

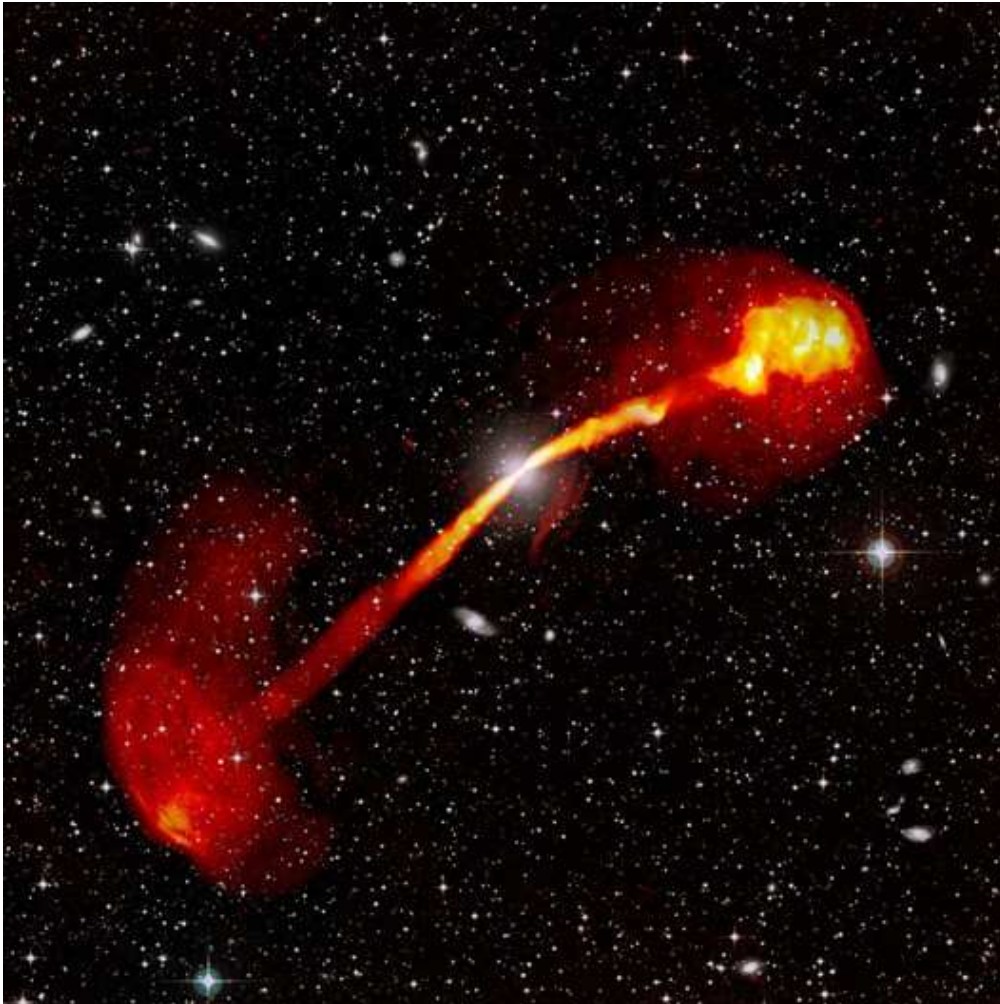
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Cover picture

The MeerKAT radio telescope has produced a striking image of the Fanaroff-Riley Type I radio galaxy IC 4296 (see page 125).



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MeerKAT's stunning image reveals cosmic threads, ribbons and rings

A new study using the MeerKAT radio telescope has produced a striking image showing a combination of cosmic features never before seen, revealing unexpected details of the inner workings of enormous radio galaxies (See front cover).

The Fanaroff-Riley Type I radio galaxy IC 4296 dominates this spectacular vista, wider than the full moon on the sky. MeerKAT radio data are represented in red/orange hues in this composite view. The visible light image from the Super COSMOS Sky Survey shows the central giant elliptical galaxy, as well as numerous unrelated galaxies and foreground stars in the Milky Way. Credit: SARAO, SSS, S. Dagnello and W. Cotton (NRAO/AUI/NSF). Adapted from J. Condon et al., "Threads, Ribbons, and Rings in the Radio Galaxy IC 4296" (The Astrophysical Journal, in press).

At the centre of the giant elliptical galaxy IC 4296 is a rotating black hole with a mass of a billion suns. Energy released by matter falling onto the black hole generates two opposing radio jets containing magnetic fields and relativistic electrons. After travelling through intergalactic space at the speed of light for 160 million years, these radio waves were detected by the South African Radio Astronomy Observatory's MeerKAT telescope, located in the Karoo region of the Northern Cape province of South Africa.

The bright spines of the initially straight jets become unstable just outside the galaxy, where some of the electrons escape to create several faint radio "threads" below IC 4296. Between the bright jets and the outer lobes are smooth "ribbons" filling channels excavated from the surrounding gas by defunct jets from an earlier period of activity. The ribbons are eventually stopped by intergalactic gas, nearly a million light-years from the central galaxy (a distance equal to 10 times the diameter of our Milky Way home galaxy), and form the "smoke rings" visible in the left radio lobe.

Jim Condon of the US National Radio Astronomy Observatory – lead author of the study just accepted for publication in *The Astrophysical Journal* that summarizes this research done by a US-South African team – says that “only MeerKAT’s unique combination of sensitivity, angular resolution, and dynamic range allowed the discovery of these threads, ribbons, and rings” in this previously well-studied galaxy.

As noted by the anonymous reviewer of the manuscript submitted for publication, “it is clear that new results like this from MeerKAT and other SKA pathfinders are set to overhaul our understanding of extragalactic radio sources”.

(Press Release 17 June)

Green light given for construction of world’s largest radio telescope arrays

At a historic meeting of its Council last week, the recently formed SKA Observatory (SKAO) saw its Member States approve the start of construction of the SKA telescopes in Australia and South Africa.



How the two SKA sites in Australia and South Africa will look when the telescopes are complete! These images blend photos of real hardware already on the ground at both sites with artist’s impressions of the future SKA antennas. The day and night composites of the two sites combine all elements in South Africa and Australia. Credit: SKA Observatory.

The two telescopes, currently designated SKA-Low and SKA-Mid, names which describe the radio frequency range they each cover, will be the two largest and most complex networks of radio telescopes ever built.

The decision to approve construction follows the creation of the SKAO as an intergovernmental organisation earlier this year, and the publication of two key documents, the Observatory's Construction Proposal and Observatory Establishment and Delivery Plan, last year. The documents are the culmination of over seven years of design and engineering work by more than 500 experts from 20 countries to develop and test the technologies needed to build and operate the state-of-the-art telescopes. Eleven international consortia representing more than 100 institutions including research labs, universities and companies from around the world, designed the antennas, networks, computing, software, and infrastructure needed for the telescopes to function.

"I am ecstatic. This moment has been 30 years in the making," said SKAO Director-General Prof. Philip Diamond. "Today, humankind is taking another giant leap by committing to build what will be the largest science facility of its kind on the planet; not just one but the two largest and most complex radio telescope networks, designed to unlock some of the most fascinating secrets of our Universe."

"I would like to thank everyone who has contributed to making this possible over the past decades, from the early inception of the project until now, and in particular all the teams who have worked so hard over recent years and powered on through a pandemic in very difficult circumstances to meet deadlines and make this milestone possible. I would also like to thank our Member States for their vision and the trust they're placing in us by investing in a large-scale, long-term research infrastructure at a time when public finances are under intense pressure."

"I would like to add my thanks to the members of the SKAO Council and the governments they represent," said Dr Catherine Cesarsky, Chairperson of the SKAO Council. "Giving the green light to start the construction of the SKA telescopes shows their confidence in the professional work that's been done by the SKAO to get here, with a sound plan that is ready for implementation, and in the bright future of this ground-breaking research facility."

In addition to delivering exciting and revolutionary science, the construction of the SKA telescopes will produce tangible societal and economic benefits for countries involved in the project through direct and indirect economic returns from innovation and technological spin-offs, new high-tech jobs and boosted industrial capacity, among others. The well-documented impact prospect of the SKA Project (detailed in the Construction Proposal), outlining the multiple benefits already flowing to Member

States and their communities thanks to their involvement in SKA-related activities over the last few years, was a key part of the case for the project.

The SKA Project has seen impressive progress in recent months, with the successful completion of the ratification process of the SKAO treaty by all seven initial signatories, Australia, China, Italy, the Netherlands, Portugal, South Africa and the United Kingdom; excellent progress from France and Spain towards membership of the Observatory; and the signature of a cooperation agreement with Ecole Polytechnique Fédérale de Lausanne on behalf of Switzerland, with the Swiss government announcing its intention to eventually join the SKAO, pending approval from Parliament on the funding required for the participation of Switzerland until 2030. Other countries, including those that also took part in the design phase of the SKA telescopes (Canada, Germany, India, and Sweden), and other more recent joiners such as Japan and South Korea, complete the select list of Observers in the Council.

“Today’s commitment by Member States is a strong signal for others to get aboard and reap the benefits of participation in this one-of-a-kind research facility,” added Dr Cesarsky.

The cost of constructing the two telescopes and the associated operations and business-enabling functions will be €2billion over the period 2021 – 2030.

Over the past few years, the excitement in the science community about using the SKA telescopes to answer some of the most fundamental questions about our Universe, has been growing. Recent meetings have demonstrated this huge scientific interest, with close to 1,000 scientists taking part in the latest SKAO Science Meeting in March of this year. More than 1,000 researchers from hundreds of institutions across 40 countries are involved in the SKAO’s Science Working Groups that are working to ensure that the maximum science potential of the new observatory can be quickly realised.

There has been significant engagement between the SKAO’s local partners, the South African Radio Astronomy Observatory (SARAO) and Australia’s Commonwealth Scientific and Industrial Research Organisation (CSIRO), and local communities in preparation for the start of construction. In South Africa, SARAO has a memorandum of understanding with Agri-SA, many of whose members own farms which share boundaries with the MeerKAT radio telescope core or will host antennas part of the SKA-Mid telescope in the three spiral arms.

Respectful dialogue and engagement with Indigenous communities has also been a hallmark of the project, with the signing of a Memorandum of Understanding between the San Council of South Africa and SARAO and, just last week, in principle support for the project from the Wajarri Yamaji, the traditional owners of the land on which the SKA-Low telescope will be built.

“The SKAO will be a good neighbour and will work with local stakeholders, and in particular Indigenous communities, to ensure that they also benefit from the SKA project alongside other stakeholders nationally and internationally,” added Prof. Diamond. “We certainly intend to play our part in supporting local communities and boosting the local economy.”

