"The Southern Cross"

HERMANUS ASTRONOMY CENTRE NEWSLETTER

OCTOBER 2018

Monthly meeting This month's meeting will place on **Monday 15 October** at the **Catholic Church Hall** starting at **19.00**. Note that the date has been changed from the previously advertised 22 October. Centre member, Johan Retief, will be talking on 'The Fermi paradox and its implications for extraterrestrial life'. See below for more details.

Membership renewal for 2019

There will be a small increase in the fees for 2019, following 2 years at the current rate The 2019 fees are as follows:

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.

Meeting attendance fees for visitors Please note that the price for visitors attending meetings at the Catholic Church Hall will be R25, with immediate effect.

WHAT'S UP?

5 naked eye planets While one or more of the five naked eye planets is visible some or all of the time between sunset and sunrise, it is unusual for them all to be visible at the same time. However, around the middle of the month, this will be the case shortly after sunset. Each of the planets is on its own course, in its own orbit round the Sun, but, from 6-20 October, their positions in their orbits are such that Mercury, Venus, Mars, Jupiter and Saturn will all be visible concurrently, for about a fortnight. The window opens on the 6th when Mercury becomes visible and closes on the 20th when Venus moves towards becoming the morning, rather than the evening, star. From low in the west, then upwards towards the east, the planetary order will be: Mercury, Venus, Jupiter, Saturn, Mars.

LAST MONTH'S ACTIVITIES

Monthly centre meeting At the meeting held on 17 September, Dr David Buckley, from the SAAO in Cape Town, gave an absorbing and informative talk on 'Gravitational waves: the new frontier in astronomy. After outlining the origin of the concept of gravitational waves in Einstein's general theory of relativity,(weak ripples produced when objects with very large masses collide), he described the history, since the 1970s, of the development of increasingly advanced detectors. This work was finally rewarded when the first gravitational wave was detected in September 2015. The event was only announced publicly after the celestial event which produced the waves had been confirmed by other observers using different frequencies, an approach now called multi-messenger astronomy.

Five more events have been detected, although one remains unconfirmed. David described his own experiences, and the role of scientists using the SALT telescope in Sutherland, in the international collaboration which took place to confirm the latest event which was detected in 2017. He is one of the 677 named authors of one of the 84 scientific papers which emerged from work on this one event.

David concluded by explaining how the discovery of gravitational waves has opened new doors in astronomy, particularly the method of multi-messenger astronomy and astronomers' understanding of what happens when two black holes or two neutron stars or a black hole and a neutron star collide.

Interest groups

Cosmology At the meeting on 3 September, Pierre Hugo gave the second part in the new series on 'Natural philosophy: science for non-scientists'. Focussing on the concept of inertial space, he outlined the different types of vacuum which have been proposed by some authors.

Astro-photography Those who attended the meeting on 10 September continued discussing processing of astro-images.

Other activities

Educational outreach

Hawston Secondary School Space Cadets No meetings were held in September because of school exams. They will resume in the final term.

Lukhanyo Youth Club Work continues to erect an analemmatic sundial at this, and other schools in the Overstarand.

Stargazing Although adverse weather conditions meant that the 15th event had to be cancelled, the rescheduled evening of the 29th was more successful, although atmospheric moisture did limit telescopic viewing. The 25 or so visitors were able to observe Venus, Jupiter, Mars and Saturn as well as some celestial objects including the Jewel Box.

Astronomy talk John Saunders gave a talk titled 'An introduction to astronomy' to the QUEST Ladies group in September.

Southern Star Party Bennie Kotze reports: "On Friday afternoon, 7 of September, three members of HAC, Pierre de Villiers, Derek Duckitt and I were on our way to Leeuenboschfontein with the aim to observe the skies for whatever object it has to offer. Telling this to anybody would think we were crazy. The weather was miserable, it rained

intermittently, the mountains on the way were covered with snow, Pierre monitored the temperature outside his vehicle to be 3 degrees; not ideal conditions for stargazing.

