"The Southern Cross"



The Hermanus Astronomy Centre Newsletter

NOVEMBER 2023

Please note that all our meetings are scheduled for **TUESDAYS**, commencing at **18.00** (6 **pm**) unless otherwise advised. The day and date may change from time to time according to the current Hermanus load shedding status and/or according to venue availability for a physical meeting; such changes will be notified via e-mail and on our website.

MONTHLY MEETINGS

Monthly Meetings are now held on the **Third Tuesday** of each month. There will be no Monthly Meeting in December.

Our last meeting was held on **October 17th**.

Dr Amoré Nel, of SANSA Hermanus, presented "A History of Geomagnetic Jerks".

The Earth's magnetic field is predominantly generated within the earth itself, primarily by the twocomponent iron core, solid at the centre and surrounded by molten iron. It is this latter part which, due to its fluid nature, is responsible for the variations of the magnetic field so evident to us at the surface and which we have put to good use since our understanding was advanced by scientists of the 17th century and onwards. Whilst generally stable and predictable, this field does suffer from short-term sudden variations, termed rapid secular variations or "geomagnetic jerks", which are now studied, recorded and analysed by a world-wide network of observatories, SANSA being one.

To view the recording of this meeting, please visit <u>https://www.youtube.com/watch?v=5KXBPGk5QKE</u>.

The next Monthly Meeting is scheduled for **Tuesday November 21^{st}** and will again be hybrid (physical and virtual), taking place at **Onrus Manor** clubhouse as well as on Zoom. Your physical attendance, requested by many members, will enable us to meet the presenter in person and to socialize with other centre members. We shall be commencing sharply at **18.00** (6 pm) in order to terminate by 19.00 at the latest.

Please consider arriving early, say from 17.30, as refreshments are available before the meeting but not after.

Prof Martin Snow will speak on "Betelgeuse Space Weather".

The brightest star in the constellation of Orion is a cool supergiant known as Betelgeuse. This star has been observed for centuries, and in recent years it has undergone some dramatic changes. In 2019, it dimmed to half of its previous brightness. Since then, its apparent brightness has returned to its previous level. I will

try to put these changes in brightness into the context of our understanding of stellar evolution. There are many ideas about what might have caused such a fluctuation ranging from a space weather event to an imminent supernova, to a rapid evolution of the star. Older observations do give a hint about what is going on with Betelgeuse, and I will summarize our best guess at the answer to this mystery in the sky.

SPECIAL INTEREST GROUP ACTIVITIES

<u>Cosmology</u>

These meetings are scheduled for the **First Tuesday** of each month with no meeting in January.

We are currently watching a series of videos titled "THE ENTIRE HISTORY OF THE UNIVERSE", in 17 episodes. On Tuesday October 3rd we watched episode 13 – "*How Many Universes Are There?*"

Yet more uncharted territories and dimensions. This video is worth a revisit:

https://www.youtube.com/watch?v=1jmNzlTd09E&list=PLROBLlvnR7BEF9b1NOvRf_zhboibmywJb&index=13

Our November meeting, scheduled for Tuesday 7th, is episode 14 - "What happened to All the Neutrinos?"

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

<u>Astrophotography</u>

This SIG is no longer scheduled but can be arranged as requested by group members.

Please let's hear from you.

For further information, contact Deon Krige: <u>krige.deon44@outlook.com</u> and please keep an eye on our website calendar and our e-mail notices and invites.

Study Group

Scheduled for the Last Tuesday of each month from November 2023.

Our last meeting was held on **September 26th**, the video topic- "*The Internal Ramp Theory for the Great Pyramid of Egypt*".