Procurement of major contracts for the SKA telescopes will start immediately, with some market surveys having already been conducted in the past few weeks. Over the coming months, some 70 contracts will be placed by the SKAO within its Member States, with competitive bidding taking place within each country.

The first significant activity on site is due to happen early next year, with construction of the telescopes lasting until 2028. Early science opportunities will start in the next few years, taking advantage of the nature of radio telescope arrays, also known as interferometers, which allow observations with only a subset of the full array. The telescopes are planned to have a productive scientific lifetime of 50 years or more.

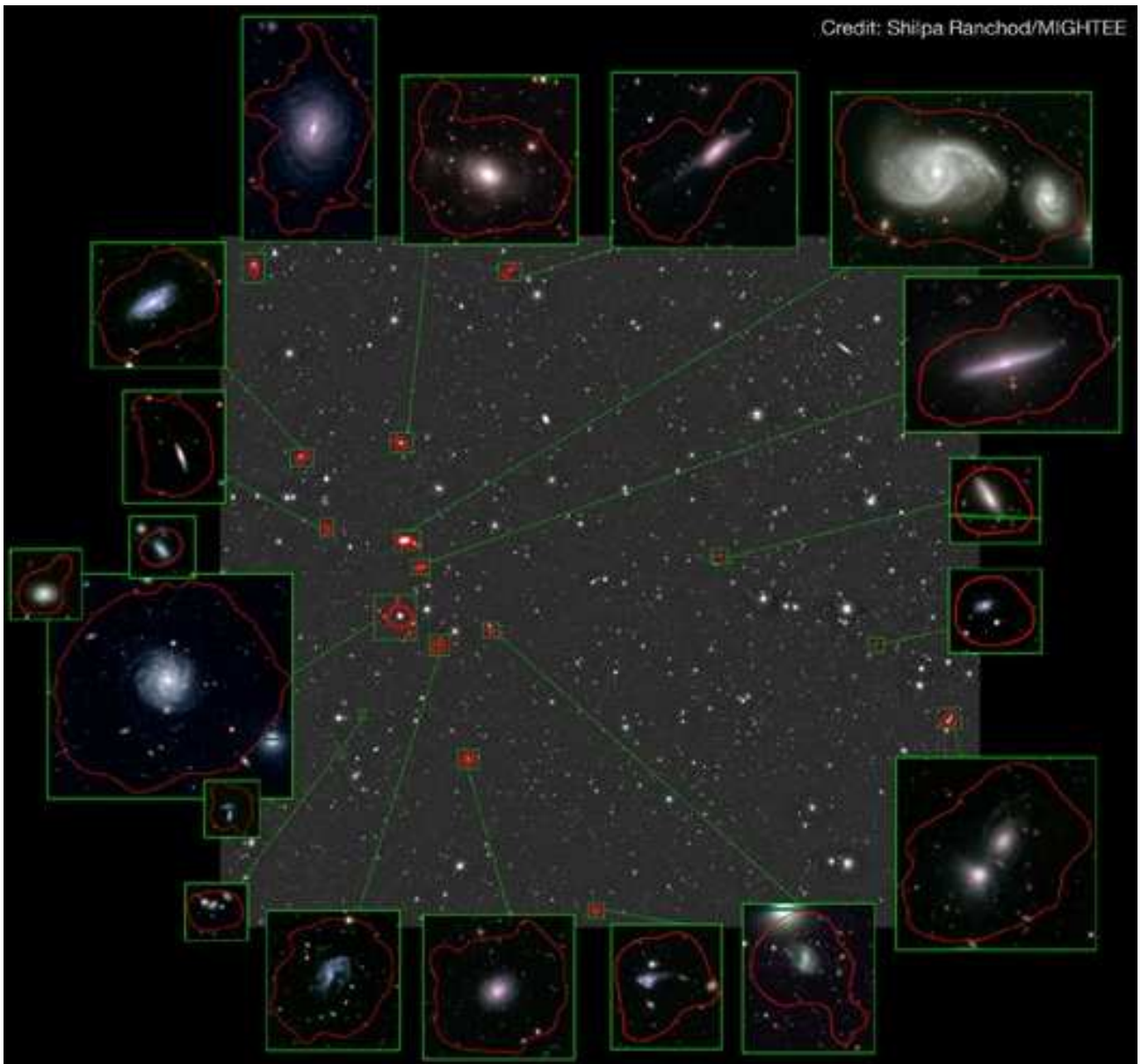
(Press Release 29 June)

MeerKAT discovers large gas-rich galaxy group hiding in plain sight

A group of 20 galaxies has been discovered with South Africa’s MeerKAT telescope. This large galaxy group is likely the most neutral hydrogen gas-rich group ever discovered, and it is the first time this group has been identified, despite residing in a very well-studied area of the sky.

Most star-forming galaxies are embedded within a cloud of cold neutral hydrogen gas, which acts as the raw fuel from which stars can eventually form. This gas is extremely faint, and can only be detected in radio wavelengths. It is diffuse, and extends beyond the visible part of the galaxy. By observing this hydrogen gas, astronomers are able to understand the evolutionary processes that take place in galaxies.

The majority of galaxies in the Universe reside in groups. However, it is rare to detect a group with such a large number of group members with so much neutral hydrogen. This suggests that the group is still in the process of assembly, as it has not undergone evolutionary processes that would remove this gas from the galaxies.



Optical image of the galaxy group with 3-colour optical images of each member galaxy using data from the Hyper-Suprime Camera on the Subaru telescope. The red outline indicates the extent of the neutral hydrogen gas around each galaxy. The central image, also showing the many thousands of background galaxies, is one degree on each side, large enough to fit four full moons (Credit: Shilpa Ranchod/MIGHTEE/HSC project

The paper was led by Shilpa Ranchod, an MSc student supervised by Prof. Roger Deane at the University of Pretoria. “The distribution of neutral hydrogen gas in these galaxies has revealed interesting, disturbed morphologies suggesting that these galaxies are group members, and are being influenced by their cosmic neighbours in the group”, notes Ranchod. “For example, we found an interacting pair of galaxies that will potentially merge to form a new galaxy with a completely transformed appearance.”

This galaxy group was discovered by the MeerKAT International Gigahertz Tiered Extragalactic Exploration (MIGHTEE) survey. It is one of the large survey projects in progress with South Africa's MeerKAT telescope and involves a team of South African and international astronomers.

The MeerKAT radio telescope in the Northern Cape, South Africa's precursor to the Square Kilometre Array (SKA), aims to answer fundamental questions about the formation and evolution of galaxies. Its exceptional sensitivity provides astronomers with further insight into the drivers of galaxy evolution.

Dr Natasha Maddox, research scientist at Ludwig Maximilians Universität in Munich, and co-chair of the MIGHTEE neutral hydrogen working group said, "This galaxy group sits in an area of sky that has been studied with many other telescopes, but only with MeerKAT is the group structure revealed so clearly. Galaxy environment strongly affects how galaxies change and grow, and observations of neutral hydrogen with MeerKAT give us a new observational window into structures like this."

Dr Bradley Frank, SRAO's associate director of astronomy operations at the Inter-university Institute for Data Intensive Astronomy and co-chair of the MIGHTEE neutral hydrogen working group said, "This discovery really highlights that MeerKAT is an amazing instrument. MeerKAT's large field-of-view, wide bandwidth, coupled with excellent sensitivity and resolving power makes it a premium survey instrument, allowing us to conduct a census of galaxies in a variety of environments. MeerKAT is an important step in the direction of the SKA — providing us with a view to future SKA science projects and lessons on how to overcome the many technical challenges involved in realising the true scientific potential of SKA and SKA pathfinders."

Dr Anastasia Ponomareva, researcher at the University of Oxford and co-author of the paper said, "This discovery shows that our MeerKAT observations caught a galaxy group in the early stages of its assembly, which is very uncommon. Therefore, this discovery is not only important per se, but will set new grounds for understanding of how galaxies are assembled into groups and transformed by their environment. We expect many wonderful findings like this in the future, thanks to the ongoing MeerKAT surveys."

This discovery has been published in the Monthly Notice of the Royal Astronomical Society, and its pre-print version is available on this link <https://arxiv.org/abs/2107.01237>.

(Press Release - 6 July)

The Herschel “20-feet” Mirror at SAAO

I.S. Glass (SAAO)

During the years 1834-1838 Sir John F W Herschel operated a 48 cm diameter reflecting telescope of 20 feet (6.1 m) focal length at the location of the present-day Grove Primary School in Claremont, Cape Town. During this time he made a survey of nebulous objects and double stars that complemented the Northern one made by him and his father, William, from England. Their work together laid the foundation for the New General Catalogue or NGC familiar to astronomers today.

In 1783 William Herschel had constructed his original 20-foot telescope, the most successful of his large instruments and at the time the largest in the world. However, by 1820 it had fallen into disrepair and was reconstructed by father and son so that the former’s survey could be repeated and extended. It was this telescope that Sir John brought to the Cape.

Large glass mirrors could not at that time be made because both of annealing problems and the inability to make reflecting surface coats. The primary mirror of the 20-feet was therefore of speculum metal, a hard alloy mainly of copper and tin that could take a brilliant polish but could only reflect about 60% of the incident light. Further, the alloy that the Herschels used was chosen to avoid excessive brittleness at the expense of liability to tarnish. As a consequence, their mirrors required precise optical re-polishing every few months and this problem may have been aggravated at the Cape by the relative proximity of John Herschel’s observatory to the sea. To avoid problems he brought three interchangeable primary mirrors with him, as well as his polishing machine.

The oldest of the three mirrors, each of which were about 48 cm in diameter, had been cast, ground and polished by William Herschel. The second was a joint effort between father and son and the third was made by John Herschel alone.

John Herschel erected the reconstructed 20-foot telescope on the estate Feldhausen that he owned during his period of residence at the Cape. He was assisted by his technician, John Stone. The very successful results of the observations were published about ten years later (Herschel, 1847).

The image of the telescope shown in the well-known illustration, with Table Mountain in the background, that formed the frontispiece of the 1847 publication, was a greatly simplified one. Fortunately, there still exists a detailed description of the telescope in

its final form by Herschel that is now in the collection of the University of Texas, unpublished until transcribed by Warner (1979).

Fig 1 is adapted from an image in Herschel's description. Motions could be imparted to the telescope by means of the various winches and Stone was kept hard at work during observing sessions. For example, when Herschel was surveying the sky during one of his "sweeps", the telescope was moved up and down fairly rapidly by three degrees in elevation while fixed on the meridian. In this way a long stretch of a 3° wide band of declination could be mapped as the Earth turned.

