"The Southern Cross"



The Hermanus Astronomy Centre Newsletter

APRIL 2023

MONTHLY MEETING

Our March meeting was held on Monday 20th. Presented by Dr Pieter Kotze, the topic was "*Mysterious Solar System Magnetism*".

In a solar/planetary system of widely varying shapes and sizes, with the majority of the planets having magnetic fields centred on their cores with one planet lacking and one moon with such a field, the bodies experience orientation and polarity changes over time. These conveniently provide us with a view of the processes within the core of the bodies concerned.

The YouTube video is highly recommended: <u>https://www.youtube.com/watch?v=Q1-e3eyqSsM</u>

The next monthly meeting is scheduled for **Monday 17th April**. The University of the Free State's **Prof P Meintjes** presents "*Cosmic Power Stations: Fast Rotating Stars*".

2023 meeting dates for your diaries: April 17, May 15, June 19, July 17, August 21, September 18, October 16, November 20. (Monthly Meetings are held on the third Monday of every month except December unless otherwise advised).

SPECIAL INTEREST GROUP ACTIVITIES

Cosmology

(the first Monday of each month)

This is a series of 17 videos entitled "COSMOLOGY, THE HISTORY OF THE UNIVERSE".

At the meeting on **13th March**, our video was episode 6 - *What Really is Everything*?

https://youtu.be/euNr9PozCmg?list=PLROBLlvnR7BEF9b1NOvRf_zhboibmywJb

In addition, we watched and discussed **Sabine Hossenfelder's** views on the recent findings that "Monster Black Holes could be the source of Dark Energy"

https://www.youtube.com/watch?v=ENGJA1cUe3M&t=512s

The next Cosmology meeting is scheduled for 3^{rd} April, episode 7 – Why is the Universe Perfect? - 35 minutes.

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

Astrophotography

This SIG is scheduled for the second Monday of each month as requested by group members. There was no meeting held on 13th March.

The next meeting will be held. Scheduled for Monday 10th April, it has been brought forward to **Tuesday 4**th in order to avoid the Easter weekend. **Derek Duckitt** will demonstrate **Siril** (updated) and the new "Astrosurface" software.

For further information, please contact Deon Krige: krige.deon44@outlook.com.

Study Group

(The last Monday of each month)

Our last meeting was on **30th January** was "*Battery Management and Care*" by Johan Smit. The YouTube link - <u>https://www.youtube.com/watch?v=cRmtn0WLyIU</u>

The meeting scheduled for 27^{th} February was cancelled. In the meeting on 27^{th} March, we watched YouTube videos on geothermal energy presented by Sabine Hossenfelder <u>https://youtu.be/l6UGpaKnkS0</u> and Matt Ferrell <u>https://youtu.be/g8sjdOjNxIE</u>.

Next up is **24th April**, the topic to be announced.

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

Stargazing

No Hermanus Astronomy Centre events are currently planned but we shall let you know when a suitable evening is scheduled.

Future Trips

No outings are planned at present.

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

Astronomy News ...

(compiled by Pieter Kotzé)

The James Webb Space Telescope discovers enormous distant galaxies that should not exist



These six galaxies may force astronomers to rewrite cosmology books.(Image credit: NASA, ESA, CSA, I. LABBE)

Nobody expected them. They were not supposed to be there. And now, nobody can explain how they had formed. Galaxies nearly as massive as the <u>Milky Way</u> and full of mature red stars seem to be dispersed in deep field images obtained by the <u>James Webb Space</u> <u>Telescope (Webb or JWST)</u> during its early observation

campaign, and they are giving astronomers a headache. These <u>galaxies</u>, described in a new study based on Webb's first data release, are so far away that they appear only as tiny reddish dots to the powerful telescope. By analyzing the light emitted by these galaxies, astronomers established that they were viewing them in our universe's infancy only 500 to 700 million years after the <u>Big Bang</u>. Such early galaxies are not in themselves surprising. Astronomers expected that first star clusters sprung up shortly after the <u>universe</u> moved out of the so-called <u>dark ages</u> — the first 400 million years of its existence when only a thick fog of hydrogen atoms permeated space. But the galaxies found in the Webb images appeared shockingly big, and the <u>stars</u> in them too old. The new findings are in conflict with existing ideas of how the universe looked and evolved in its early years, and don't match earlier observations made by Webb's less powerful predecessor, the Hubble Space Telescope.

