NASA successfully launched their joint Solar Orbiter mission from Cape Canaveral Air Force Station in Florida, with the spacecraft catching a ride aboard a United Launch Alliance Atlas V rocket.


Te launch of Solar Orbiter. Jared Frankle, NASA Solar Orbiter Social Participant

During its mission, the Solar Orbiter will get up close and personal with the Sun in order to investigate our host star and its magnetic field, as well as how the Sun influences our solar system as a whole. Though the spacecraft will spend a few years easing into its unique elliptical orbit around the Sun, once there, it will be well positioned to also study the Sun's poles up close for the first time. Equipped with a camera, the orbiter's special orbit - which occasionally takes it closer to the Sun than Mercury ever gets - will enable the spacecraft to snap the first ever photos of the Sun's poles. Over the course of its mission, researchers plan to have the Solar Orbiter make 22 close approaches to the Sun.

There are 10 different instruments onboard the orbiter that will collaboratively study the Sun, including a visible light telescope and tools to capture solar wind particles, dust, and cosmic rays.

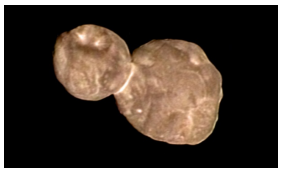
For the first two days following its launch, the orbiter will initiate communications with Earth and begin gathering data. The next three months of the mission will be used to ensure its instruments are working correctly. Then, the Solar Orbiter will spend two years (dubbed the 'cruise phase'" reaching its desired orbit. In the meantime, it' wil still be collecting data before it begins its main objective.

The Parker Solar Probe, which launched in 2018, will work in conjunction with the Solar Orbiter. While the Parker Probe is smaller, it is able to go closer to the Sun, but it does not have cameras to capture what it sees. The Solar Orbiter does. Between the two, scientists will finally be able to have a better understanding about the star that lets life on Earth keep chugging along. "As humans, we have always been familiar with the importance of the Sun to life on Earth, observing it and investigating how it works in detail, but we have also long known it has the potential to disrupt everyday life should we be in the firing line of a powerful solar storm," Günther Hasinger, ESA director of Science, said. "By the end of our Solar Orbiter mission, we will know more about the hidden force responsible for the Sun's changing behaviour and its influence on our home planet than ever before."

By: Hailey Rose McLaughlin

New data from New Horizons' Arrokoth flyby hints at how planets formed 13 February: On New Year's Day of 2019, the New Horizons probe buzzed past a small, snowman-shaped world designated 2014 MU69. At the time of the flyby the distant object went by the unofficial name Ultima Thule, but its formal name, now approved by the International Astronomical Union, is Arrokoth, which means 'sky' in the Native American Powhatan language. It is the farthest object to ever receive a fly-by from an Earthly spacecraft, taking New Horizons 13 years to reach it.

Now, more than a year after the fly-by, the data is in. Researchers from the New Horizons' team presented their latest findings, based on a trove of new data from the spacecraft. The data represents a far larger portion of New Horizons' findings than last year's minimal transmissions, and the resulting analysis may change scientists' understanding of how the solar system formed.


If you were on board the New Horizons spacecraft during its flyby of Arrokoth, the world would look visibly red to the human eye. NASA/Johns Hopkins University Applied Physics Laboratory/Southwest Research Institute

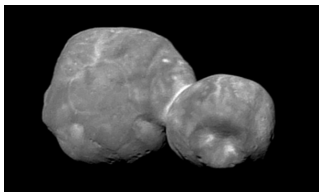
Astronomers know that the solar system started as a nebulous cloud of gas and dust, which eventually resolved itself into the well-ordered system we see today. However, the steps in between have been fuzzy. Arrokoth, an ancient but unassuming body orbiting in the distant, cold region of the Kuiper Belt beyond Neptune, is perfectly poised to begin giving us answers. The distant world has likely changed very little since its formation near the solar system's birth, so it functions as a time capsule of sorts from that ancient milieu. The view of that ancient world, astronomers say, points clearly to a past where objects

like it formed from the direct collapse of the original solar nebula - the gaseous cloud that eventually collapsed to become our solar system.

Made up of two red-hued lobes, like a slightly flattened snowman, Arrokoth has a relatively smooth surface with few signs of asteroid impacts. Most importantly, the two lobes appear to have been moving and spinning in match step even before they made contact. One can imagine two lovers on a walk, gravitating together even before they reach out and join hands.