Because of the poor reflectivity of speculum mirrors, the "20-foot" was used as a "front view" telescope, meaning that the eyepiece was placed at the prime focus of the mirror, whose axis was tilted slightly relative to the axis of the tube. The observer had to look downwards into the tube. This off-axis configuration inevitably caused distortion of the images that could be reduced to some extent by stopping down the diameter of the input pupil or by introducing a form of apodizing using triangular masks. [The optical performance of front view reflectors including those of the Herschels has been analysed in detail by Ceragioli (2018)].

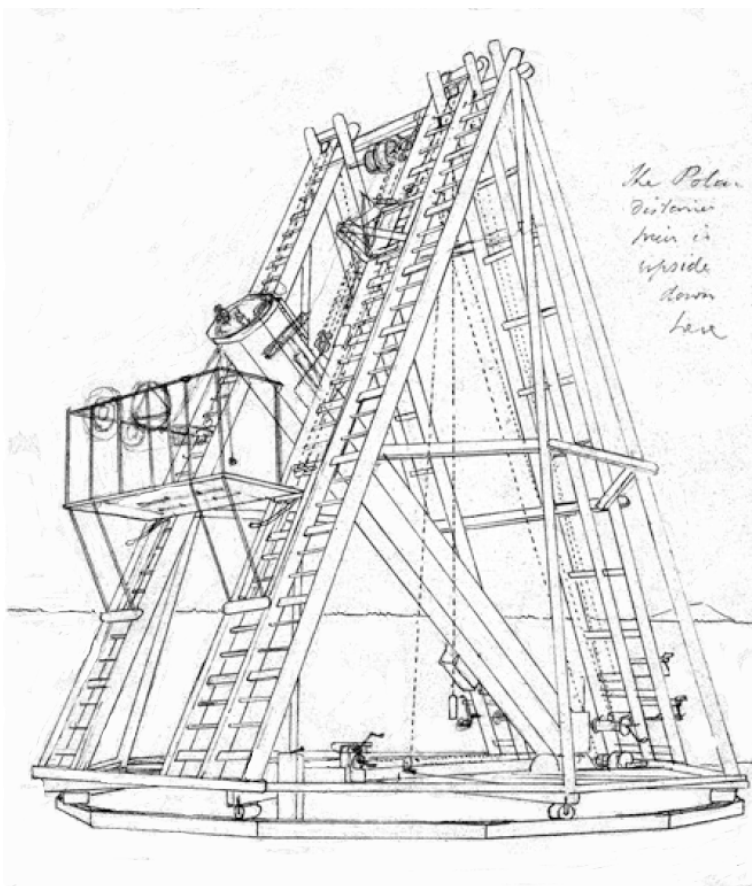


Fig 1. Sketch of the Herschel 20-foot telescope as erected at Feldhausen. From a sketch by John Herschel (credit: Harry Ransom Center, the University of Texas at Austin).

Following his work at the Cape, Herschel returned to England and did not re-erect the telescope, which gradually deteriorated. Two of the mirrors, the tube and a few other parts have survived and are in the possession of the National Maritime Museum in Greenwich, UK (Maurer, 1971). The third mirror, that made by John Herschel alone, is in the Museum of the SAAO.

This third mirror was sent many years later, in July 1905, to the Royal Observatory, Cape of Good Hope, by Sir William James Herschel, the oldest son of John Herschel.

The date is based on an unsigned note found with the mirror, sent in July 1905 from Woodstock Road, Oxford, his address. The 4-page document contains instructions on how to remove the mirror from its packing case, with a caveat on preserving the inscription on its back.

According to Warner (1979), the mirror was sent to the South African Museum (now called the Iziko South African Museum) for an exhibition commemorating John Herschel in 1934. It was last displayed at the Museum in March 1992.

Together with certain other items that belonged to the Royal Observatory, it was returned in November 2020 to the SAAO, the successor institution of the Royal Observatory, Cape of Good Hope.

The outer box (Fig 2) is of wood, somewhat worm-eaten. Its lid was held down by many screws. Underneath it, lay an inner tin box (Fig 3).



Fig 2. (left) Top of the outer wooden box. Fig 3. (centre) shows the top of the inner tin box which lay beneath a layer of toweling material. Fig 4. (right) shows the surface of the mirror, still fairly reflective.

The tin lid could easily be removed to reveal the front surface of the mirror itself (Fig 4.).

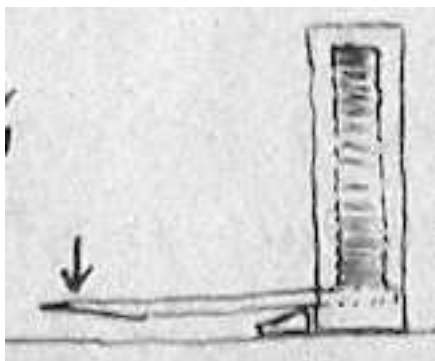


Fig 5. Piece of wood used to lever the mirror, still within its tin box, out of the wooden case. One person puts his weight where the arrow indicates and another twists and rolls the mirror out.

To extract the mirror from the wooden box the small piece of wood above the tin in Fig 3 was removed and replaced by a longer piece as shown in Fig 5, taken from the note accompanying the mirror. The box was then placed on its side and the mirror turned and rolled out. Two people were necessary for this manoeuvre.

The mirror was then placed face down and supported by its edges. The tin can was lifted off to reveal the gilt inscription on the back (Fig 6).

Fig 6. The back of the mirror carries an inscription in Hebrew and English in gilt lettering.



Hagai Netzer, an Israeli friend, suggests that a more accurate translation of the Hebrew would be “And I have seen all the heavens and they are telling the glory of God”.

Figs 7 and 8 show the bottom and top of the tin.



Fig 7. (left): The lower part of the tinned box that surrounded the mirror. The brass rod around the inner edge can be seen.



Fig 8 (right): The lid of the box, also with a brass rod most of the way around the inner edge. The significance of the writing is unknown.

unknown.



Fig 9. On the side of the mirror is written “Mirror J1”.

The mirror itself has diameter 47.5 cm and thickness ~37.5 mm. Because of its extreme thinness it must have flexed quite considerably. Its mass has not been measured but is probably around 60 Kg.

Under the tin were several layers of felt-like material, including a pad stitched together from several pieces, which was probably similar to that described by Herschel in the introduction to his Cape Observations where he discusses the

supporting of large mirrors (Herschel 1847, p. x) as follows “between the back of the case and the mirror are interposed six or eight thicknesses of coarse woolen baize, or blanketing, of even texture, and quite free from knots, stitched together at the edges to prevent any hard substance from getting between them. On this bed the metal is laid flat, and being shaken into a concentric situation, as respects the rim of the case, two supports of strips of similar woolen stuff, many times doubled, occupying about 30 degrees each of the circumference of the case, so as to leave an arc of about 40 degrees unoccupied, opposite the point which is intended to be placed lowermost in the tube...”.

Fig 10. Pad, consisting of 4 layers of blanketing material sewn together, found behind mirror.



The Foucault test was only published in 1858 and was thus unavailable to the Herschels. The second 20-foot mirror, that made by father and son, is the only one to have been examined by more-or-less modern methods, by Davies (1923). He found it to be somewhat hyperbolic. The Herschels tested their mirrors using zonal masks, a method that would have been less accurate than the Foucault test.

Ceragioli (2018) points out that these 20-foot mirrors probably represented about the largest size that were usable in front-view telescopes. The much larger Herschel 40-foot instrument, constructed at great expense and to much fanfare, was in fact a disaster that the Herschels did their best to keep quiet about.

The Herschel method of mounting large mirrors was greatly inferior to the “equilibrated levers” invented by Thomas Grubb and adopted by Lord Rosse for his instruments.

The SAAO possesses another quite big Herschel mirror, a 14-inch (34 cm) mirror of 14 (feet 4.3 m) focus. This mirror is about 4.5 cm thick and has a bar fixed to its back at about 1/3 of its height (if the mirror is placed on its edge). It is surrounded by a brass ring and had a tin cover that covers its front. This mirror was part of a telescope built by William Herschel in 1810 and sold to Glasgow University. It was later purchased for the Royal Observatory, Cape of Good Hope. Unfortunately the telescope, in an advanced state of decay, was scrapped around 1950.

Another speculum mirror 6 inches (15 cm) diameter and 18 mms thick exists at SAAO but its provenance is unknown. It is enclosed in a tin box.



*Fig 11. A new box with a Plexiglass cover, to display the 20-foot mirror in a vertical position, has been constructed and is shown in the lower part of the figure together with the lid of the mirror tin. Above it is a 14-foot mirror and lid, constructed by William Herschel in 1810; (See Warner, B., MNASSA 1987, **46**, 158); also a smaller concave speculum mirror of about 15 cm diameter of unknown provenance.*

Note: The original wooden box of the 20-foot mirror has been kept and treated to kill the woodworm infestation.

Acknowledgments: The author wishes to thank Dr Roger Ceragioli (University of Arizona) for information, Mr Chris de Coning for help with handling the mirror and Dr Hagai Netzer for his translation.

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The Western Cape bolide of August 9, 2021 (SAFC Event 401)

Tim Cooper, Comet, Asteroid and Meteor Specialist, ASSA

The Western Cape seems to have had its fair share of very bright bolides in recent years, and such was the case again during the early morning of August 9, 2021. The last bright bolide over the area occurred on January 16, 2019 (Event 316 in the Southern African Fireball Catalogue (SAFC), see Figure 1), which approached from the south descending at a steep angle, and disintegrated with two explosions just south

of the coast, probably in the vicinity of Gansbaai. Sounds were reported like rumbling thunder, and the ground vibrated. This event was preceded by the daylight bolide of March 12, 2013 (Event 249), which was observed by many individuals despite occurring shortly after midday, and was also recorded by US Government sensors (<https://cneos.jpl.nasa.gov/fireballs/>), exploding at an altitude of 26.0 km with energy equivalent of 0.1 kT. No sounds were heard, but the explosion occurred 85 km west of St Helena Bay, and 190 km north-west of Cape Town. The latest event on August 9 (Event 401) occurred in the early hours of the morning, and consequently was not widely seen, but sounds were heard over a wide area.



Fig 1. Probable paths for three bright Western Cape bolides. Yellow = SAFC 249 on March 12, 2013. Red = SAFC 316 on January 16, 2019. Green = SAFC 401 on August 9, 2021. Event 401 disrupted over land and may have deposited meteorites, but in the absence of sufficient video calibrations no potential strewn field locations could be determined.

Event 401 on August 9, 2021 was extensively reported on the Mosselbaai-op-sy-beste Facebook page. The author contacted several of those who posted to that group and also requested any video footage which might have caught the visible fireball or flash from the bolide. Kos Coronaios also posted to the Southern Cape Astronomy Club and ASSA Facebook pages, and coordinated searches for video footage. Case Rijdsijk forwarded the same request for reports and videos to the press in the George area, and several additional reports were received via the George Herald. The following is a summary of reports received, with locations shown in Figure 2.