"... is one of the most interesting ideas ever proposed for its construction. French architect Jean-Pierre Houdin has spent more than 20 years developing and refining this idea. In November of 2022, Houdin published an update to his theory which reflects the ScanPyramids findings from the past six years. The ScanPyramids 'Big Void' is an intriguing clue that Houdin may be correct with his notion of the Grand Gallery being used as a counterweight ramp for the largest pyramid stones. The 'Big Void' may be another Grand Gallery-like space which could be used for the same purpose. Institutional Egyptology remains unreceptive to Houdin's publications, nor the extremely confident results from the ScanPyramids mission. This video takes a closer look at those conflicts, highlights some of Houdin's new model, and proposes some areas that could use improvement."

https://www.youtube.com/watch?v= JlnMs616Z0

The discussion: https://youtu.be/S62a8RNG_-Y

Next scheduled for **Tuesday October 31st**. The video topic- "The Mystery of the Octopus".

Brainy, hearty, multiskilled, venomous and playful. Is this creature from outer space?

The video:

https://www.youtube.com/watch?v=pv3YRnHzfjI&pp=ygUadGhlIG15c3Rlcnkgb2YgdGhlIG9jdG9wdXM%3D

The discussion: <u>https://www.youtube.com/watch?v=O-Y4wzRu9tI</u>

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

Observing

This section includes recommended dates for **Stargazing**, **Moonwatch**, **Meteors**, **Solar observation** and whatever else deserves a close look.

For quick reference:

Optimal dates for November 2023:

Stargazing –	November 1 st to 15 th (please refer to <i>Skynotes</i> page 2 for more detail).	
Moonwatch –	a window a few days either side of First Quarter November 20 th (Skynotes on page 2).	
Eclipses –	None observable in southern Africa (Skynotes page 4).	
The Sun -	The Sun and Aurora Activity : Daily solar activity and predictions for auroral activity can be found at the following website: <u>https://www.spaceweatherlive.com/en/solar-activity.html</u> .	
Meteors -	Southern Taurids, Northern Taurids, Leonids and α Monocerotids (<i>Sky Guide</i> page 86 an <i>Skynotes</i> page 4)	

Future Trips

No outings are planned at present.

<u>Website</u>

Please check our website calendar for HAC scheduled events: https://www.hermanusastronomy.co.za

(compiled by Pieter Kotzé)

JWST's first spectrum of a TRAPPIST-1 planet



Joint constraints on the H2/He abundance and the atmospheric pressure on TRAPPIST-1 b resulting from the sequential fit of the stellar contamination and planetary atmosphere. The colour shading illustrates the posterior probability density, where darker colours correspond to higher probabilities. Contours indicate the 1s, 2s, and 3s Bayesian credible regions. The displayed posterior probability is marginalized over the H2O, CH4, CO, CO2, NH3, and N2 abundances. Hydrogen-dominated scenarios with high-altitude clouds are at the top left corner of the plot and cloud-free, volatile-rich, high-mean-molecular-mass atmospheres are at the bottom right. Any hydrogen-rich atmospheres without high-altitude clouds, at the bottom left, are robustly ruled out. The second horizontal axis at the top shows the mean molecular mass representative for pure H2/H2O atmosphere.

In a solar system called TRAPPIST-1, 40 light years from the sun, seven Earth-sized planets revolve around a cold star. Astronomers obtained new data from the James Webb Space Telescope (JWST) on TRAPPIST-1 b, the planet in the TRAPPIST-1 solar system closest to its star. These new observations offer insights into how its star can affect observations of exoplanets in the habitable zone of cool stars. In the habitable zone, liquid water can still exist on the orbiting planet's surface.

The team, which included University of Michigan astronomer and NASA Sagan Fellow Ryan MacDonald, published its study in the journal The Astrophysical Journal Letters.

"Our observations did not see signs of an atmosphere around TRAPPIST-1 b. This tells us the planet could be a bare rock, have clouds high in the atmosphere or have a very heavy molecule like carbon dioxide that makes the atmosphere too small to detect," MacDonald said. "But what we do see is that the star is

absolutely the biggest effect dominating our observations, and this will do the exact same thing to other planets in the system."