https://www.space.com/james-webb-space-telescope-giant-distant-galaxies-surprise

Galactic explosion offers astrophysicists new insight into the cosmos



SN 2021aefx in NGC 1566 at \approx 2–21 µm. Left panel: MIRI F1130W PHANGS-JWST image of NGC 1566 showing the location of SN 2021aefx, marked with a green circle. Right panels: zoom-ins on SN 2021aefx in each PHANGS-JWST filter. The top four panels show 200 pc \times 200 pc cutouts from NIRCam images at 2.0-3.6 μ m. The bottom four panels show 1 kpc \times 1 kpc MIRI images at 7.7–21 µm. The inner green circle marks the aperture used in the photometry measurement, and the two concentric dashed cyan circles mark the inner and outer apertures used for the backgroundsubtraction. *Credit:*The Astrophysical Journal Letters (2023). DOI: 10.3847/2041-8213/acb6d8

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IXPE unlocks mysteries of Tycho Supernova



Using data from NASA's Imaging X-ray Polarimetry Explorer (IXPE), international researchers have uncovered new information about the Tycho supernova remnant, an exploded star in the constellation Cassiopeia, the light from which was first seen on Earth in 1572. The results offer new clues about how shock waves created by these titanic stellar explosions accelerate particles to nearly the speed of light, and reveal, for the first time, the geometry of the magnetic fields close to the supernova's blast wave, which forms a boundary around the ejected material, as seen in this composite image. IXPE data (dark purple and white) have been combined with data from NASA's Chandra X-ray Observatory (red and blue) and overlaid with the

stars in the field of view as captured by the Digitized Sky Survey. An international team of scientists has uncovered new information about the remains of a star whose explosion was discovered 450 years ago. The supernova remnant is called Tycho, named for Danish astronomer Tycho Brahe, who noticed the bright glow of this new "star" in the constellation Cassiopeia in 1572.IXPE revealed, for the first time, the geometry of the magnetic fields close to the shock wave, which is still propagating from the initial explosion and forms a boundary around the ejected material. Understanding the magnetic field geometry allows scientists to further investigate how particles are accelerated there.

https://www.spacedaily.com/reports/IXPE_unlocks_mysteries_of_Tycho_Supernova_999.html

New magnetic cataclysmic variable detected



X-ray image of the NGC 2516 obtained by eROSITA. The white dashed circle marks the position of SRGE J075818-612027. False colors of the image were made using photon energies between 0.2 - 1.1 keV, 1.1 - 2.3 keV and 2.3 - 5 keV for the red, green, and blue channels, respectively. The image displays an area of 1×1 degree. Credit: Ok et al, 2023

Cataclysmic variables (CVs) are binary star systems consisting of a white dwarf accreting material from a normal star companion. They irregularly increase in brightness by a large factor, then drop back down to a quiescent state. Polars are a subclass of cataclysmic variables distinguished from other CVs by the presence of a very strong magnetic field in their white dwarfs. Recently, a team of astronomers led by Samet Ok of the Leibniz Institute for Astrophysics Potsdam (AIP) in Germany, has analyzed observational data of the field of open cluster NGC 2516 using Spektr-RG's eROSITA X-ray telescope and TESS. As a result, they serendipitously discovered a new CV. SRGE J075818-612027 was identified as one of the X-ray brightest objects of the field during the eROSITA Calibration and Performance Verification (CalPV) phase of observations. It turned out to be an accretion-powered background object at a distance of between 4,000 and 13,500 light years. Further observations of SRGE J075818-612027 revealed its variability with a period of about 106 minutes.

https://phys.org/news/2023-03-magnetic-cataclysmic-variable.html

Astronomers detect radio recombination lines of carbon oxygen ions for first time



The white line shows the RRLs of ions of C and/or O detected by TMRT. The green areas are the modeled emission of ion RRLs. The green dotted lines are the modeled emission, taking into account all RLLs and molecular lines. The background is the image of the heart-shaped Orion nebula (M42), with Orion KL located within the lower-left bright region of M42, credit to Shawn Nielsen.