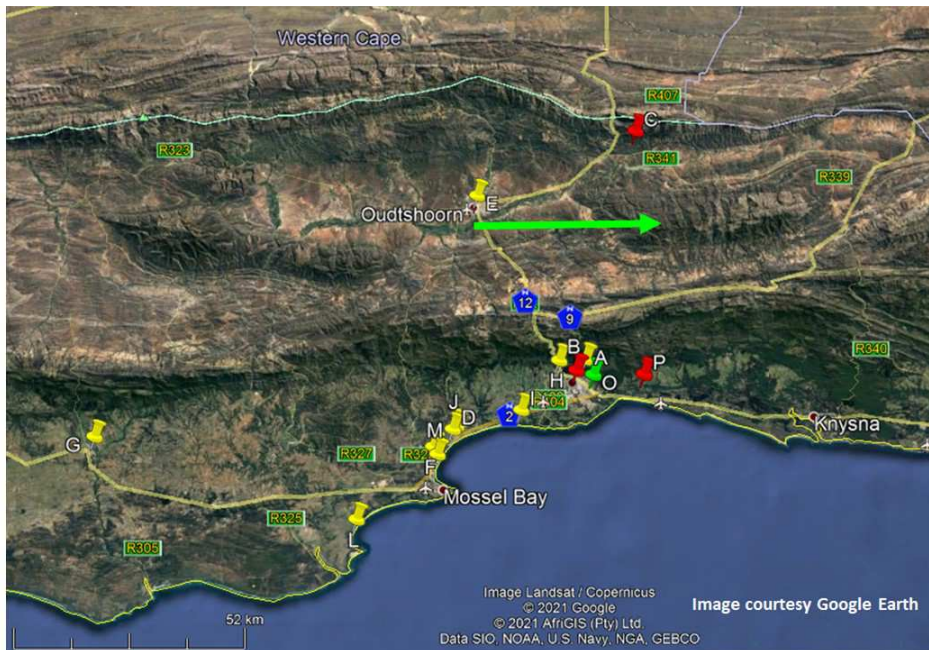


Figure 2 Locations of reports for Event 401, yellow pins are locations where sounds were heard, red pins are three locations from where the bolide was observed visually, and green pin is the location of a security camera that recorded the bright flash and subsequent sounds.

Reports of sounds heard

Many persons in the Western Cape reported hearing sounds at around 1am local time. Locations included Riversdale, Mossel Bay, Oudtshoorn, Boggoms Bay, George, Hartenbos, Klein Brak River, Wilderness and De Rust, spanning a horizontal distance of around 115 km. The most westerly location where sound was reported was Riversdale, where it was described as rumbling, like distant thunder. The most easterly was from several observers in the vicinity of George, where most reports said it sounded like thunder, but some also likened it to a gas cylinder exploding, and caused windows to rattle. Godwin Pangel said he saw the flash (see evidence from video captures), which was followed some time later by a ‘thunderous vibration’. From Oudtshoorn the sound was also likened to distant thunder, but also ‘like a gas cylinder exploding and caused the roof to rattle’. Ted Nutting near De Rust, situated north of the path saw the passage of the bolide, which was followed 1-2 minutes later by up to four distinct ‘bangs and tailing off afterwards like the sound of a jet flying over’.

Visual sightings of the bolide

Only three visual sightings were received of the bolide, no doubt due to the early hour and the fact that most people were indoors. The best description was received from Ted Nutting, who was outdoors at the time and saw the passage of a bright green fireball in a clear sky, duration about 4 seconds moving west to east, and

disintegrated into four or five fragments with a bright flash before disappearing. Sounds were heard about one to two minutes later. The start and end azimuths were estimated as 230° and 180° respectively, travelling parallel to a rooftop, at altitude $60\text{--}70^\circ$. Frankie Dos Santos saw the bolide through a window facing azimuth 330° from Hoekwil, near Wilderness. He described the fireball as ‘very bright, much bigger than a normal shooting star’, moving left to right (towards north east) at an altitude of about 45° , and very fast with a duration of about a second. The sky was overcast with thin patchy clouds and the appearance was like ‘seeing car headlights through fog’. A third reporter [name withheld] saw the fireball from George as ‘a ray of light moving very fast, slanting towards the ground, from left to right, i.e. towards east. It looked like a shooting star that was very close and then a big explosion’.

The descriptions of start and end points give a tentative path from west to east, possibly beginning ablation near overhead and just south of Oudtshoorn, and disrupting in the vicinity above Kammanassie Nature Reserve. Fragments may have fallen as meteorites near to the Kammanassie Mountain range.

Evidence from video captures

In order to determine the fall location of possible meteorites, sufficient video footage is required which shows both the passage and disruption of the bolide, or shadows cast by the flash, which are in the anti-direction of the disruption. Unfortunately, despite requests on various forums to check security cameras, only one clip was received, from Godwin Pangel in George. The clip shows a brief very bright flash, with duration less than 1 second, and was followed 2m56s later by a booming sound. The sky is seen to be mainly overcast at the time of the bright flash. The video footage was calibrated against internet time to give the exact time of the flash as August 9, 01:00:30 SAST (August 8, 23:00:30 UT). The time lag of the sound gives a distance to the flash of approximately 60km.

Misconceptions reported on social media

Several misconceptions arose on social media in connection with the event. Firstly, the statement on some sites that the event was a ‘skyquake’. There is no accepted scientific definition of what constitutes a ‘skyquake’; rather it appears to be a loose term originating on the internet describing ‘rumbling sounds from unexplained sources, including possibly the sonic boom from meteors’. Since the bolide was observed visually, the term is clearly irrelevant.

Secondly, that the event might be linked to the Perseid meteor shower, which normally peaks around the night of August 11/12, and showed an unexpected surge in activity this year on August 14 at around 08h00 UT, the outburst lasting about two hours. The Perseid meteor stream is known debris from comet 109P/Swift-Tuttle, and particles from comets are too small to produce effects like that witnessed over

the Western Cape on August 9. The radiant of the meteors in the constellation of Perseus only rises early morning and is highest before dawn, and even then the radiant does not rise above the horizon at any time as seen from the George/Mossel Bay area. Finally, the radiant is located in the north-east in the early morning and cannot explain any meteor observed on a trajectory moving from west to east.

Thirdly, in connection with statements that what was seen was a meteorite. Particles travelling through space are termed meteoroids. If they enter the atmosphere then the resultant streak of light is termed a meteor. Bright meteors are termed fireballs, and if seen to explode they are called bolides. If the object survives its passage through the atmosphere, reaches the ground and is recovered then it is termed a meteorite. Since no videos were obtained to triangulate the path and hence no fragments could be found on the ground, the event on August 9 is classified as a bolide.

Conclusions

I conclude that a bright bolide passed roughly west to east over the Western Cape, disrupting with a bright flash, and with accompanying sounds. The event was widely reported on social media, but was not detected by NASA fireball detectors, neither were there any reports to the ASSA, AMS nor IMO reporting forums. There is a distinct possibility that the bolide could have deposited meteorites, but insufficient video evidence could be obtained that could have enabled determination of a strewn field site. This situation is similar to that of the January 16, 2019 bolide (Event 316) which may have made landfall, but only one reliable video clip was obtained which could be calibrated. The recent report on the location and recovery of the Motopi Pan meteorite from asteroid 2018 LA (see MNASSA Vol. 80, June 2021, pp 77-103), following calibration of five video clips which showed either the bolide or shadows therefrom, demonstrated the success of this method in locating meteorites from fireball observations. There is a need to develop further awareness of how to secure video captures which can be calibrated in order to locate and recover potential meteorites from future bright fireball events.

Acknowledgements

Thanks to Kos Coronaios (ASSA Observing Director), and to Case Rijdsdijk and John Atherstone of the ASSA Garden Route Centre for forwarding reports, to the admin of the Mosselbaai-op-sy-beste Facebook page for granting access to that page from where many of the reports originated, and to Lizette da Silva for reports forwarded from the George Herald. Figures 1 and 2 are reproduced from Google Earth images downloaded August 27, 2021, credit to Google and AfriGIS (Pty) Ltd.

ASSA AGM 2021

Report on ASSA 2020 / 2021 Activities (Chris Stewart)

Preamble

Thank you, Mr Chairman.

First, I would like to thank the Pretoria Centre for hosting this meeting, Bosman Olivier for chairing it, and all attendees for your participation.

Second, I wish to thank the Council members for their indefatigable commitment and support over the past year, especially considering the trying times under which we are operating.

There is a great deal more going on behind the scenes than meets the eye, much of it tedious - your tireless efforts and considerable expertise are deeply appreciated.

State of the Nation

Covid continues to hamper our activities, particularly by precluding travel and physical meetings at unpredictable intervals. Some of us have tragically lost friends and family members to the virus; you have our sincere condolences. The recent death of José da Silva is particularly poignant in this respect, as he was about to take over the reins of the Spectroscopy Section, a specialised field with few practitioners to draw from. Please do take care and stay well.

Fortunately, thanks to electronic communications technology, many of our communal activities are now taking place on-line as the “new normal”, to the additional benefit of individuals who would not otherwise be able to attend Centre meetings. Some Centres have joined forces, with one Centre inviting another to their monthly meeting, thereby sharing the reach of the speakers. Some have even teamed up with other astronomy groups abroad, building alliances, broadening the range of topics and deepening the available pool of expertise.

The same applies to Sections, the Deep Sky section having had a very successful interactive meeting with observers as far afield as Sweden asking questions, sharing favourite targets and taking notes of experiences across the hemispheres. In addition, similar interactions with AfAS (the African Astronomy Society) are ongoing.

Review of activities

I present here brief summaries of the reports received to date, which will be made available on the website.

Communications

The Internal communications through the mail groups are working well, being widely used and keeping members up-to-date. ASSA liaison with the media has shown a marked increase since the CV19 Lockdown was announced and two events received wide publicity, i.e. Tim Cooper's work on Bolide 2018LA which struck Botswana in June 2018, and Clyde Foster's discovery of an eruption on Jupiter's surface. The "Ask an Astronomer" feature on the website; has produced over 120 questions since the last AGM, of which career guidance queries were usually passed on to the SAAO.

Citizen Science

No report available, due to time constraints on the Director.

Cosmology

The cosmology section is a platform for ASSA members to highlight relevant research that they encounter. Following the CHIME radio telescope's commissioning, two themes have largely dominated astrophysics over the past year - Fast Radio Bursts and the possible early detection of a fifth force in Nature.