It is a formation story that helps answer an old cosmic riddle posed by differing interpretations of available data. "For decades, there's been a war of computer models," says New Horizons' Principle Investigator, Alan Stern. One side backed the so-called hierarchical accretion model, where dust grains collided to form pebbles, which formed rocks, then boulders, and finally large bodies in a long and violent game of bumper cars. The other side argued for cloud collapse, meaning the original nebula of dust and gas swirled together through gravity and very gently collapsed directly into larger bodies. It may seem like a fine distinction, but it's one that has big implications for how our solar system came to be.

Arrokoth, orbiting in the remote hinterlands of the solar system, provides a never-before-seen view of how the process of forming planets actually happened. "We never went to an object that was as primitive and well preserved as Arrokoth," says Stern. "It's basically unchanged since four-plus billion years ago when it formed." That makes it priceless for answering questions about the solar system's deep past.


MU69 (aka Arrokoth) from New Horizons, showing craters and hints of layering. The larger lobe appears to have a thick-pancake shape. NASA/Johns Hopkins University Applied Physics Laboratory/Southwest Research Institute/National Optical Astronomy Observatory

Early data from New Horizons last year hinted at a gentle crash between the two lobes that make up Arrokoth, evidence for the collision theory of solar system formation. However, says Stern, with ten times as much data and many months of computer modelling, they now see a different story, one that involves Arrokoth forming much more placidly."There are five different lines of evidence for cloud collapse," he says, all pointing to the gentler formation theory. If Arrokoth formed that way, it is a sign the rest of the solar system's building blocks may have also emerged from a cloud of dust, rather than from the violent collisions of countless objects. "Arrokoth has provided a decisive test between the two," Stern said during the press briefing. "I believe this is a game changer."

With more of the data now on Earth, researchers are re-visiting their theories about this distant world. Arrokoth has a recognizable snowman shape, though the data seemed to indicate it might be flattened, more like two pancakes than two spheres. Updated observations show the pieces are still mostly round, and only slightly flattened. The data also reinforces Arrokoth's red hue, a feature it shares with many other distant solar system objects. Scientists think the red colour is due to organic molecules similar to tholins, thought to be the building blocks of life.

Data on Arrokoth is still flowing from New Horizons to Earth, and will not finish for another year and a half. Spacecraft managers sorted the data from highest priority to low, so it' i unlikely that data yet to be downlinked will dramatically change the picture. In the future, mission planners would like to see New Horizons buzz by one more Kuiper Belt object on its trip out of the solar system. Stern says that unless the spacecraft malfunctions, it can continue collecting data until the late 2030s. It should leave the Kuiper Belt in the late 2020s, so it has only a few years to scan the skies for its next target. By: Korey Haynes

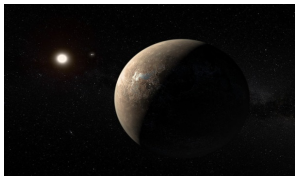
Dimming Betelgeuse is now also bent out of shape, new surface images show
14 February: Betelgeuse - a red supergiant located roughly 700 light-years away in the constellation Orion the Hunter - has been dimming over the last few months. Now, astronomers have found it is also changing shape. In a new image captured with the European Southern Observatory's Very Large Telescope (VLT), astronomers captured how much the star has dimmed compared to a picture taken late last year. When they saw the before and after images, they noticed that Betelgeuse has also changed its shape.


A new image of the star shows it's dimming and changing shape. ESO

Betelgeuse's dimming, which began in late 2019, is noticeable even with the naked eye. The star, which is often a popular anchor for observers, is currently only about 36 percent its normal brightness. The big question surrounding Betelgeuse is whether this fading is a sign the star will go supernova soon. One day, the red supergiant will explode, but scientists do not think that is happening quite yet. "Of course, our knowledge of red supergiants remains incomplete, and this is still a work in progress, so a surprise can still happen," said Miguel Montarges, an astronomer studying Betelgeuse with VLT.