On Saturday morning we were privileged listening to a few very interesting speakers. Prof Herman Steyn gave a historical overview of the University of Stellenbosch's involvement in Satellite Projects over the past 25 years. We have listened to a similar talk at the SSP about two years ago. The involvement of the US in the design and manufacture of cube-sats for the Euro Space Agency, is evident. This was followed by Dr Daniel Cunnama briefing us on the Simulations of Galaxies and Galaxy clusters.

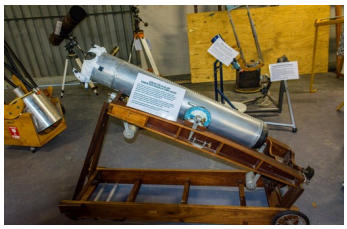
A mid-day braai at the lapa facility of the camp was enjoyed by all. A series of short talks followed during the afternoon. I must mention the talk by Chris Forder, a very knowledgeable astronomer. He has been involved, almost all his life, in the making of telescopes. He has ground and manufactured 55 primary telescope mirrors to date.

 Here he is operating his telescope, one of his masterpieces, all hand made. Chris is also a co-owner of the observatory in the Sederberg. He will be our host when HAC visits the Cederberg during mid-October, hence my reason for including this photo.

I also need to mention the talk given by Wim Filmalter. Wim is a "Boer maak 'n plan" type. If you let him loose in a scrapyard, he will leave the yard at the exit with enough parts to manufacture a complete telescope. His innovative skills really are amazing. Here are some of the many products that were on display:

 A complete optical tube made of wood.

 A pot was used to house the primary mirror and the lid as a cover. Hope his wife did not miss her cooking utensil.

 A wooden mount fitted with old pram wheels for ease of transport.

Saturday evening went by with rather limited opportunity for serious viewing. We were positive that Sunday evening will turn out fine – and so it did. We mainly viewed the objects suggested by Kechil Kirkham, a speaker of the day before, viz. globular clusters,

galaxies and several open clusters. He also gave some guidelines as to how to identify and how to track these objects in the sky.



Pierre and I preparing our telescopes for viewing later the evening


The 14-inch HAC telescope which Derek operated.


The three brave men that took the risk, despite adverse weather conditions, to visit the SSP

In conclusion, a fantastic evening of viewing was had by all. However, I must admit the sky was not as clear compared to our visit to Bonnievale earlier this year. Pierre agrees with me. We base our finding on the clarity of Eta Carina we experienced at Bonnievale compared to viewing it this evening.

Whale Talk article An article by Jenny Morris titled 'Roving Mars' was published in the September/October 2018 issue of the magazine.

THIS MONTH'S ACTIVITIES

Monthly centre meeting This month's meeting, will take place on **Monday 15 October** at the **Catholic Hall** starting at **19.00**. Centre member, Johan Retief will be talking on "The Fermi paradox and its implications for extraterrestrial life'. This is the second presentation which Johan will be giving this year, and the latest in a line which goes back to the formation of the HAC. The content of Johan's presentations is always informative and interesting, and his clear and accessible style of delivery invariably enriched with moments of humour.

Johan states: "Enrico Fermi (born 1901, died 1954) was an Italian nuclear physicist and mathematician that emigrated to the USA in 1938 due to the threat of Mussolini's laws to Fermi's wife who was Jewish. In the USA he worked as a professor at the University of Columbia and later he moved to the University of Chicago to continue work on uranium enrichment. By the end of 1942, Fermi had constructed the world's first working nuclear reactor in a disused squash court at the University of Chicago. By mid-1944, Fermi joined the atom bomb team known as Project Manhattan at the Los Alamos National Laboratory

in New Mexico. He oversaw the manufacture of the bomb and attended the first test of an atomic bomb in July 1945.

In 1950, at Los Alamos, Fermi had an informal discussion with his colleagues regarding a spate of UFO sightings and extraterrestrial life, when Fermi asked his historic question: "Where is everybody?". This was followed by a series of calculations regarding the probability that earth-like planets may exist elsewhere in the Galaxy, as well as the probability of life, as well as the conclusion that we ought to have been visited long ago and many times over (Wikipedia). Now, nearly seventy years later and having been Searching for Extraterrestrial Intelligence (SETI) and searching for exoplanets (as of 1 September 2018, 3,823 planets have been found in 2,680 star-systems according to Wikipedia), it is interesting to once again revisit Fermi's Paradox and to review the large number of solutions that have been offered by various scientists and science fiction writers.