Deep Sky

The Section's activities have been chronicled in 2 multi-topic issues of the beautifully presented Nightfall publication. Highlights included online observing using remote observatories, hydrogen-alpha images of the LMC, and observations of the Hogg star clusters. In addition, 5 special reports were produced, each dedicated to a specific topic ranging from star formation and planetary nebulae, to a resource guide for astronomy education.

Double & Variable stars

The year has seen increased observation and discussion activity, with webinars giving access to more specialists than ever before. Work on exoplanets, high-energy systems, and photometry proceeded, with observations being directly submitted to the appropriate clearinghouses in support of international scientific initiatives. Notably the Director collaborated on an international paper and continued mentoring beginners for the AAVSO.

Historical

A concerted effort was made to update the website. All the Handbooks of ASSA to 2003 were digitized and are now available on the web. (From 2004 this became the Sky Guide, which is available from Struik.) The material of the Digital part of the Archive was properly archived, the Section was represented in the centenary

celebrations of the SAAO and articles with historical content were published in MNASSA.

Imaging / Astrophotography

Given the Covid lockdowns, there was a notable shift to narrowband imaging from the cities. The Flickr collection continues to showcase the talent of our astrophotographers, with some of their output being featured in Nightfall. A last-minute competition for photographs of the recent conjunction has just been concluded; the three winning entries will be showcased in the next issue of SGAS.

Instrumentation

The Section directly supports the needs of both ASSA members and the general public regarding selection, purchase, construction, maintenance and use of instrumentation.

This is mostly done via the Amateur Telescope Making (ATM) class, the ever-growing Telescope Making SA Facebook page, e-mail correspondence, telephonic discussion, and WhatsApp/SMS. Despite ATM classes being on hold due to lockdown, work continues with several instruments in progress.

Etsuo Takayanagi was able to get the majority of his classic Cassegrain's novel skeletal optical tube assembly constructed prior to his return to Japan. Notably, this included a novel hybrid pantograph / helical focuser realized through 3D printing, which you can see [here](#). A great number of other interesting 3D printed parts have emerged, notably geared drives and bearing supports for equatorial platforms capable of taking large telescopes.

Percy Jacobs has successfully completed construction of a second, higher-resolution spectrograph in order to better serve the scientific community's need for quality spectra of chronically underrepresented southern hemisphere objects.

Observing & Outreach

The Director has reluctantly resigned for personal reasons. Although social distancing has precluded group observing activities, impacting on outreach, many opportunities to observe on an individual basis occurred, which were advertised through the usual channels. The most recent conjunction event spurred a successful photo challenge. As usual, many queries from the public have been fielded and answered directly, shared in the discussion group, or forwarded to an appropriate Specialist. Notably, three comets were observable during the period under review, though 156P Russel could only be captured photographically.

Photometry & Spectroscopy

With photometry being mostly practiced in variable star observation, the emphasis continues to be on promoting spectroscopy and supplying spectra to global research programs. Practitioners submit spectra directly to research programs per demand.

It would be appreciated if someone with an interest in this topic would step forward to take over the reins from Percy. You do not need to be an expert, and you will get guidance.

Shallow Sky

Observation of solar system objects is another area of prolific Pro-Am collaboration. Clyde's Spot, the convective outbreak in Jupiter's South Temperate Belt region, that Clyde Foster discovered at the end of May 2020 continued to be followed by both the amateur and professional planetary communities. The storm is still developing and has taken the form of a folded filamentary Region. It was beautifully captured in April this year by the Juno spacecraft on its 33rd Perijove. This discovery led to numerous presentations, publications and media appearances.

ASSA reports on meteor, etc. sightings are published in MNASSA, whilst sighting reports from the public are analysed and responded to by Tim Cooper (for comets / meteors / asteroids) and Greg Roberts (for satellites).

Meteor studies led by Tim Cooper resulted in reports in MNASSA and 4 papers, involved 8 meteor showers observed for a total of 35.75 hours, and the recovery of meteoritic fragments. 47 fireball event reports were investigated, a new meteor stream was discovered and the radiants of over 11 000 individual meteors were determined.

Scholarships

Due to poor performance of our invested funds during 2020, no scholarships were offered in 2021. However, having obtained their BSc degrees both 2019 Awardees have gone on to pursue BSc (Hons), with Collins pursuing her interests in Cosmology and General Relativity, and Mulaudzi combining studies in particle- and nuclear-physics with a search of MeerKAT data for evidence of dark matter. Clearly our faith in these high achievers was not misplaced.

Scholarships Committee	
Dr Claire Flanagan	Scholarship Convenor
Dr Ian Glass	Retired Professional Astronomer
Sivuyile Manxoyi	EUNAWWE, SAAO outreach
Maciej Soltynski	Previous Scholarship Convenor
Dr Vanessa McBride	OAD, SAAO, UCT

Conclusion

Note that all reports received will be available for perusal on the ASSA website.

Despite the troubling times and the restrictions on physical gatherings, members of the Society continue to actively pursue their interests. Centres have found ways to keep their members in touch, and Council remains engaged and functional.

It even appears that lockdown-induced boredom and the reduction in work travel times are raising public interest and activity in astronomy.

On balance, I think we are doing very well. Our communications have definitely improved but could always be better. Scholarships took a knock due to funding, but the team is fully committed with an excellent track record and the bursary recipients have excelled.

Citizen Science and our Observing & Outreach areas were affected by manpower limitations. Some changes are in place to improve these areas.

My sincere thanks to everyone for your selfless commitment.

ASSET: ASSA Endowment Trust summary (Chris Stewart)

The endowment trust was established many decades ago, the intention being to have a means to support the Society should it run into financial strictures. It is entirely separate from the Society, managed by Trustees who have the best interests of ASSA at heart.

Whilst the Society has managed its finances such that there has been no need for intervention, and although we continue to actively work against ever being in that position, it is comforting to know that we have some guardian angels out there.

For a difficult period, the passing of some trustees affected their ability to transact on the accounts. All existing Trustees FICA records have now been updated with the Master's Office and the accounts of ASSET can again be transacted fully. Peter Cramb continues to stand as acting Secretary, independent compilers have been appointed, and the Annual Financial Statements are being brought up to date - including any remaining tax obligations with SARS. The Trust's objectives are also currently being reviewed to align with future requirements.

I would like to express Council's appreciation to the Trustees for their dedication in this noble cause.

Financial Report (AJ Nel)

Please see separate document for the report.

Acceptance

(Audience voted to accept the reports without dissent.)

Council Office Bearers 2021 / 2022 (Chris Stewart)

Normally the President’s term is 2 years, but last year the decision was made on an exceptional basis to extend my term to 3 years. Whilst I am grateful for this show of confidence, I am happy to be able to announce that we have attracted new members with specific expertise that will definitely strengthen our operations.

Not only do we remain in good shape, but are successfully accommodating the changing operational environment. We expect to tackle the new year with vigour, augmented by the fresh perspectives of the new appointees. Accordingly, you will see some minor tweaks to our structure as shown in the tables below:

Role	Council Members 2021/22
President	Chris Stewart
Vice President (Outgoing President)	Case Rijsdijk
Vice President (Incoming President)	Dr Daniel Cunnama
Treasurer	AJ Nel
Membership Secretary	Eddy Nijeboer
Secretary	Lerika Cross
Council Member	Dr Pierre de Villiers
Council Member	Dr Ian Glass
Bloemfontein Representative	Thinus van der Merwe (TBC)
Cape Chair	Christian Hettlage (Acting Chair)
Durban Chair	Amith Rajpal
Garden Route Chair	Case Rijsdijk
Johannesburg Chair	Alison Coulter
Pretoria Chair	Bosman Olivier
Hermanus Chair	Dr Pierre de Villiers

Structure & how it works. Core council / Financial Subcommittee

Per the Constitution and long tradition, the Core Council members are appointed by the Core Council itself. Whilst this is at their discretion, it is motivated by the best interests of the Society and informed by wider consultation. Every effort is taken to ensure competent and committed individuals are identified for the roles.

For the long-term health of the organisation, it is necessary both have a periodic refresh in personnel and to retain the institutional knowledge of longer-term incumbents. Accordingly, we adopted the practice of appointing an “incoming” Vice President who will have time to learn the ropes prior to ascending to the presidency, whilst the former President is retained as the “outgoing” Vice President in an advisory capacity. We also endeavour to alternate the Presidency between professional and

amateur astronomers, which helps strengthen the historical bond between amateur and professional astronomers, something almost unique in the world of science.

Today, I would like us all to welcome professional astronomer Dr. Daniel Cunnama as incoming Vice President and professional Communications specialist Dr. Sally MacFarlane as our comms coordinator. We also thank Eddie Neijboer for making himself available as membership Secretary. May you all enjoy your terms of office.

Centre Chairs & Representatives

Centre Chairs are elected per the custom of the Centres and they are automatically members of Council, in order to ensure proper representation of the wider membership.

In the event that a Centre Chair is unable or unwilling to attend Council, be it temporary or for a longer term, a Committee member may be appointed as Centre Representative to fill the role.

The Cape Centre were unable to find a willing candidate for Chairman at their recent AGM. As a result, Vice Chair Christian Hettlage is acting as Chairman until a suitable person can be elected. We welcome the new Johannesburg chair Alison Coulter and wish her every success.

The Bloemfontein Centre is still trying to get back on their feet following a long period of dormancy. I would appreciate it if Thinus van der Merwe would convey our encouragement to the Centre Committee, and I appeal to the other Centres to support and keep in contact with them.

Appointees

Role reporting into Council	Appointees
Convener of Scholarships	Dr Claire Flanagan
Communications Coordinator	Dr Sally MacFarlane
Observing Director	Angus Burns
Webmaster	John Gill
Web Manager: SAAO Liaison for Website	Dr Christian Hettlage
ASSA Archivist	Chris de Coning
Social Media Liaisons	Allen Versfeld (Youtube, Twitter) Martin Heigan (Flickr) Kos Coronaios (ASSA FB Admin) Chris Stewart (Mail groups)

Council appoints people to manage various defined roles that exist to support the Society's aims and purpose in general. We have a new role of Comms Coordinator filled by Dr. Sally MacFarlane. This will strengthen our communications capabilities – something that now more than ever is critical to our success. The various social media liaisons will of course assist her with our presence in channels such as Twitter, Flickr, FaceBook, etc.