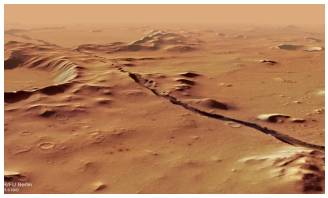
An exact answer to when Betelgeuse will go supernova is still lingering, but after the star explodes, there is a good change it will become a neutron star. There is a small possibility it could become a black hole, but the chances are slim. For now, Betelgeuse's future remains a mystery. By: Hailey Rose McLaughlin

Proxima Centauri: The closest exoplanet to Earth 20 February: Astronomers are finding new exoplanets nearly every day, but astronomers have already probably found the closest - two planets orbiting Proxima Centauri, the closest star to our Sun. One of them was discovered in 201and is just slightly larger than Earth. Even more exciting, it orbits in the habitable zone of its star, where temperatures allow liquid water – and therefore possibly life A second world ws announced in 2020. This one is a few times the size of Earth, and orbits farther away, on a colder track.


An artist's conception of Proxima Centauri b as a rocky-like exoplanet, with Proxima Centauri and the Alpha Centauri binary system in the background. The actual appearance of the planet is unknown. ESO/M. Kornmesser

Proxima Cenaturi is only 4.2 light-years away. This is still tens of thousands of years by rocket travel, but only a hop, skip and a jump away in cosmic terms. If there were a star closer than Proxima, we would have found it by now. Without any closer stars, astronomers do not expect to find any closer planets. There is always the chance of a rogue planet existing closer than Proxima. Rogue planets are those that escaped their star systems and now travel the galaxy solo. However, while astronomers think rogue planets are reasonably common, it is unlikely one would lurk quite that close. By: Korey Haynes

NASA's InSight lander detects 174 'marsquakes', proving Mars is seismically active 24 February: Not far from Mars' equator, a series of strange fissures rip deep into the Red Planet's surface. The cracks of Cerberus Fossae run for hundreds of miles, cutting through craters, hills, and everything in their path. Relatively young looking volcanoes nearby, combined with trails of tumbling rocks, have long fuelled speculation over whether the region is still active today. Now, there is no need to wonder anymore. Scientists have released the first 10 months of discoveries from NASA's Mars InSight lander. Its findings, among many others, include a resounding answer to the mystery of Cerberus Fossae - the Red Planet is geologically active and bustles with marsquakes.


Vew of Cerberus Fossae, created using stereo data from ESA's Mars Express spacecraft, shows fault cracks cutting across the Red Planet. ESA/DLR/FU Berlin

The InSight lander was designed to study Martian seismology, geophysics, meteorology, and magnetism. It carries the first working seismometer and first magnetometer to ever land on the Red Planet's surface. While InSight's lack of wheels might bring fewer news headlines than a rover like Curiosity, astronomers say its findings will ultimately help them better understand the geological processes that have shaped our neighbouring world. As the marsquakes continue, InSight should build a better picture of the subsurface geology beneath the spacecraft, as well what's happening within the Martian crust - and even deeper. NASA expects the lander to continue operating for another year.

The mission has not been a complete success, however. One crucial instrument, a heat probe called the 'mole', was designed to hammer itself 4.8m down below the surface and reveal details about how rocky planets form. Instead, it has been stuck for the last year. Teams of engineers around the world have worked with earthbound replicas of the spacecraft to test hacks that could free the instrument, but the mole keeps bouncing out of its hole. Last week, NASA announced it would try to push on the mole's top, in a move the space agency had so far avoided over fears it could damage the instrument.

By: Eric Betz

China's Chang'e-4 mission peers beneath the lunar farside's surface 26 February: New data from the first spacecraft to land softly on the lunar farside is offering up fresh details about the part of the Moon that's hidden from view on Earth. The Chinese rover found that the ground beneath it is similar to what's found on our satellite's more familiar face.It is further evidence that the Moon's entire surface - not just the limited parts that astronauts explored —-is deeply covered in the fluffy Moon dirt that astronomers call regolith.