During the meeting, I intend presenting a distillation of the various solutions that have been offered."

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.

Interest group meetings

The **Cosmology** group meets on the first Monday of each month at 19.00. The next meeting will take place on **Monday 1 October** at the **Catholic Hall**, starting at **19.00**. Information and discussion on the nature of space will continue in the third meeting in the series on 'Natural philosophy: science for the non-scientist'

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 is on **Monday 8 October.** Members will continue work on astro-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 Organisers are progressing with work towards enabling learners to take and process images themselves.

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

FUTURE ACTIVITIES

Cederberg trip The 12-14 October trip to the Cederberg is fully booked. Please contact John Saunders at antares@hermanus.co.za with any queries.

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**. Details for the first few months are:

15 October	'The Fermi paradox and its implications for extraterrestrial life' Presenter: Johan Retief, Centre member

19 November	'Table Mountains: geology and astronomy' Presenter: Jenny Morris, Centre member
10 December	Xmas party

ASTRONOMY EDUCATION CENTRE AND AMPHITHEATRE (AECA)

A decision by the Council of Overstrand Municipality on the planning application continues to be awaited. In the meantime, the Friends of the Observatory pledge fund continues to be an important source of funds to cover associated costs.

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, something which is still awaited.

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

Two stars will NOT merge and explode into red fury in 2022 7 September: Five years ago, Calvin College astronomy professor Larry Molnar and his team began analysing a pair of tightly bound stars - known as KIC 9832227 - located just 1,800 light-years away in the constellation Cygnus the Swan. The researchers bolstered their own observations with archival data from 1999, as well as data collected between 2007 and 2013. In 2017, Molnar's team came to an exciting conclusion: The stars are already tangled up in a complicated dance that will inevitably end with their merger and ensuing explosion in 2022. This first-of-a-kind prediction of a 'red nova' event visible to the naked eye quickly made headlines around the world, captivating astronomy enthusiasts and astronomers alike. However, another team of researchers led by Quentin Socia, at San Diego State University, scrutinised Molnar's original prediction, ultimately concluding that the prophesied explosion will not happen as predicted.

V838 Mon, which exploded as a 'red nova' in January 2002, suddenly becoming 600,000 times brighter than our Sun. NASA and The Hubble Heritage Team (AURA/STScI)

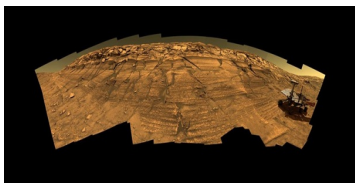
Molnar himself agrees. "Good science makes testable predictions," he said. "There have been a few other papers that have tried to poke at our project, and we've been able to

poke back - criticisms that just don't fly. But this one does fly, and I think they have a good point. This illustrates how science can be self-correcting."

To verify (or disprove) Molnar's original prediction, Socia and his team concentrated on a gap in observational data, from 1999 to 2007, for KIC 9832227. After obtaining previously unpublished data captured in 2003, the researchers discovered a curious discrepancy between when the two stars were expected to eclipse each other, and when they actually did. This led Socia to dig a little deeper. When they turned their attention to meticulously analysing the paper that described the 1999 data, they discovered a typo. The paper had incorrectly transcribed the time of an observed eclipse by precisely 12 hours. This innocent mistake threw off Molnar's calculations for the timing of future eclipses.

Molnar's original prediction of a 2022 merger was based off the apparent exponential decay of KIC 9832227's orbital period. He then matched this slowing orbital period with models of previously seen mergers, finding that the slowing orbit falls in line with what would be expected from a pair of touching stars preparing to put on a show. However, since KIC 9832227's orbital period is not changing quite as dramatically as Molnar first though, his model-based prediction no longer holds water. By: Jake Parks

Is time running out for Opportunity? 14 September: Since 10 June, the 14-year-old Opportunity rover has been silent, presumably sleeping as thick dust clouds blocked the Sun from its solar cells. Now that sky is clearing, and NASA is implementing a listening plan for the rover through January 2019.


A computer-generated Opportunity explores Burns Cliff on Mars. NASA/JPL-Caltech/Cornell.