Sections, which are in effect Special Interest Groups, exist to assist interested members in advancing their expertise in specific fields of astronomical endeavour. They naturally wax and wane according to general levels of interest and the availability of suitable Directors. We welcome Angus Burns, who will be promoting observing in general, with the new Observing section encompassing the former Deep & Shallow Sky sections and more. Happily, Dr. Daniel Cunnama has expressed an interest in engaging external entities with respect to preserving our endangered night sky, and will kick-start our dormant Dark Sky section. With the sad loss of Jose da Silva, Percy Jacobs has kindly agreed to continue running Spectroscopy and Photometry whilst a replacement is sought.

Special Interest Groups	Directors
Dark Sky Section	Dr Daniel Cunnama
Double and Variable Stars Section	Dave Blane
Photometry, Spectroscopy Section	Percy Jacobs
Cosmology and Astrophysics Section	Bruce Dickson
Southern African Astronomy History Section	Chris de Coning
Astrophotography Section	Martin Heigan
Instrumentation Section (including ATM)	Chris Stewart

Sections (Special Interest Groups)	Directors
Dark Sky Section	Dr Daniel Cunnama

Observing Section	Angus Burns
Double and Variable Stars Section	Dave Blane
Photometry, Spectroscopy Section	Percy Jacobs
Cosmology and Astrophysics Section	Bruce Dickson
Southern African Astronomy History Section	Chris de Coning
Astrophotography Section	Martin Heigan
Instrumentation Section (including ATM)	Chris Stewart

In recognition of the vital role our publications play, we have formalised their supporting structure somewhat, bringing in more recognition and support from Council without interfering in their operations.

Nightfall, originally the Deep Sky section’s newsletter, has grown into a formidable magazine in its own right, and is being recognised as such. Where MNASSA continues its role as the Society’s formal publication of record, Nightfall as a complementary channel brings lavishly-illustrated wide-ranging articles.

I would like to take the opportunity to give thanks to the unsung heroes of the back room, without whose diligent support our publications could not retain their high standard.

ASSA Awards

President’s Award, Astronomy Outreach: Carol Botha

Carol has vigorously promoted astronomy for several decades. She originally entered outreach through involvement in the National Science Week, followed by many more years in collaboration with OOG, and continues to be very dedicated to the mission via various avenues.

President’s Award: Tim Cooper

The Society has previously conferred recognition of Tim Cooper’s impressive body of work, and rightly so. However, Tim is not one to rest on his laurels: he is “the gift that

keeps on giving". Not only is Tim unstinting in his excellent work, but generous too. In achieving international recognition for his personal efforts, he has been careful to graciously share the limelight with ASSA. A case in point is the recent successful recovery of meteorite fragments based on scant observations of a bolide - a magnificent sleuthing task, covering an immense swathe of ground, crossing international borders, and requiring cooperation from many official entities. On top of his scientific workload, Tim has been a lodestone for the society, always available to dispense invaluable, level-headed wisdom when needed. I have no hesitation in commending Tim for the President's award

McIntyre Award: Auke Slotegraaf

Since 2003, with but a few gaps, Auke Slotegraaf has worked tirelessly on behalf of ASSA to produce the annual Sky Guide. Despite each year bringing its own unique challenges, and having set a punishingly high standard in its first issue, he has consistently ensured that the content has remained high-quality, relevant, easily assimilable and useful - as well as being presented in a modern, fresh style. In parallel, Auke's literary contribution to the beautiful 2014 book, Pearls of the SOUTHERN SKIES, is an edifying delight to read.

Either of these is impressive; taken together, this body of work is a magnificent achievement.

Whilst these have both been collaborative endeavours, Auke's contributions are indisputable, and the world would be poorer without them.

I have no hesitation in proposing that ASSA confer the McIntyre award in recognition of Auke's literary and scholarly contributions.

Director's Award, Instrumentation: Johan Smit

Johan has for many years been a foremost contributor to the Amateur Telescope Making class, procuring materials, guiding beginners and selflessly fabricating parts so as to enable others to successfully complete their telescopes. In addition, he has explored many new techniques and approaches that advance the art in novel ways, most recently via 3D printing

Director's Award, Instrumentation: Percy Jacobs

As an active member of the astronomical fraternity, Percy Jacobs needs no introduction. His enthusiasm to promote observing, telescope making, and participation in the Society's affairs is well known and recognised. However, his work in contributing spectroscopic observations to international scientific organisations in support of their research sets him apart. Percy has recently completed building his second home-made spectroscope in order to provide even higher resolution observations than his already

impressive first spectroscope was capable of, an indication of his ongoing commitment to this very important niche. Few people build a telescope, fewer yet build an Ha solar scope, and a vanishingly small number build spectroscopes. The Instrumentation Director's award serves to recognise this accomplishment, and it is hoped that his example will be followed by others in time to come.

Director's Award, Archive and History: Em Prof. Brian Warner

We admire and acknowledge a lifetime of passionate dedication, the many contributions, research and publications made by Brian Warner to the field of the History of Astronomy in South Africa.

Keynote Address (Speaker: Tim Cooper)

Please see video recording of Tim Cooper's exciting account of one of the greatest sleuthing adventures of all time.

Closing (Chris Stewart)

Thank you, Tim, for the fascinating account. It highlights once again how pro-am collaboration is alive and well in the world of Astronomy.

Again, my heartfelt thanks to the team for their sterling efforts in these troubled times, especially Lerika and Bosman for organising tonight's meeting, and to Tim for his presentation.

Conjunction of Mars, Venus and the crescent Moon (11-13 July 2021)

Astrophotography Competition

Shortly after sunset on the evenings of July 11 to 13, weather permitting, there was a fine conjunction (close approach) between Mars, Venus and the crescent Moon in the western sky. The trio was closest on the 12th, as the Moon passed by. Such events are pretty to watch and present opportunities to capture a relatively rare sight photographically.

On the 12th, the Sun set at about 17h00 SAST (there was some variance according to your location), with the planets reaching the horizon about two hours later. The Moon set at approximately 18h25 on the 11th (and of course later on the following days, as it moved from west to east through the sky). During the intervening time between sunset and the planets setting, the sky naturally darkened progressively. Given the proximity of the celestial bodies to the horizon during that time, it should have been possible to include interesting foreground detail illuminated by twilight.

ASSA Astrophotography/Imaging section invited all who were interested to submit their photos of this event. The best three, as judged by Chris Stewart (ASSA President) and Martin Heigan (ASSA Imaging Section Director) will be featured in the 2022 Sky Guide (with the photographer of course being credited), and the photographers will each receive five copies of that Sky Guide.

Results



In addition to being featured in the Sky Guide, each of the three winners will receive a prize sponsored by:

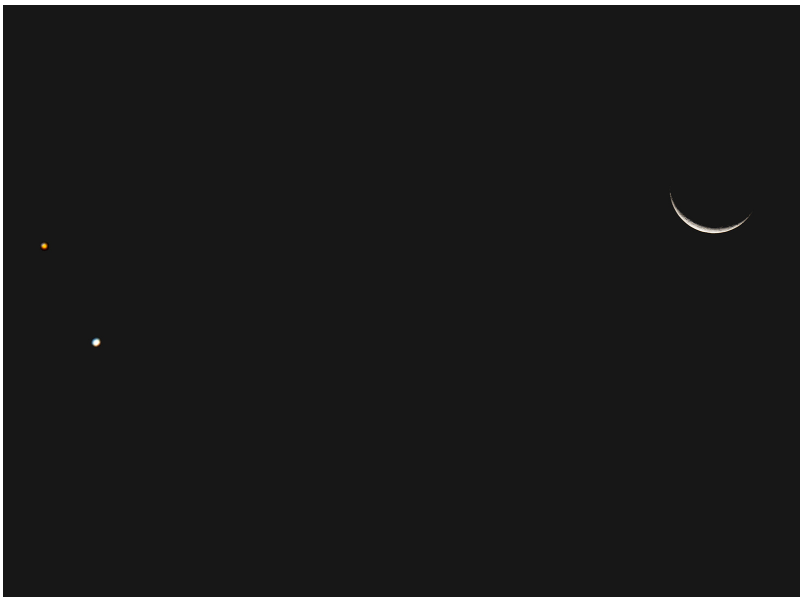
telescopium.co.za.

1st Prize: Angus Burns *Conjunction Newcastle 12 July 2021* received a Svbonny 1.25" 18mm SWA eyepiece

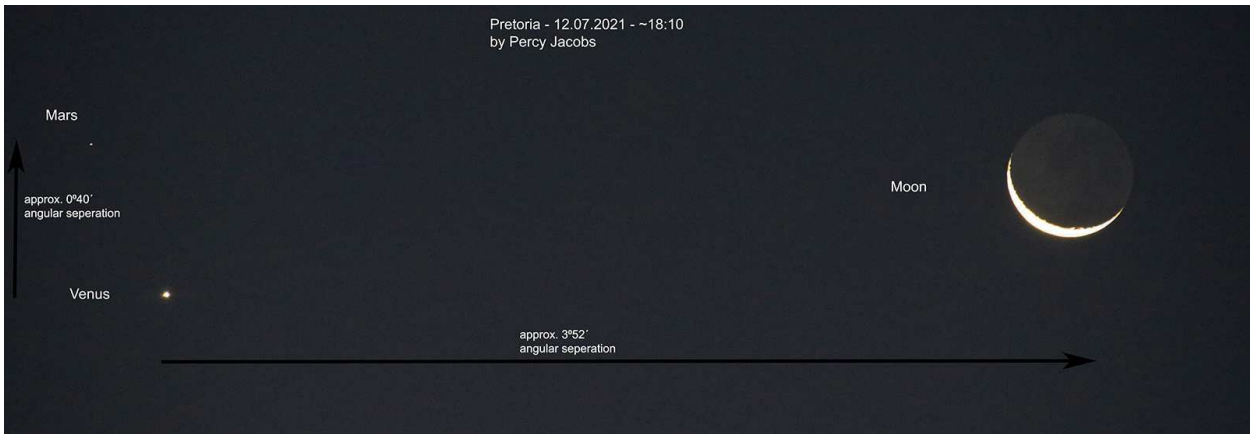
2nd Prize: Jaco Boshoff *Moon Venus Mars 12 July 2021* Svbonny 2x Barlow and Svbonny 1.25" to T-thread adapter

3rd Prize: Percy Jacobs *12 07 2021 ~18h10* Svbonny 1.25" UV/IR cut filter and Svbonny 1.25" 0.6ND filter

Angus Burns Conjunction Newcastle



Jaco Boshoff Moon Venus Mars



Percy Jacobs 12 07 2021 ~1810

Streicher Asterisms 58-61

Magda Streicher

STREICHER 58 – DSH J0542.9-0801

Orion

An extended chain of several bright stars draped from north to south with a shallow curve on the southern part. In a way it reminds one of a mini Kemble's arcade. In the southern part of the string, faint nebulosity mingles well with the few bottom stars, as seen in the photograph by *Picture Credit: <http://archive.stsci.edu/cgi-bin/dss>*