This image w of China’s Chang’e-4 spacecraft was taken by the country's Yutu-2 rover, which landed with the spacecraft. CNSA via ESA

In January 2019, Cian’s Chang’e-4 lander, along with a rover named Yutu-2 (Chinese for Jade Rabbit), touched down on the Moon’s farside. It landed inside Von Kármán crater, a large impact site nestled inside the even more enormous South Pole-Aitken Basin crater. Aitken is the widest, deepest and oldest crater on the Moon. That status has made it a prime target for scientists who want to study how the 2,575 kilometre-wide basin formed and evolved over billions of years. Yutu-2 was well equipped to probe below the surface thanks to ground-penetrating radar, which sends pulses through the world’s subsurface and measures the signals that reflect back. It found that the landing site is carpeted with loose dirt that extends up to 12m deep,

NASA astronauts and experiments, as well as the Soviet Luna missions, showed that this pulverised dust and rock is prevalent across the near side of the Moon. While scientists have spent decades studying regolith, they were not sure if it would also be prevalent across the vast unexplored lunar reaches. Regolith was a major challenge during the Apollo missions. It soiled both scientific equipment and space suits. Some scientists initially thought the dust might be so thick that spacecraft would simply sink down into it. And NASA is still concerned about the health hazards regolith could pose to future astronauts.

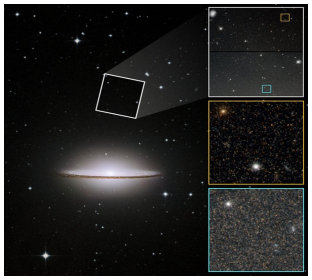
Yutu-2’s ground-penetrating radar also got a good look at the layers beneath the surface regolith. The Chinese-led team of scientists say they found alternating layers of boulders and large rocks interspersed with finer soil down to roughly 40m. Each of those layers of large rocks was probably deposited as space rocks hit the surface and filled the air with ejecta. Below that, their radar instruments could not get a good signal. However, the scientists suspect this pattern extends even deeper. This is not the first time scientists have used radar to study the Moon’s subsurface. NASA’s Apollo 17 mission in 1972 carried the Lunar Sounder Experiment, which was used to study the ground beneath craters across the Moon’s surface. The Japan Aerospace Exploration Agency has also flown an orbiting radar experiment.

The Chang’e-4 mission was initially designed to last through at least three lunar days, which is roughly three months back on Earth; on 18 February, China’s state-run news agency reported the pair had begun their 15th lunar day. Both the rover and lander are still fully functional, according to a government release. Yutu-2 has travelled roughly 350m since the mission began. The spacecraft have endured more than a dozen cycles of hibernation during the long lunar nights, followed by powering back up once daylight returns. The rover also does not operate at high noon, when the Sun is brightest and temperatures soar.

The mission's results should ultimately help scientists better understand the Moon’s formation and evolution. Astronomers say that studying craters on the Moon can provide a proxy for researching what happens when large objects hit Earth. “Chang’e-4 lived up to expectations, realising the feat of the first soft landing of the human probe on the back of the Moon, with abundant scientific data and great scientific contributions,” reads a

translation of a Chinese government press release posted in January. "Looking around the world, the hearts of countless Chinese children care about Chang'e-4." By: Eric Betz

Hubble finds hints the Sombrero galaxy had a turbulent past 27 February: New data from the Hubble Space Telescope reveals the popular Sombrero galaxy may have had a more violent past than previously thought. Based on the number of metal-rich stars Hubble spotted in the galaxy's extended halo, astronomers think the seemingly serene Sombrero galaxy could have once went through a major merger with another galaxy."The Sombrero has always been a bit of a weird galaxy, which is what makes it so interesting," Paul Goudfrooij, a scientist for the Space Telescope Science Institute, said.



On the left is an image of the Sombrero galaxy, and on the right side shows the detail in which Hubble was able to capture of the stars in the halo. NASA/Digitized Sky Survey/P. Goudfrooij (STScI)/The Hubble Heritage Team (STScI/AURA)

The Sombrero galaxy is a go-to target for amateur observers, largely due to the stunningly smooth brim of its disk, which appears to us nearly edge on. This is where the Sombrero gets its name. However, as with most galaxies, the Sombrero's stars extend far beyond the galaxy's disk. This area of space surrounding the 'sombrero' is called the halo. Halos are usually packed with old, metal-poor stars. However, using Hubble, astronomers resolved tens of thousands of stars in the Sombrero's dim halo. They surprisingly found it contains many more younger, metal-rich stars than expected.

Utilising models and simulations, scientists investigated different ways the metal-rich stars could have ended up in the Sombrero's halo. Based on the evidence, astronomers speculate that billions of years ago, the galaxy merged with another galaxy of similar mass. Oddly, the Sombrero galaxy's disk and halo do not show any other signs that such an event happened though. Both have a silky smooth appearance, which doesn't seem to suggest a turbulent past. The team will continue to observe the Sombrero galaxy, especially when the powerful James Webb Space Telescope is launched in 2021.