Without power, the rover has likely experienced several faults. Among them, its mission clock might have stopped recording time accurately. To counteract this possibility, the rover's mission team is both passively waiting for the rover to communicate at predetermined times and actively pinging it with commands to respond, just in case the rover is not sure when it should be sending signals back to Earth.

As of 11 September, the tau value - which measures the opacity, or clarity - of the atmosphere above the rover's site had fallen below 1.5 (lower tau means clearer skies) for two consecutive weeks. This means sufficient sunlight can once again reach the rover's panels to recharge its batteries. It also starts the clock on a 45-day period that NASA believes represents the best window for getting a response from the rover. "If we do not hear back after 45 days, the team will be forced to conclude that the Sun-blocking dust and the Martian cold have conspired to cause some type of fault from which the rover will more than likely not recover," said John Callas, Opportunity project manager at NASA's Jet Propulsion Laboratory.

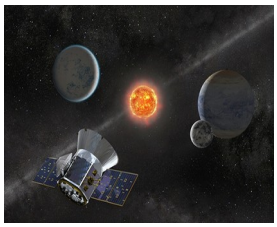
Throughout the massive, planet-encircling dust storm that Opportunity had been riding out, the mission team's primary concern was the inability of the rover to recharge its batteries. Battery-damaging cold, while a concern, is less likely to have affected the rover,

as thick dust can actually keep the ground warmer than average and provide some protection. With sunlight now reaching the surface, the rover should have no problem slowly warming and waking up. It is less likely, says the mission team, that dust piled up on the rover's solar panels is hindering its recovery efforts. Even if this has happened, they say one of Mars' many dust devils may come along and sweep the dust away, giving the rover a windy power wash and allowing it to wake up.

Once the batteries can provide sufficient power, the hope is that the rover will restart and begin to assess its condition, which includes trying to communicate with Earth at predetermined intervals. In case the rover has not been keeping accurate time, the mission team is now actively transmitting a command telling the rover to send back a beep. This signal is being sent multiple times per day, three days a week Even after active communications attempts have ended, the team will continue passively listening for the rover, just in case it needs additional time to wake up or one of the 'cleaning dust devils' happens by. "In the unlikely chance that there is a large amount of dust sitting on the solar arrays that is blocking the Sun's energy, we will continue passive listening efforts for several months," said Callas.

Once the 45-day window has passed, Opportunity's team will report to NASA and further active recovery efforts may be planned. Time has not yet run out for the ageing rover, but with only a few months before the active search may be called off, the stakes just got a little higher. By: Alison Klesman

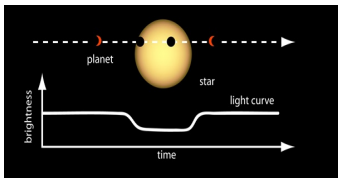
TESS begins the hunt for rocky worlds 14 September: In just six weeks of science observations, NASA's Transiting Exoplanet Survey Satellite (TESS) has already found 50 possible new worlds for scientists to examine.


The Transiting Exoplanet Survey Satellite, or TESS, is designed to hunt for planets among nearby bright stars. NASA's Goddard Space Flight Centre

TESS finds planets by watching the dip in light as a planet passes in front of its parent star. It began science observations on 25 July and the first set of information was available to astronomers on 5 September, but the first step in examining TESS' data is to eliminate false positives. Sometimes a possible 'planet' will actually be a binary star blocking its companion's light, or it could be sunspots on the star's surface, no second body needed.

While most of these planetary candidates will be discarded upon future analysis, principal investigator George Ricker at the Massachusetts Institute of Technology said there are likely six new bona-fide planets lurking in this data alone. Ricker says that usually five to 20 percent of planetary candidates turn out to be true planets, once the transit method is followed up by the radial velocity method on the ground (which observes the influence of an orbiting object). Even amateurs can help with the search, he said. "We make alerts available to astronomers worldwide, and we continue to do that, because there are a lot of amateurs with superb instruments they can use for the initial parts of the screening,"

Ricker said, adding the process will likely take months or years due to the number of planetary candidates – suspected rocky planets and larger ones – to double-check. "As we become more adept at seeking these things out, we are going to get 100 or 200 more [candidates] per sector. There will be a lot to work through. I expect there are going to be 3,000 or so potential objects of interest," he added.