A research team from the Shanghai Astronomical Observatory (SHAO) of the Chinese Academy of Sciences has detected radio recombination lines (RRLs) of ions heavier than helium for the first time, using the TianMa 65-m Radio Telescope (TMRT). These lines were assigned to carbon and/or oxygen ions. Ionized gas is the most widely distributed interstellar gas component and an important laboratory for measuring the abundance of elements. Radio recombination lines (RRLs) can avoid the difficulties of optical line observations, since RRLs are usually optically thin and have well understood emission mechanisms. However, detected RRL emitters have nearly all been neutral atoms so far. Only two RRL transitions (121a and 115a) of helium ions in planetary nebulae have been previously reported.

https://www.spacedaily.com/reports/Astronomers_detect_radio_recombination_lines_of_carbon_oxygen_io_ns_for_first_time_999.html

NASA's Curiosity Views First 'Sun Rays' on Mars



NASA's Curiosity Mars rover captured these "sun rays" shining through clouds at sunset on Feb. 2, 2023, the 3,730th Martian day, or sol, of the mission. It was the first time that sun rays, also known as crepuscular rays, have been viewed so clearly on Mars.

Martian sunsets are uniquely moody, but NASA's Curiosity rover captured one last month that stands out. As the Sun descended over the horizon on Feb. 2, rays of light illuminated a bank of clouds. These "sun rays" are also known as crepuscular rays, from the Latin word for "twilight." It was the first time sun rays have been so clearly viewed on Mars.

Curiosity captured the scene during the rover's newest twilight cloud survey, which builds on its 2021

observations of noctilucent, or night-shining, clouds. While most Martian clouds hover no more than 37 miles (60 kilometers) above the ground and are composed of water ice, the clouds in the latest images appear to be at a higher altitude, where it's especially cold. That suggests these clouds are made of carbon dioxide ice, or dry ice.

https://www.marsdaily.com/reports/NASAs_Curiosity_Views_First_Sun_Rays_on_Mars_999.html



Tracing 13 billion years of history by the light of ancient quasars

Artist's rendering of the accretion disk in ULAS J1120+0641, a very distant quasar powered by a supermassive black hole with a mass two billion times that of the Sun. Credit: ESO/M. Kornmesser

Astrophysicists in Australia have shed new light on the state of the universe 13 billion years ago by measuring the density of carbon in the gases surrounding ancient galaxies. The study, published in *Monthly Notices of the Royal Astronomical Society*, adds another piece to the puzzle of the history of the universe.

"We found that the fraction of <u>carbon</u> in warm gas increased rapidly about 13 billion years ago, which may be linked to large-scale heating of gas associated with the phenomenon known as the Epoch of Reionization," says Dr. Rebecca Davies. The study shows the amount of warm carbon suddenly increased by a factor of five over a period of only 300 million years—the blink of an eye in astronomical timescales. While previous studies have suggested a rise in warm carbon, much larger samples—the basis of the new study—were needed to provide statistics to accurately measure the rate of this growth. "As humans we strive to understand 'Where did we come from?' It's incredible to think that the barcode of those 13-billion-yearold carbon atoms were imprinted on photons at a time when [...] Earth didn't even exist. Those photons traveled across the universe, into the VLT, and then were used to develop a picture of the evolution of the <u>universe</u>."

https://phys.org/news/2023-03-billion-years-history-ancient-quasars.html

Cosmic-Ray Muons Reveal Hidden Structure in Khufu's Pyramid

<u>Khufu's Pyramid</u> is one of the largest archaeological monuments all over the world, which still holds many mysteries. In 2016 and 2017, the ScanPyramids team <u>reported</u> on several discoveries of previously unknown voids by cosmic-ray muon radiography. In new research, scientists carried out a precise analysis of the void — about 9 m in length with a transverse section of about 2 m by 2 m — found behind the North Face Chevron and named the ScanPyramids North Face Corridor.