The key finding of the study was the significant impact of stellar activity and contamination when trying to determine the nature of an exoplanet. Stellar contamination refers to the influence of the star's own features, such as dark regions called spots and bright regions called faculae, on the measurements of the exoplanet's atmosphere.

https://www.spacedaily.com/reports/JWSTs_first_spectrum_of_a_TRAPPIST_1_planet_999.html

https://www.spacedaily.com/reports/New_insights_into_the_atmosphere_and_star_of_an_exoplanet_999.ht ml

1st black hole imaged by humanity is confirmed to be spinning, study finds



The Event Horizon Telescope, a planet-scale array of eight ground-based radio telescopes forged through international collaboration, captured this image of the supermassive black hole in the center of the galaxy M87 and its shadow. (Image credit: EHT Collaboration)

The supermassive black hole M87*, which rose to fame in 2019 when it became the first void to be <u>imaged</u> and revealed a fuzzy orange donut (then later <u>sharpened</u> by AI into a skinny ring), is now confirmed to be spinning. The announcement of this update came on Wednesday (Sept. 27). However, as to how fast M87* is spinning?

That's not yet known.

For two decades, a network of radio telescopes have been eyeing the black hole, which resides in the heart of the Messier 87 (M87) galaxy about 55 million <u>light-years</u> away from <u>Earth</u> in the <u>constellation Virgo</u>. These instruments have been especially intrigued by a powerful jet of radiation and particles blasting from the black hole's poles, and according to new results, that <u>relativistic jet</u> appears to be swinging like a pendulum on a 11-year cycle.

https://www.space.com/historic-donut-black-hole-is-spinning-new-study-finds

James Webb telescope makes 'JuMBO' discovery of planet-like objects in Orion

Jupiter-sized "planets" free-floating in space, unconnected to any star, have been spotted by the James Webb Space Telescope (JWST). What's intriguing about the discovery is that these objects appear to be moving in pairs. Astronomers are currently struggling to explain them. The telescope observed about 40 pairs in a fabulously detailed new survey of the famous Orion Nebula. They've been nicknamed Jupiter Mass Binary Objects, or "JuMBOs" for short. One possibility is that these objects grew out of regions in the nebula where the density of material was insufficient to make fully fledged stars. Another possibility is that they were made around stars and were then kicked out into interstellar space through various interactions.



At just 1,400 light-years from Earth, the Orion Nebula, M42, is visible to the naked eye as a faint smudge

https://www.bbc.com/news/science-environment-66974738

Bursts of star formation explain mysterious brightness at cosmic dawn



Cosmic Dawn - file illustration only

When scientists viewed the James Webb Space Telescope's (JWST) first images of the universe's earliest galaxies, they were shocked. The young galaxies appeared too bright, too massive and too mature to have formed so soon after the Big Bang. It would be like an infant growing into an adult within just a couple years. The startling discovery even caused some physicists to question the standard model of cosmology, wondering whether or not it should be upended. Using new simulations, a Northwestern University-led team of astrophysicists now has discovered that these galaxies likely are not so massive after all. Although a galaxy's brightness is typically determined by its mass, the new findings

suggest that less massive galaxies can glow just as brightly from irregular, brilliant bursts of star formation.Not only does this finding explain why young galaxies appear deceptively massive, it also fits within the standard model of cosmology.The research will be published on Tuesday (Oct. 3) in the Astrophysical Journal Letters.

https://www.spacedaily.com/reports/Bursts_of_star_formation_explain_mysterious_brightness_at_cosmic_d awn_999.html

Pulsar surprises astronomers with record-breaking gamma-rays



Artist's impression of the Vela pulsar, in the center, and its magnetosphere, whose edge is marked by the bright circle. The blue tracks travelling outwards represent paths of accelerated particles. These produce gamma radiation along the arms of a rotating spiral by colliding with infrared photons emitted in the magnetosphere (in red).(Image credit: Science Communication Lab for DESY)