The transit method of exoplanet detection involves staring at a single star to look for dips in its light associated with the passage of a planet. NASA

It is a promising start for TESS, which is supposed to find 50 rocky planets - worlds that are four times Earth's diameter, or smaller - in its primary three-year mission. NASA is on a long-term hunt for planets like Earth, and with the long-running Kepler planet-hunter mission running low on fuel, TESS is billed as a logical successor to Kepler's work. While Kepler's primary mission focused on distant stars in a zone of the constellation Cygnus, TESS is an all-sky survey optimised to look at close-up stars. It travels in a never-before-used lunar-resonant orbit that brings TESS around Earth twice for every time that the Moon circles the Earth once. TESS moves its wide view between different sectors of the sky roughly every month. TESS will study stars that are 30 to 100 times brighter than those surveyed by Kepler. Brighter stars are easier to observe from the ground if something interesting is found, they are also likely closer than most of Kepler's stars. So the hope is with TESS observations, there will soon be a network of telescopes doing follow-up work on the planets it finds.

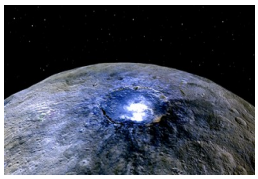
All NASA missions go through periodic reviews to determine if they should receive more funding for longer periods of work. So far, indications are positive that TESS will exceed its initial goal of 50 rocky planets; TESS' observations are already cleaner (better signal to noise) than expected. The spacecraft is also expected to find planets that are larger and gaseous, but its formal goal is more focused on rocky planets. Furthermore, the spacecraft's trajectory is so efficient that TESS has enough remaining fuel to do its observations for another century or two; in other words, unlike Kepler, the spacecraft's end of life will not come from running out of gas. TESS has also effectively tripled its storage capacity because the spacecraft is more stable than expected in its orbit; this means it takes fewer bits per pixel to generate an image and store it on the spacecraft.

During the extended mission, Ricker said the team will try to send information down to Earth even more quickly to catch more short-term phenomena. TESS has already spied several new near-Earth asteroids, one comet, and a supernova during its short time in orbit, but adding a more rapid response will allow astronomers to see more star explosions - as well as events such as tidal disruptions in stars that are orbiting close to another object, such as another star. While the search for 'Earth 2.0' is still ongoing, Ricker said it is possible there already are small planets sitting in the TESS dataset. "We've seen indications that there are several small planets that are in this initial set, and we're just going through the process of looking at them and making sure that we really got the properties set and it isn't a false positive," he said.

The candidates TESS finds will also serve as prime targets for follow up with the James

Webb Space Telescope (JWST), currently set to launch in 2021. These worlds, if they possess Earth-like life, would have chemical signatures in their atmosphere visible in the infrared - exactly the wavelength regime in which JWST will operate. TESS' sectors are also perfectly poised in JWST's "continuous viewing zone," which is the area of sky it will be able to observe at any time of the year during its orbit. By: Elizabeth Howell

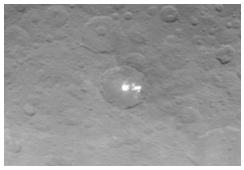
Volcanoes of mud erupt from dwarf planet Ceres 17 September: In new research, a large team of astronomers has laid out a new view of the weirdest world in our solar system. It seems that Ceres has had a busy last few billion years - including random smatterings of volcanism, but of a type seen nowhere else in the solar system.


NASA/JPL-Caltech/UCLA/MPS/DLR/IDA

Ceres is the largest world in the asteroid belt, and is believed to be a remnant proto-planet, or the kind of small worlds that served as the building blocks of the planets we see today. There's abundant evidence that Ceres might once have had an ocean that's since frozen over, and the tantalising clues to a geologically active history. Ceres even appears to have a form of volcanism. There are two types of volcanism in the solar system, typically: the kinds of magma eruptions seen on Earth and Jupiter's moon Io, where heated rock wells up from the core to the surface. And then there's the kind of volcanism seen on Europa and Enceladus, where large plumes of frozen water erupt. Scientists call this cryovolcanism.