East-West cut view of the Great Pyramid and front view of the North face Chevron area: (a) subterranean chamber; (b) queen's chamber; (c) grand gallery; (d) king's chamber; (e) descending corridor; (f) ascending corridor; (g) al-Ma'mun corridor; (h) north face Chevron area; (i) ScanPyramids Big Void with horizontal hypothesis (red hatching) and inclined hypothesis (green hatching). Image credit: Procureur et al., doi: 10.1038/s41467-023-36351-0.

Using a technique called cosmic-ray muon radiography, Dr. Sébastien Procureur from the Université Paris-Saclay and his colleagues measured the size, shape and location of the North Face Corridor in detail, without entering it. According to the team, the corridor measures about 9 m in length, and has a transverse section of about 2 m by 2 m.

https://www.sci.news/archaeology/cosmic-ray-muons-hidden-structure-khufus-pyramid-11715.html

Astronomers find missing link for water in the Solar System



This artist's impression shows the planet-forming disc around the star V883 Orionis. In the outermost part of the disc water is frozen out as ice and therefore can't be easily detected. An outburst of energy from the star heats the inner disc to a temperature where water is gaseous, enabling astronomers to detect it. The inset image shows the two kinds of water molecules studied in this disc: normal water, with one oxygen atom and two hydrogen atoms, and a heavier version where one hydrogen atom is replaced with deuterium, a heavy isotope of hydrogen.

Using the Atacama Large Millimeter/submillimeter Array (ALMA), astronomers have detected gaseous water in the planet-forming disc around the star V883 Orionis. This water carries a chemical signature that explains the journey of water from star-forming gas clouds to planets, and supports the idea that water on Earth is even older than our Sun. This discovery was made by studying the composition of water in V883 Orionis, a planet-forming disc about 1300 light-years away from Earth. When a cloud of gas and dust collapses it forms a star at its centre. Around the star, material from the cloud also forms a disc. Over the course of a few million years, the matter in the disc clumps together to form comets, asteroids, and eventually planets. Tobin and his team used ALMA, in which the European Southern Observatory (ESO) is a partner, to measure chemical signatures of the water and its path from the star-forming cloud to planets.

https://www.spacedaily.com/reports/Astronomers_find_missing_link_for_water_in_the_Solar_System_999. html

Runaway black hole the size of 20 million suns found speeding through space with a trail of new-born stars behind it

Astronomers have discovered a "runaway" black hole, potentially the first observational evidence that supermassive black holes can be ejected from their host galaxies.



An illustration showing a black hole being ejected from a galaxy's centre, as a trail of brightly glowing gas follows behind(Image credit: Keio University)

Astronomers have spotted a runaway supermassive black hole, seemingly ejected from its home galaxy and racing through space with a chain of stars trailing in its wake. The discovery offers the first observational evidence that supermassive black holes can be ejected from their home galaxies to roam interstellar space. The researchers discovered the runaway <u>black hole</u> as a

bright streak of light while they were using the Hubble Space Telescope to observe the dwarf galaxy RCP28, located about 7.5 billion light-years from Earth. Follow-up observations showed that the streak measures more than 200,000 light-years long — roughly twice the width of the Milky Way — and is thought to be made of compressed gas that is actively forming stars. The gas trails a black hole that is estimated to measure 20 million times the mass of the sun and is speeding away from its home galaxy at 3.5 million mph (5.6 million km/h), or roughly 4,500 times the speed of sound.

https://www.livescience.com/runaway-black-hole-the-size-of-20-million-suns-found-speeding-through-space-with-a-trail-of-newborn-stars-behind-it

Webb Telescope spots swirling, gritty clouds on remote planet in spectrum data



A research team led by Brittany Miles of the University of Arizona used two instruments known as spectrographs aboard the James Webb Space Telescope, one on its Near Infrared Spectrograph (NIRSpec) and another on its Mid-Infrared Instrument (MIRI) to observe a vast section of near- to mid-infrared light emitted by planet VHS 1256 b. They plotted the light on the spectrum, identifying signatures of silicate clouds, water, methane and carbon monoxide. They also found evidence of carbon dioxide.