By: Hailey Rose McLaughlin

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

DID YOU KNOW?

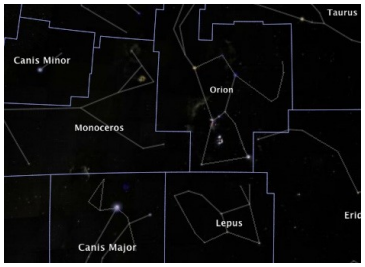
Zodiac constellations 1 – Constellations

Constellations divide the sky, as seen from Earth, into different areas. In Latin, 'constellation' means 'set of stars'. This label describes groups of stars which form imaginary outlines, often representations of mythological characters, animals, gods or inanimate objects on the celestial sphere. The word came into use in English in the 14th century. However, their origins go back to prehistory.

Orion constellation – mythological hunter

Different cultures and nations described and adopted their own constellations, although there is evidence of communication and influence across large distance, even in ancient times. For example, parallels to Babylonian star catalogues suggest that the Chinese system, which dates to the 5th century BCE, did not evolve independently.

The 88 constellations formally recognised today are based on classical and western groupings. Constellations have not remained constant over time, and the shape and size of several changed before the International Astronomical Union (IAU) formally agreed the present constellations, in 1928. Of the 88 modern constellations, 36 lie mainly in northern skies and other 52 in southern skies. The origins of these differ. Northern constellations, and those south of the celestial equator which are visible from the northern hemisphere, generally arose from antiquity and have names based on classical Greek legends. More southerly constellations are modern, a consequence of European exploration from the 15th - 18th centuries.



In the past, the boundaries of constellations, particularly recently discovered southern groupings were arbitrary and not always clear. Different groupings and names were proposed by different observers even when catalogues were built on earlier observations and descriptions. There were attempts to define the membership of constellations. For example, in his 1603 catalogue, *Uranometria*, Johann Bayer assigned stars to individual constellations, labelling them with Greek and Latin letters. These Bayer designations are still in use eg alpha Orionis. However, it was only in 1875 that the American astronomer Benjamin Gould proposed the establishment of contiguous boundaries for constellations.In 1922, another American astronomer, Henry Norris Russell, produced a general list of 88 constellations, but it was only when the IAU became involved that clear, contiguous borders between the constellations were achieved.

The boundaries agreed for each modern constellation are contiguous, with no gaps between them, and cover the whole celestial sphere. The boundaries are drawn along horizontal and vertical lines relating to right ascension (longitude) and declination (latitude). The constellations are not unchanging. Since stars have their own motions, over time, all constellations change very slowly.

The 48 'traditional' constellations, which from the core of the modern 88 constellations, are considered to be Greek, dating from the 4th century BCE. Drawn and described in documents like Ptolemy's *Almagest,* many were, however, borrowed from or based on constellations identified by earlier civilisations. Earliest evidence of human identification date to around 3,000 BCE in Mesopotamian inscribed stones and clay writing tablets. Some of these are also found in the oldest Babylonian catalogues of stars and constellations, dating back to around 1,000 BCE.

Other star patterns or groups are called asterisms eg Pleiades (left), Northern Triangle. Some of these within one constellations, others cross boundaries, while others include stars from more than two constellations. Members of these groupings appear near each other from Earth. In reality, however, members often are at different distances. A sub-

group of the ancient Pleiades constellations belong to the zodiac. This series focuses on these constellations.

Sources: Ridpath, I (Ed) 2012 Oxford dictionary or astronomy Oxford, OUP, Ridpath, I (Ed) 2006 Astronomy London, Dorling Kinderslety, curious.astro.cornell.edu, en.wikipedia.org,

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COMMITTEE MEMBERS

Pierre de Villiers	(Chairperson, GPAED)	028 314 0830
Laura Norris	(Treasurer)	028 316 4453
Peter Harvey	(Secretary, sky notes)	028 316 3486
Jenny Morris	(Vice-chair, events co-ordinator, newsletter)	071 350 5560
Derek Duckitt	(Cosmology group co-ordinator, website editor)	082 414 4024
Deon Krige	(Astro-photography, youth robotics project)	028 314 1045

Non-committee members with roles:

Johan Retief	(Membership)	028 315 1132