Hanna Sizemore, a Planetary Science Institute research scientist says Ceres' volcanoes are a weird mix of the two. "The big difference on Ceres is that you're in this hybrid between the inner rocky solar system and the icy outer solar system," she says. That means that while water may be a driving mechanism for the volcanoes, the actual material could include rock, salt, and heated material from the interior of Ceres, which is both a rocky and an icy world at once. When those volcanoes explode, "It would probably look superficially like lava extrusion on the earth, but it would be mud oozing out of cracks or fissures on the surface," Sizemore says.

Sizemore says a new cryovolcano appears on Ceres roughly once every 50 million years, as indicated by data from the Dawn spacecraft, which has orbited Ceres for around three years. The craft has seen a series of "domes" dotting the world that have similar proportions to mountains, but are made of ices that have since settled after their volcanically active period ended, leveling them out a little.


These high-resolution images show Ceres' mysterious bright spots.NASA/JPL-Caltech/UCLA/MPS/DLR/IDA

Those famous bright spots on Ceres could also be some of the more recent areas of cryovolcanism. The brightness is caused by large deposits of salts, which would be

expected to come up from down below. We may have also "narrowly" (geologically wise) missed seeing an eruption, by anywhere from "hundreds to millions" of years, according to Sizemore. So what's causing it? Sizemore says one of the team's suspicions is that an impact long ago drove deep into the mantle of Ceres. This could be a contact point between the surface and warmer materials near the core, which could still be geologically active today. "To some extent, we don't fully understand the mechanisms to maintain heat in these icy bodies," she says, pointing out other icy worlds that should be dead but which instead seem quite active, like Pluto.

"Our main question is where is the heat coming from that can mobilise these materials," Sizemore says. "Frankly we don't know the answer to that. It's a field that's opening up. This idea of cryovolcanism has been viewed sceptically over time." Now, it's a booming field of research. By: John Wenz

Milky Way nearly collided with a smaller galaxy in cosmic fender bender 19 September: Our Milky Way galaxy holds hundreds of billions of stars. Many of those suns were formed locally from clouds of gas - at the rate of handful every year -over billions of years. However, our home galaxy gets stars another way, too. It steals them. The Milky Way has cannibalised smaller galaxies throughout the aeons, adding them to our cosmic ranks whenever one strays too close. However, sometime in the past billion years, one of those meals got away - though the struggle left a mark.


A new study of stars in the Milky Way reveals evidence of a cosmic near miss collision with a smaller galaxy sometime in the last billion years. ESA

A new study has tracked the motion of more than six million stars in our galaxy using the European Space Agnecy's Gaia spacecraft. The research reveals that the Milky Way nearly collided with another nearby galaxy - called the Sagittarius dwarf galaxy - sometime in the past 300 to 900 million years. This cosmic 'fender bender' set millions of stars moving like ripples on a pond, the authors say.

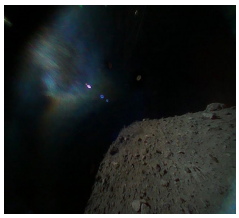
The European team of astronomers behind the discovery says they were able to pick out the event because the Gaia spacecraft does not just accurately measure the positions of stars; it also precisely picks out how fast they're travelling across the sky. Teresa Antoja of the University of Barcelona led the team. She says she could hardly believe her eyes after she plotted the star positions and their movement on her computer. A surprising, snail shell-like pattern appeared on her screen that looked unlike anything astronomers had seen before. "At the beginning the features were very weird to us," Antoja said. "I was a bit shocked and I thought there could be a problem with the data because the shapes are so clear." However, once they verified their results, it became clear that these stars really were following strange and distinct paths as they orbit the galactic centre. This same sort of pattern is known to form in other physical systems during so-called 'phase mixing'.

They were able to recreate the pattern with computer models in which our galaxy nearly collides with another galaxy and some of the Milky Ways' stars are set in motion."It looks like suddenly you have put the right glasses on and you see all the things that were not

possible to see before," Antoja said. The shape was not the only thing that surprised them. Scientists knew that the Milky Way has seen many collisions over its 13.5 billion year history. They thought that was ancient history. "Many such collisions happened in the past," says Amina Helmi of the University of Groningen in the Netherlands. "However, most of these should've taken place a long time ago, as the disk of the Milky Way appears to be relatively unperturbed."