Nearly 1,000 light-years from where you're sitting lies a spinning, highly magnetized neutron star that is so dense,

a tablespoon of it equals something like the weight of Mount Everest. It's an intense sight, to say the least, which is why astronomers naturally love studying it. You might've even heard its name uttered before: The Vela Pulsar. And on Thursday (Oct. 5), scientists announced that data from the High Energy Stereoscopic System (HESS) observatory in Namibia indicates this cosmic marvel just became a little more marvelous. It would appear that <u>Vela</u> unleashed the highest-energy radiation ever seen coming from a <u>pulsar</u>.

https://www.space.com/vela-pulsar-highest-energy-radiation-gamma-rays

The Hubble Telescope Just Captured An Extremely Rare Radio Galaxy

This beautiful object is one of only five such galaxies in the entire universe.



Lenticular, radio galaxy NGC 612 is seen edge-on by the Hubble Space Telescope.

NASA published a snapshot this week of a strange and beautiful galaxy. It's so weird that NASA officials say it's one of only five such galaxies known to exist in the universe.

Astronomers give galaxies a variety of labels. Often, they describe them according to their shape. Take galaxy NGC 612, as seen above, which was most recently <u>highlighted</u> by the scientists running the <u>Hubble Space Telescope</u>. As you might see, it lacks the <u>dramatic swirl</u> of a spiral galaxy and doesn't quite fit the mold of a halo-like elliptical

galaxy. It's somewhere in between. NGC 612 is a lenticular shape. Lenticular galaxies are strange — and NGC 612 may be amongst the strangest of the bunch. Its stars are only about 40 to 100 million years old, which is very young as far as lenticular galaxies are concerned. Stellar populations inside lenticular galaxies stars are usually older, and there is "little ongoing star formation," according to NASA.

https://www.inverse.com/science/hubble-telescope-captured-extremely-rare-radio-galaxy

'Potentially catastrophic' solar storm identified in ancient tree rings

If a solar storm of a similar magnitude hit today, it would wreak havoc on our technological world. Earth was hit by the largest-ever detected solar storm 14,300 years ago, ancient tree rings reveal. If a storm of a similar magnitude hit our planet today, it could have potentially catastrophic effects on our modern technological society. The powerful solar storm was identified by an international team of scientists studying ancient tree rings preserved in the eroded banks of the Drouzet River, near Gap, in the Southern

French Alps. By studying ancient tree rings, the team found an unprecedented spike in radiocarbon levels that occurred 14,300 years ago. By comparing the ancient tree ring radiocarbon spike to measurements of beryllium — a chemical element found in Greenland ice cores that can be analyzed to provide a record of solar activity — the scientists proposed the radiocarbon spike was caused by a colossal solar storm that bombarded <u>Earth's atmosphere</u> with huge volumes of energetic particles.



Scientists have discovered the most powerful solar storm ever recorded using ancient tree rings from the French Alps.(Image credit: MARK GARLICK/SCIENCE PHOTO LIBRARY via Getty Images)

https://www.space.com/largest-ever-recorded-solarstorm-found-in-tree-rings

The Milky Way's 'fountain of youth' is made of forbidden stars and water ice



A 2009 image of the Milky Way's central area, constructed with telescopes including the Hubble Space Telescope, the Spitzer Space Telescope, and the Chandra X-ray Observatory.(Image credit: NASA, ESA, SSC, CXC and STScI)

Astronomers have spotted a figurative "stellar fountain of youth" at the heart of the Milky Way. Situated around our galaxy's supermassive black hole, it's an area that holds a shockingly high number of young stars and regions of ice water. The discovery was made by an

international team of researchers, led by University of Cologne Institute of Astrophysics researcher Florian Peißker, that examined a star cluster close to our galaxy's central supermassive black hole, <u>Sagittarius A*</u> (Sgr A*).

https://www.space.com/forbidden-young-stars-ice-water-milky-way-fountain-of-youth

Mysterious 'Singing' Plasma Waves Detected Around Mercury

Artist's impression of localized chorus waves at Mercury. (NASA/Johns Hopkins University Applied Physics Laboratory/Carnegie Institution of Washington)