OBJECT	TYPE	RA	DEC	MAG	SIZE
Streicher 58 DSH J0542.9-0801	Asterism	05h42m.57	-08°01'.30	9	23'



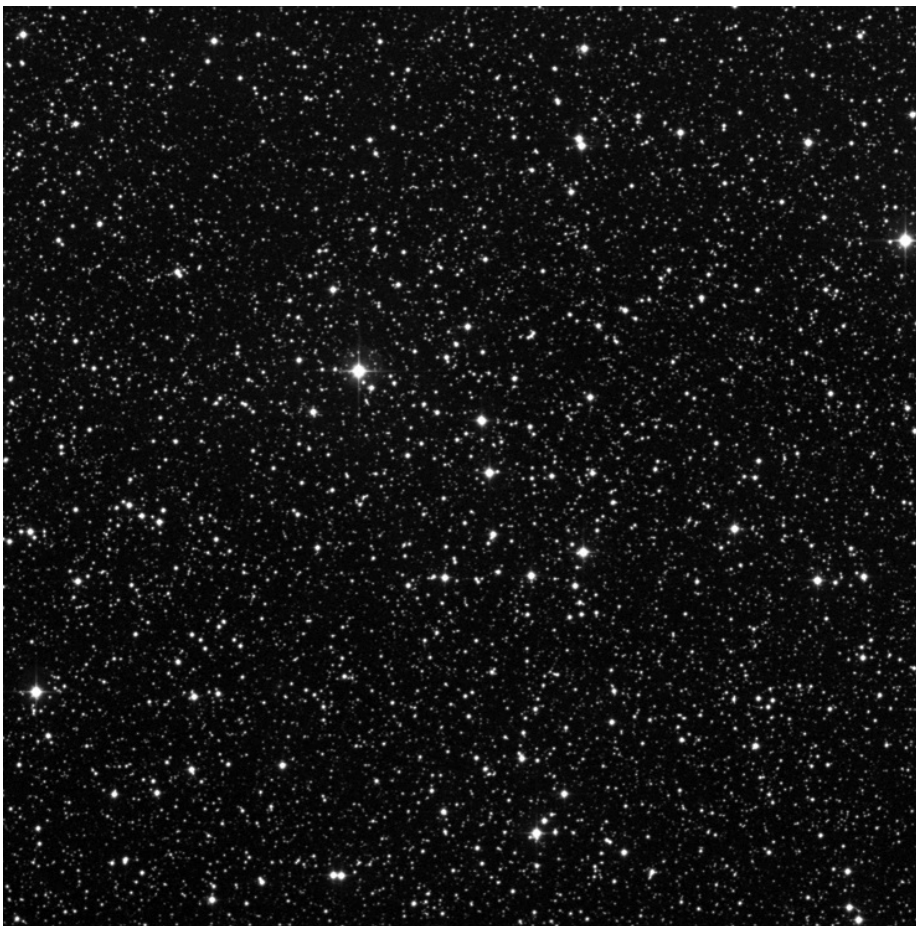
STREICHER 59 – DSH J2212.7+5252

Lacerta

A conspicuous group of stars situated in an over-crowded faint star field. The barely brighter magnitude 10 stars form a lovely question mark asterism with the brightest member indicating the dot towards the north-east. The open cluster IC 1434 is situated only 18' towards the west of the asterism.

OBJECT	TYPE	RA	DEC	MAG	SIZE
Streicher 59 DSH J2212.7+5252	Asterism	22h12m.45	+52°52'.42	10	9'

Picture Credit: <http://archive.stsci.edu/cgi-bin/dss>



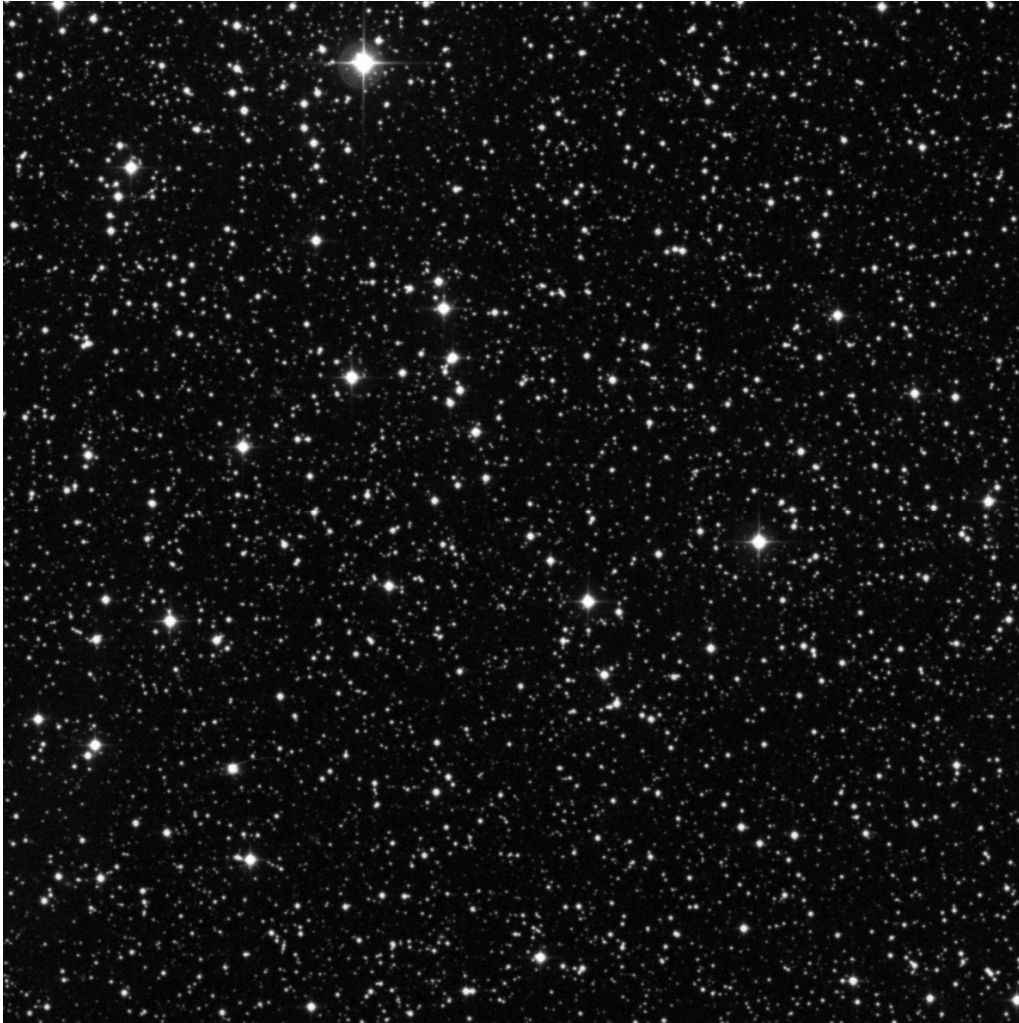
STREICHER 60 – DSH

J2223.3+5102

Lacerta

What amazed me was the long string of not fewer than 10 stars about magnitude 11 in brightness in a north to south-west direction and even extending further with fainter stars. The bright star in this string is the magnitude 7.3 star, HD 235820 towards the southern area. The small out of focus dot-like planetary nebula IC 5217 is situated only 7' east from the asterism.

OBJECT	TYPE	RA	DEC	MAG	SIZE
Streicher 60 DSH J2223.3+5102	Asterism	22h23m.20	+51°02'.54	9	11'



Picture Credit: <http://archive.stsci.edu/cgi-bin/dss>

Webinars, Colloquia and Seminars

Used form an important part of a research facility, often as a sort of pre-publication discussion or a discussion of an individual's current research, and as such it is virtually impossible to "publish" this material. However by recording the topics discussed in the form below does indicate to those, who are unable to attend, what current trends are and who has visited to do research: it keeps everyone 'in the loop' so to speak

These form an important part of a research facility, often as a sort of pre-publication discussion or a discussion of an individual's current research, and as such it is virtually impossible to "publish" this material. However, by recording the topics discussed in the form below does indicate to those, who are unable to attend, what current trends are and who has visited to do research: it keeps everyone 'in the loop' so to speak

With the advent of CV19, these Colloquia and Seminars are being presented to wider audiences via Zoom and other virtual systems. The editor has started by identifying what would originally been “local” Colloquia and Seminars; not easy as there are now Webinars on interesting topics from around the globe! In time we will either return to the traditional Colloquia and Seminars or many will become Hybrid session.

Title: Characterisation of Small, Close-Approaching Near-Earth Asteroids

Speaker: Petro Janse van Rensburg (SAAO/UCT)

Date Thursday 24 June 2021

Time: 11:00 AM

Abstract: Near-Earth Asteroids (NEAs) are a population of asteroids in a steady state, constantly being replenished with asteroids from the main belt. NEAs have orbits that come close to or cross the Earth’s orbit and therefore some could have impacting trajectories and pose a threat. Small NEAs (diameter < 300 m) pose a greater threat compared to large NEAs because they are more abundant and can cause significant damage on impact. The characteristics of small NEAs can give an indication of the most likely properties of potential future impactors. Even though in recent years the number of discovery and characterisation programmes of NEAs have increased, the characterisation of the small NEA population still lags behind because they can only be observed with 1-m class telescopes when they pass close to the Earth and become bright enough. I will present 20 NEAs that were successfully observed and characterised with the South African Astronomical Observatory (SAAO) 40-inch telescope and the Sutherland High-Speed Optical Camera (SHOC). Out of the 20 NEAs, 14 had diameters < 300 m ($H > 21$). Characterisation involved assigning taxonomic probabilities to each NEA based on spectra from the Bus-DeMeo classification scheme and thereby inferring its most probable composition, as well as using a Lomb-Scargle periodogram to extract the rotation period from multi-band photometry. The taxonomic probabilities were determined with the colours $g'-r'$ and $r'-i'$, in combination with a machine learning (ML) algorithm trained on synthetic colours from observed spectra obtained from literature. The taxonomies considered were the S-, C-, and X-complexes, and the D-, Q-, and V-types.

Title: Compact Objects in Accreting Binaries: Formation and Demography

Speaker: Prof. Poshak Gandhi from University of Southampton

Date Thursday 08 July 2021

Time: 11:00 AM

Abstract: Despite almost 60 years of accreting compact object binary studies, major uncertainties remain regarding their formation, subsequent evolution and demographics. It is also unclear whether the known population of accreting black holes forms a continuum with the population of more massive gravitational wave

sources. Here, I will review recent results from the ongoing Gaia astrometric sky survey on their spatial and phase space distributions, discussing natal kicks and birth sites. Current studies are also handicapped by the scarcity of well-characterized systems. Upcoming multi-wavelength time-domain surveys are expected to help to resolve some of these uncertainties by substantially enhancing their census.