Researchers observing with NASA's James Webb Space Telescope have pinpointed silicate cloud features in a distant planet's atmosphere. The atmosphere is constantly rising, mixing, and moving during its 22-hour day, bringing hotter material up and pushing colder material down. The resulting brightness changes are so dramatic that it is the most variable planetary-mass object known to date. The team also made extraordinarily clear detections of water, methane and carbon monoxide with Webb's data, and found evidence of carbon dioxide. This is the largest number of molecules ever identified all at once on a planet outside our solar system. Catalogued as VHS 1256 b, the planet is about 40 light-years away and orbits not one, but two stars over a 10,000-year period. VHS 1256 b is about four times farther from its stars than Pluto is from our Sun, which makes it a great target for Webb. That means the planet's light is not mixed with light from its stars. Higher up in its atmosphere, where the silicate clouds are churning, temperatures reach a scorching 1,500 degrees Fahrenheit (830 degrees Celsius).

https://www.spacedaily.com/reports/Webb_Telescope_spots_swirling_gritty_clouds_on_remote_planet_in_spectrum_data_999.html

Mysterious radio signal reveals intricate core of distant galaxy cluster



These twenty-seven moveable antennas, known as the Very Large Array (VLA), take in radio signals, some extremely faint, from throughout the cosmos, 1999 near Socorro, New Mexico. (Image credit: Joe McNally/Getty Images)

A puzzling radio emission from a galactic cluster located in the constellation may come from the 1.66 million light-year-long radio tail of its dominating central galaxy. The team that made this discovery also found evidence of mergers between <u>galaxies</u> in the cluster

Abell 1213, which is in the constellation of <u>Ursa Major</u> and is located around 647 million light-years from Earth. The findings are the result of astronomers investigating an anomalous radio emission from Abell 1213. In 2009, observations with the <u>Very Large Array</u> (VLA), comprised of 28 radio antennas spread across the Plains of New Mexico, revealed the presence of a diffuse extended emission from the cluster.

https://www.space.com/mysterious-radio-signal-intricate-core-galaxy-cluster

Asteroid Ryugu samples found to contain uracil, a key component of RNA



The surface of asteroid Ryugu, seen here, was sampled in 2018 by the Hayabusa 2 mission.MASCOT/DLR/JAXA

How did life come about? The answer to this question goes to the very heart of our existence on planet Earth. Did life simply arise from chemical reactions among organic compounds in a primordial soup left after Earth clumped together from space rubble? If so, where did the organic compounds come from? Some of the so-called "building blocks of life" may have been surprisingly common in the early solar system. A team of Japanese and American scientists led by Yasuhiro Oba has analyzed samples taken from the asteroid Ryugu in 2018 by the Hayabusa2 mission and found uracil, one of the five key bases of the RNA and DNA molecules that are crucial to life as we know it.

Furthermore, the presence of these amino acids on Ryugu shows that even on asteroid surfaces, exposed to solar wind, micrometeorites, and cosmic rays, organic molecules can survive transportation through the solar system.

The Hayabusa2 samples from Ryugu provide a new context for understanding the origin of organic compounds that may have been the start of life on Earth. It is still a big step from having these organic compounds available to early Earth, and the formation of life itself.

https://astronomy.com/news/2023/03/asteroid-ryugu-samples-found-to-contain-uracil-a-key-component-ofrna

COMMITTEE MEMBERS

Derek Duckitt	(Chairman, website editor, "Southern Cross" editor,	082 414 4024
	Cosmology SIG co-ordinator)	derek.duckitt@gmail.com
Pierre de Villiers	(Vice-chairman, GPAED project leader)	082 854 2277
Elaine Sykes	(Treasurer)	083 286 2683
Peter Harvey	(Secretary, "Skynotes", "Southern Cross", Study Group SIG coordinator)	081 212 9481 petermh@hermanus.co.za
Mick Fynn	(Educational outreach)	082 443 0848
Pieter Kotzé	(Events co-ordinator, "Southern Cross" Astronomy News)	082 581 3233

Non-committee members with portfolios:

Deon Krige	(GPAED project, Astro-photography SIG coordinator)	
Johan Retief	(Membership)	028 315 1132