This discovery changes that view. After they found the cause, the team set out hunting for the object our galaxy may have nearly collided with. There was an obvious suspect: The Sagittarius dwarf galaxy, which packs tens of millions of stars, is in the process of being cannibalized by the Milky Way. And the two galaxies last passed by each other in the same time range astronomers think the strange pattern formed. It's not quite case closed just yet. The scientists say their work is still largely based on simple computer models, so they will next dive into a detailed analysis of the strange shape. By: Eric Betz

Hayabusa2 rovers start exploring asteroid Ryugu 27 September: On 21 September, Japan's Hayabusa2 spacecraft successfully deployed two rovers on to the surface of asteroid Ryugu, becoming the first in history to accomplish such a feat. Once there, rover-1A and 1B were quick to get to work. They began exploring the surface, snapping pictures and taking videos., giving us a long-awaited ground-level view of an asteroid.

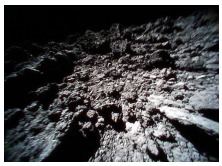

MINERVA-II rover 1B's picture of Ryugu rafter separation from Hayabusa2.JAXA

Hayabusa2, which has been hovering roughly 20 kilometres above the asteroid since it arrived in June, descended to just 55 metres above Ryugu to deploy the rovers from its MINERVA-II lander. Now that they are operational, the two will spend their time investigating Ryugu's surface for clues about its formation, evolution and ultimately the state of our early solar system. Asteroids like Ryugu, which orbits between Mars and Earth, are hot research commodities. Unlike planets, it is believed they have more or less gone unchanged since they first formed in the early days of our solar systems. Researchers believe that they may have spread organic molecules around the ancient solar system, as well as water. Ryugu, which likely carries lots of hydrated material, is a good candidate for probing that hypothesis further.

These rovers do not operate like their counterparts on Mars. Given the asteroid's rough terrain, it would be pretty difficult for them to navigate with wheels and crawlers like traditional landers do. Ryugu also has a weak gravitational field, so a standard rover would start floating into space as soon as it started moving. To get around these obstacles, JAXA opted to have them 'hop' around the surface instead of roll, allowing them to jump over rough patches. Using internal rotating masses, each bot can propel itself upward and remain afloat for nearly 15 minutes, traveling up to 49 feet (15 meters) with each hop. And thanks to advanced accelerometers, optical sensors and gyroscopes, they operate completely autonomously.

The rover's journey is n'o just a frolic through space, though. Their tiny bodies, which

measure just 18 centimetres in diameter, are equipped with high-powered, asteroid-probing instruments. The rovers will use their seven cameras to study Ryugu's estimated 920 metre surface, ultimately creating a 3D, composite image of the asteroid. An up close view of its surface will help researchers figure out the conditions that it formed in, and how much of a cosmic beating it's taken during its evolution. As they image the asteroid, the probes will also use finely tuned sensors to record surface temperatures at each destination. Variations in temperature will help shed light about its physical properties and its possible makeup of elements.

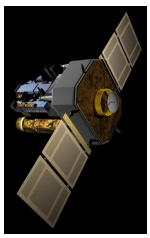

Rover 1B's picture of Ryugu's rocky terrain shortly after its arrival. JAXA

However, even with their impressive instruments, probing a massive asteroid is much too big a job for two tiny rovers. In about a week or so, the duo will be joined by the MASCOT lander, which will use an infrared microscope and wide-angle camera to record Ryugu's structural, compositional and surface characteristics, and also document how well it holds onto heat and what its magnetic properties looks like. Also, as soon as the end of October, they could be joined by Hayabusa2 itself, which will make its first attempt at shooting a projectile into an asteroid and collecting samples to bring back to Earth. The team will then welcome a final member, a third rover from MINERVA-II, next summer. The gang will gather as much information about Ryugu as possible before Hyabusa2 returns to Earth in 2020. By: Jake Parks

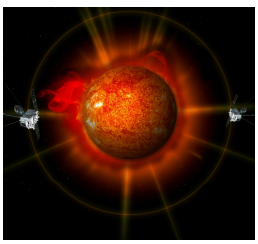
Source of these and further astronomy news items: www.astronomy.com/news

DID YOU KNOW?