Title: What the quasi-chaotic light curves of Active Galactic Nuclei can tell us about their inner being

Speaker: Hartmut Winkler, Department of Physics, University of Johannesburg

Date Thursday 22 July 2021

Time: 11:00 AM

Abstract: 50 years since Active Galactic Nuclei were first shown to be variable, the processes responsible for the luminosity changes are still not well understood. AGN light curves neither show much evidence of a pattern, nor is it clear why some appear more active than others. However, despite the chaotic appearance of the light curves, information can be extracted from these to unravel some of the structure and physical processes in operation near the central black hole. The talk explores results from the presenter's recent spectral observations using the Sutherland 1.9 m telescope and photometry with the Los Cumbres Observatory global network. For the spectroscopy, these include the now ubiquitous reverberation mapping programmes and the search for "changing look" events (and tracking thereof). Several such dramatic spectral change events are presented and their significance is explored. The new photometry revives an old programme to determine nuclear colour and obscuration of AGN using multi-colour luminosity fluctuations, this time on a larger and fainter sample. This not only allows an improved AGN intrinsic luminosity determination, but sometimes even enables the characterisation of dust extinction around an AGN. Finally, growing evidence is presented of a sub-class of AGN that appears to have considerably more stable light curves than other sub-types, and potential reasons for this are explored.

Title: : Current Capabilities and Future Potential of the SAAO workshop

Speaker: Craig Sass (SAAO)

Date Thursday 29 July 2021

Time: 11:00 AM

Abstract: Modern day machining has evolved rapidly over the past few decades. OEM's(original equipment manufacturer), driven by pressure from manufacturing plants and machine shops, have not disappointed on delivering new technology required in the modern world.

SAAO runs a modern machine shop with a number of CNC (computerised numerical control) machines. Capable of machining complex geometries with high precision, the SAAO machine shop is well positioned to manufacture the types of parts required for building scientific instruments. The advancements and progress in the SAAO workshop is enabling cutting edge and competitive instrument and telescope design. I will be discussing some of the projects that we are currently involved with, processes of manufacture, as well as some of the challenges we face going forward.

Title: Deep Learning for Morphological Classification of Radio Sources

Speaker: Mr. Chaka Mofokeng, SAAO, Cape Town

Date Thursday 05 August 2021

Time: 11:00 AM

Abstract: Classification is one of the most fundamental aspects in scientific investigation. Astronomers have thus developed several classification schemes to try and make sense of the evolving properties of planets, stars and galaxies. One of the most popular ways to classify galaxies is according to their shape, or morphology, which has long been performed visually to produce annotated galaxy catalogues. However, visual inspection and manual annotation by astronomers will not be able to keep up with the expected data flow from next-generation sky surveys. In this context, the main objective of our study was to use deep learning to automate radio source characterization (that is detection, classification and identification) from image data efficiently. We adopted a pre-trained deep learning model called CLARAN (Classifying Radio Sources Automatically with Neural Networks) based on the Radio Galaxy Zoo Citizen Science Classification Project and applied it to a GMRT 610 MHz survey in the ELAIS-N1 region covering an area of 12.8 square degrees at a resolution of approximately 6 arcsec at a root-mean-square noise of about $40\mu\text{Jy}/\text{beam}$. We successfully applied transfer learning and confirmed via visual inspection that our source characterization algorithm works better than PyBDSF in most cases, and especially for faint and extended radio sources. Moreover, we computed an estimate of CLARAN's performance in detecting and correctly classifying extended radio sources and found that we achieved 78% completeness (recall) and 92% reliability (precision). Furthermore, we implemented a cross-identification algorithm to pinpoint the infrared counterparts of our radio sources. We thus turned a pre-trained deep learning model into a robust automated radio source characterization pipeline. Such a tool will be very useful when dealing with wide-area radio surveys such as VLASS and EMU and eventually SKA1.

Title: Considerations for optimizing photometric classification of supernovae from the Rubin Observatory

Speaker: Catarina Alves from the University College London (UK)

Date: Friday 06 August 2021

Time: 11:30 AM Via Zoom

Abstract: Survey telescopes such as the Vera C. Rubin Observatory will increase the number of observed supernovae (SNe) by an order of magnitude; however, it is impossible to spectroscopically confirm the class for all the SNe discovered. Thus, photometric classification is crucial but its accuracy depends on the not-yet-finalized observing strategy of Rubin Observatory's Legacy Survey of Space and Time (LSST). In this work, we quantitatively analyze the impact of the LSST observing strategy on SNe classification using the simulated multi-band light curves from the Photometric LSST Astronomical Time-Series Classification Challenge. First, we model the light curves with Gaussian processes, and augment the simulated training set to be representative of the test set. Then we build a machine learning classifier using the photometric transient classification library `snmachine`, based on wavelet features obtained from Gaussian process fits. We study the classification performance for SNe with different properties within a single simulated observing strategy. We find that season length is an important factor, with light curves of 150 days yielding the highest classification performance. Cadence is also crucial for SNe classification; events with median inter-night gap <3.5 days yield higher performance. This analysis is the first exploration of the impact of observing strategy on photometric supernova classification with LSST.

Title: Modelling the Interactions and Explosions of Evolved Stars in 3D

Speaker: Prof. Shazrene S. Mohamed from UCT/SAAO

Date: Friday 06 August 2021

Time: 15:00 Via Zoom

Abstract: The massive outflows of evolved stars - highly enriched in dust and heavy elements - not only play a central role in the chemical evolution of galaxies, but also provide the raw material for planetary systems and life. The origin of these outflows is still poorly understood, however, the recent tremendous progress in computational facilities, together with spatially resolved, multi-wavelength and increasingly multi-epoch observations, presents a perfect opportunity to test our theories and improve our understanding of mass loss from stars in their final phases of evolution.

Our high-resolution ALMA observations of cool, evolved giant stars have revealed complex and intricate structures in their extended circumstellar envelopes, e.g., spirals, shells, cavities, arcs, jets and disks; fossil records of their stellar mass-loss histories which also hold important clues to the physical processes driving their outflows. Using front-line numerical codes that include realistic treatments of the important microphysics, hydrodynamic and radiative processes, we model these cool giants in 3D, tracing their outflows from the stellar surfaces to the interstellar medium. In this talk, I will focus on our studies of the impact of interactions with a

nearby companion, and their role in driving and shaping the complex and in some cases, explosive outflows. I will also discuss the progress we have made towards validating our new mode of binary interaction, wind Roche-lobe overflow, and discuss its implications for symbiotic binaries and related systems such as chemically peculiar stars, X-ray binaries and the progenitors of Type Ia supernovae.

Title: New advances in the diffuse ultraviolet background

Speaker: Prof. Jayant Murthy Senior Professor Indian Institute of Astrophysics

Date: Thursday 12 August 2021

Time: 11:00 AM

Abstract: Although an important part of our Galaxy, interstellar dust is difficult to characterize.

Historically, most of our information about dust has come from observations of extinction curves against background stars but these are limited to those directions where there are suitable stars. Infrared observations of the thermal emission from dust heated by the interstellar radiation field fills the sky and has yielded considerable information about the properties and the distribution of the dust. Ultraviolet observations of the scattered light from the dust have been difficult and sparse until the launch of the GALEX mission.

I will discuss my extraction of this diffuse light from the GALEX data and what it tells us about the properties of interstellar dust. My primary focus will be on the modelling I am now doing and on its successes and deficiencies. I will also present our latest results on the background at the Galactic poles where we have discovered a new component of the extragalactic radiation field, one for which we do not yet know the source.

Title: Variability Studies of AGN Toward the LSST Era

Speaker: Dr Demetra de Cicco from Pontificia Universidad Católica de Chile.

Date: Friday 13 August 2021

Time: 15:00 Via Zoom

Abstract: The next years will see the advent of new-generation telescopes designed to survey wide areas in the temporal domain and providing information about millions of sources per night. In this framework the availability of reliable classification methods, as well as effective means to analyze the physical properties of the returned catalogs of sources, will be crucial.

Variability will certainly be one of the main AGN discovery approaches combined with complementary selection methods. In the context of performance forecasting for the Vera C. Rubin Observatory, which will grant us access to much deeper limits than the ones currently surveyed, the VST survey of the COSMOS field is particularly valuable as the depth of its visits is comparable to the depth of the single visits from the long awaited Legacy Survey of Space and Time (LSST).

I will discuss how we made wide use of this dataset to develop an automated, robust, efficient methodology to identify optically variable AGN, with the aim of deploying it on future LSST data.

I will also present the results of our analysis of the structure function of VST-COSMOS AGN, which explores fainter magnitudes (down to $r \sim 23.5$) than most literature to date. I will focus on various subsamples of AGN, defined on the basis of different properties, and will investigate possible dependencies on the main physical properties of the central supermassive black holes.

Title: Activities in the evolutionary phase of solar flares as candles to the pre-eruptive magnetic-field structures on the Sun

Speaker: Dr. Arun K. Awasthi, Associate Researcher, School of Earth and Space Sciences, University of Science and Technology of China (USTC), China

Date: Thursday 2 September

Time: 11:00

Abstract: Solar flares are transient explosions on the Sun. Being the earliest observational signature of solar eruptions that drive space-weather, investigating multi-wavelength emission emanated during flares not only probes the plasma processes but the capability of space-weather prediction is also improved. My research focuses on probing the pre-eruptive processes associated with impending solar flares and filaments and identifying their role in triggering eruptions. Pre-eruptive processes, including low-intensity flares and related plasma dynamics, enable tracing magnetic-field structures without disrupting them. This vital virtue has been widely utilized in our recent investigations, as will be presented in the talk

The **Astronomical Society of Southern Africa** (ASSA) was formed in 1922 by the amalgamation of the Cape Astronomical Association (founded 1912) and the Johannesburg Astronomical Association (founded 1918). It is a body consisting of both amateur and professional astronomers.

Publications: The Society publishes its electronic journal, the *Monthly Notes of the Astronomical Society of Southern Africa (MNASSA)* bi-monthly, the annual *Sky Guide Africa South* and *Nightfall*.

Membership: Membership of the Society is open to all. Potential members should consult the Society's web page : <http://assa.saa.ac.za> for details. Joining is possible via one of the local Centres or as a Country Member.

Local Centres: Local Centres of the Society exist at Bloemfontein, Cape Town, Durban, Hermanus, Johannesburg, Pretoria and the Garden Route Centre; membership of any of these Centres automatically confers membership of the Society.

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