Around planets that have a magnetosphere, something magical happens. If you listen with the right instruments, you can hear chirping and whistling, almost like the singing of birds at dawn and dusk. These so-called chorus waves have been recorded at Earth, and Jupiter, and Saturn; and observed at Uranus and Neptune. Now, led by astronomer Mitsunori Ozaki of Kanazawa University, scientists from Japan and France have detected them whistling around Mercury, barren and alone as it skirts the Sun. This is interesting, because those other planets have a few things that Mercury does not: thick, lush atmospheres, and permanent radiation belts where solar particles become trapped in a planet's magnetic field. Scientists say it's a discovery that could shed some light on the magnetic environment around Mercury, and how planetary magnetic fields in general are shaped by the solar wind.

https://www.sciencealert.com/mysterious-singing-plasma-waves-detected-around-mercury

NASA's Webb Discovers New Feature in Jupiter's Atmosphere

Narrow jet stream near equator has winds traveling 320 miles per hour

NASA's James Webb Space Telescope has discovered a new, never-before-seen feature in Jupiter's atmosphere. The high-speed jet stream, which spans more than 3,000 miles (4,800 kilometers) wide, sits over Jupiter's equator above the main cloud decks. The discovery of this jet is giving insights into how the layers of Jupiter's famously turbulent atmosphere interact with each other, and how Webb is uniquely capable of tracking those features.



This image of Jupiter from NASA's James Webb Space Telescope's NIRCam (Near-Infrared Camera) shows stunning details of the majestic planet in infrared light. In this image, brightness indicates high altitude. The numerous bright white 'spots' and 'streaks' are likely very high-altitude cloud tops of condensed convective storms. Auroras, appearing in red in this image, extend to higher altitudes above both the northern and southern poles of the planet. By contrast, dark ribbons north of the equatorial region have little cloud cover. Image: NASA, ESA, CSA, STScI, R. Hueso (University of the Basque Country), I. de Pater (University of California, Berkeley), T. Fouchet (Observatory of Paris), L. Fletcher (University of Leicester), M. Wong (University of California, Berkeley), J. DePasquale (STScI)

"This is something that totally surprised us," said Ricardo Hueso of the University of the Basque Country in Bilbao, Spain, lead author on the paper describing the findings. "What we have always seen as blurred hazes in Jupiter's atmosphere now appear as crisp features that we can track along with the planet's fast rotation."

The research team analyzed data from Webb's NIRCam (Near-Infrared Camera) captured <u>in July 2022</u>. The <u>Early Release Science program</u> – jointly led by Imke de Pater from the University of California, Berkeley and Thierry Fouchet from the Observatory of Paris – was designed to take images of Jupiter 10 hours apart, or one Jupiter day, in four different filters, each uniquely able to detect changes in small features at different altitudes of Jupiter's atmosphere.

https://www.nasa.gov/missions/webb/nasas-webb-discovers-new-feature-in-jupiters-atmosphere/

Astronomers detect most distant fast radio burst to date



This artist's impression (not to scale) illustrates the path of the fast radio burst FRB 20220610A, from the distant galaxy where it originated all the way to Earth, in one of the Milky Way's spiral arms. The source galaxy of FRB 20220610A, pinned down thanks to ESO's Very Large Telescope, appears to be located within a small group of interacting galaxies. It's so far away its light took eight billion years to reach us, making FRB 20220610A the most distant fast radio burst found to date. Credit: ESO/M. Kornmesser

An international team has spotted a remote blast of cosmic radio waves lasting less than a millisecond. This 'fast radio burst' (FRB) is the most distant ever detected. Its source was pinned down by the European Southern Observatory's (ESO) Very Large Telescope (VLT) in a galaxy so far away that its light took 8 billion years to reach us. The FRB is also one of the most energetic ever observed; in a tiny fraction of a second it released the equivalent of our sun's total emission over 30 years. The discovery of the burst, named FRB 20220610A, was made in June last year by the <u>ASKAP</u> radio telescope in Australia and it smashed the team's previous distance record by 50 percent. "Using ASKAP's array of dishes, we were able to determine precisely where the burst came from," says Stuart Ryder, an astronomer from Macquarie University in Australia and the co-lead author of the study titled "A luminous fast radio burst that probes the Universe at redshift 1" and <u>published</u> in *Science*.