The Sun Part 31: **Solar exploration 2**


SSOHO satellite


Solar Dynamics Observatory


STEREO – artist's diagram


Parker Solar Probe

In 1995, the joint ESA and NASA Solar and Heliospheric Observatory (SOHO) satellite was launched. One of the most important solar missions, its twelve instruments were designed to observe the Sun in ultraviolet and visible light, study the solar wind and measure small oscillations on the Sun's surface. Intended as a two year mission, its successful mission was extended to 2012. Situated at the L1 Lagrangian point between the Sun and Earth, around 1.5 million km from Earth in the sunward direction and Sun where the gravitational pull from each is equal and the Sun can be observed without interruption of eclipses from the Earth, SOHO provided a constant view of Sun at many wavelengths. It also enabled discovery of more than 2,000 comets, mostly tiny sungrazing comets that incinerate as they pass the Sun.

The SOHO mission was so successful that, in 2010, the follow-up Solar Dynamics Observatory (SDO) was launched by NASA. Its objective is to improve understanding of solar activity and its effects on Earth. It instruments measure solar oscillations and the magnetic fields in the photosphere to determine how internal solar processes relate of surface activity, closely monitor the corona, and solar emissions at extreme ultraviolet wavelengths.

All these satellites have observed the Sun from the plane of the ecliptic, so have only observed the solar equatorial region in detail. In contrast, the joint ESA-NASA Ulysses probe was launched in 1990 to study the solar wind particularly from the unexplored polar regions. It travelled to Jupiter to slingshot into an orbit far above the ecliptic. Observing the solar wind and magnetic field strength at high solar latitudes, it found that the solar wind was moving at about 750 km/s, slower than expected. Large magnetic waves that scattered galactic cosmic rays were also found emerging from high latitudes. Ulysses ceased operations in 2009.

The Genesis probe was launched in 2001 by NASA in an effort to increase understanding of the composition of the interior of the Sun. It was designed to collect samples of the solar wind and return them to Earth in order to allow for direct measurement of the composition of solar material. Positioned at the L1 Lagrangain point, it worked from 2001 to 2004. It then returned to Earth but was damaged in a crash landing from parachute failure. However, some usable samples were recovered from the sample-return capsule which it had dropped into the atmosphere.

NASA's Solar Terrestrial Relations Observatory (STEREO) was launched in 2006. The two identical spacecraft were sent into orbits that cause them to respectively pull ahead or fall behind Earth. This enables three-dimensional imaging of the Sun and solar phenomena. Instruments on each craft enable observation of the inner and outer corona and the chromosphere at four different wavelengths, and of coronal mass ejections. In addition, radio burst trackers trace radio disturbances in the solar wind, and experiments study energetic particles from the Sun and interplanetary magnetic field.

In August 2018, NASA launched the Parker Solar Probe. Approaching as close as 6.2 million km of the solar surface (photosphere during its almost 7 year mission, it will be the first spacecraft to fly into the low region of the very hot solar corona. The probe will reach that close to the Sun in late 2024, after a series of gravitational assists achieved via 7 flybys of Venus. The probe will measure and analyse the structure and dynamics of the solar corona and the Sun's magnetic field, the energy flows which heat the corona and initiate and accelerate the solar wind, and the mechanisms which accelerate energetic particles. A solar shield will protect the craft and its instruments from the extreme heat and radiation experienced that close to the Sun. The probe will reach that close to the Sun in 2014, after a series of gravitational assists achieved via 7 flybys of Venus.

Other countries are also interested in solar space research. The Indian Space Research Organisation has scheduled the launch of a 244 kg satellite, Aditya-L1, for 2021. Originally planned to carry a chronograph to study the Sun's aurora from a low-Earth orbit,, it is now planned to be a comprehensive solar and space environment. Placed at the L1 Lagrangian point, it is scheduled to be a 5-year mission.

Sources: Ridpath, I (Ed) (2012) Oxford dictionary of astronomy 2nd ed rev, 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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