"While we still don't know what causes these massive bursts of energy, the paper confirms that fast radio bursts are common events in the cosmos and that we will be able to use them to detect matter between galaxies, and better understand the structure of the universe," says Shannon.

https://phys.org/news/2023-10-astronomers-distant-fast-radio-date.html

https://www.spacedaily.com/reports/Astronomers_detect_most_distant_fast_radio_burst_to_date_999.html

Patterns in Sun's layers have implications for longstanding solar mystery



Small-scale magnetic structures of the 'quiet Sun' at high resolution captured by DKIST.

Astronomers at ARC are one step closer to understanding an enduring solar mystery by capturing the most detailed representations to date of the magnetic field of the 'quiet Sun' - and discovering something unexpected in the process. The researchers from the Astrophysics Research Centre (ARC) at the School of Mathematics and Physics at Queen's have collected groundbreaking data with the US National Science Foundation's (NSF) Daniel K Inouye Solar Telescope (DKIST) in Hawaii - the most powerful, solar telescope in the world, using cameras made by

Northern Ireland-based company Andor Technologies. The research, led by Queen's University Belfast, was carried out in partnership with an international group of experts from the NSF's National Solar Observatory, USA; the HighAltitude Observatory, USA; California State University, Northridge, USA; the Max Planck Institute for Solar System Research, Germany; the University of Sheffield, UK; and Eo"tvo"sLora'nd University, Hungary. DKIST, inaugurated in 2022, is the most powerful, solar, optical telescope on Earth. It enables record-breaking observations of our Sun, with a resolving power being the equivalent to seeing a 50p coin in Manchester from London. Queen's University researchers have harnessed this power to reveal a new, complex, snake-like pattern of energy in the magnetic field, in addition to the 'loops' observed previously. The researchers believe this has implications for how we model energy transfer between the layers of the Sun, which might help explain one of the biggest conundrums in astrophysics - why the outermost layer of the Sun ('corona') is hundreds of times hotter than the surface ('photosphere'), even though the opposite would be expected.

https://www.spacedaily.com/reports/Researchers_discover_new_patterns_in_Suns_layers_with_implications for_longstanding_solar_mystery_999.html





The S1222a marsquake detected by InSight on 4 May 2022 somewhat resembled previous impact-generated events.

A global team of scientists have announced the results of an unprecedented collaboration to search for the source of the largest ever seismic event recorded on Mars. The study, led by the University of Oxford, rules out a meteorite impact, suggesting instead that the quake was the result of enormous tectonic forces within Mars' crust. The quake, which had a magnitude of 4.7 and caused vibrations to reverberate through the planet for at least six hours, was recorded by NASA's InSight lander on May 4 2022. Because its seismic signal was similar to previous quakes known to be caused by meteoroid impacts, the team believed that this event (dubbed 'S1222a') might have been caused by an impact as well, and launched an international search for a fresh crater. Although Mars is smaller than Earth, it has a similar land surface area because it has no oceans. In order to survey this huge amount of ground - 144 million km2 - study lead Dr Benjamin Fernando of the University of Oxford sought contributions from the European Space Agency, the Chinese National Space Agency, the Indian Space Research Organisation, and the United Arab Emirates Space Agency. This is though to be the first time that all missions in orbit around Mars have collaborated on a single project. Each group examined data from their satellites orbiting Mars to look for a new crater, or any other tell-tale signature of an impact (e.g. a dust cloud appearing in the hours after the quake).

https://www.spacedaily.com/reports/International_team_reveals_source_of_largest_ever_Mars_quake_999. html

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