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monthly notes of the astronomical society of southern africa

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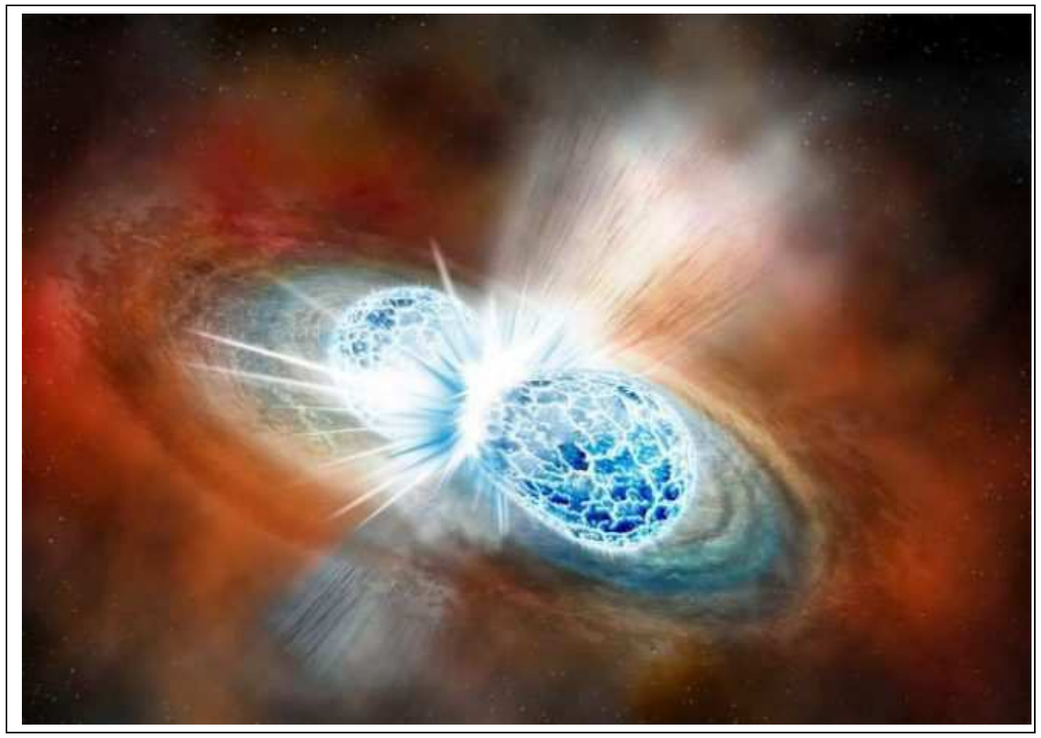

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Artist's impression of a kilonova. See article on page 1

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 as well as the annual *Sky Guide Africa South.*
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Vol 77 Nos 1 & 2 February 2018

News Notes

SAAO observes the first optical counterpart of a Gravitational Wave source

Following on from the major global announcement in October 2016 on the discovery of the first electromagnetic counterpart of a gravitational wave source, named GW170817, a new paper has just been published on observations undertaken at the South African Astronomical Observatory (SAAO), which are compared to the latest model predictions. On 16 October 2016 the SAAO, together with many other observatories world-wide, announced the important discovery of the first gravitational wave source counterpart [1]. The preliminary results from the Southern African Large Telescope (SALT) and other telescopes at the SAAO were featured in a number of multi-institutional investigations utilizing a range of global facilities.

This recent paper brings together various observations made at the SAAO to improve upon the original estimates of the luminosity of the remnant kilonova and compares the observations with recent models developed by a Japanese team. Lead author, Dr David Buckley, explained that SALT spectroscopic results were improved upon by taking simultaneous observations of the kilonova's brightness at three different wavelengths using the MASTER-SAAO facility.

The MASTER-SAAO is a southern hemisphere node of a global network of small robotic telescopes, operated from Russia, used to discover and observe “transient” events in the Universe. These include counterparts to gravitational wave sources and gamma ray bursts. The MASTER-SAAO observations were used to more accurately estimate the flux measurements made by SALT. These were then compared to recently published models. It was fortuitous that only a matter of a few months before the observations a preprint of a new paper on kilonova models was posted. Dr Buckley contacted the lead author, Professor Masaomi Tanaka of the National Astronomical Observatory of Japan (NAOJ), who kindly shared the detailed results in order for us to compare our results with these models, continued Buckley.

Fig 1. Master-SAAO Robotic telescope.

This allowed a direct comparison with the observations made in the optical with SALT and MASTER-SAAO and in the infrared with the Japanese Infrared Survey Facility (IRSF), also situated at the SAAO observatory site, near Sutherland. The results were very interesting, showing that the kilonova evolved rapidly, over a matter of days, from a very blue to a red object, pretty much as the models predicted. Buckley was quite struck by the matching of the observations to the predictions in the blue part of the spectrum, using just the known distance of the host galaxy. No other parameters needed tweaking.

This initial blue component, which disappeared after about two days, was consistent with ultraviolet observations made at an earlier time by the Swift satellite. The SAAO observations, taken over a period of about nine days, showed broad agreement with the predictions of the new kilonova models. These show a rapid reddening of the spectra over timescales of

OBJECT	TYPE	RA	DEC	MAG	SIZE
NGC 40	Planetary Nebula	00h13m.4	+72°31’.0	10.7	37”
NGC 188	Open Cluster	00h44m.5	+85°20’.0	8.1	13’
NGC 6939	Open Cluster	20h31m.4	+60°38’.3	7.8	7’
NGC 6946	Galaxy	20h34m.8	+60°09’.0	8.8	12’x12’
Gyulbudaghian’s Nebula	Reflection Variable Nebula	20h45m.8	+67°58’.3	16+	0.9’
NGC 7023	Reflection Nebula	21h00m.5	+68°10’.0	7.1	8’
IC 1396	Emission Nebula	21h39m.1	+57°30’.0	3.5	50’
NGC 7129	Open Cluster	21h42m.8	+66°06’.0	11.5	7’
NGC 7142	Open Cluster	21h45m.9	+65°48’.0	9.3	4.3’
Sh 2-140	Open Cluster	22h18m.8	+63°15’.4	8.5	9.3’
King 19	Open Cluster	23h08m.3	+60°31’.8	9.2	6’
NGC 7510	Open Cluster	23h11m.5	+60°34’.2	7.9	4’

days. The results confirmed the conclusions of other investigators that the kilonova explosion, resulting from the rapid (less than a minute) merger of two neutron stars in orbit about each other, resulted in the ejection of a fast (5% to 10% the speed of light) outflow of material, which was observed at a high angle to the orbital plane of the neutron stars.

It was through good fortune that the SALT observations were able to be undertaken. The information on the position of the optical counterpart to GW170817, crucial for the SALT follow-up, was only received several hours before the telescope could observe, from the US and Australian co-authors. As Dr Petri Väisänen, also one of the papers co-authors and the SALT astronomer observing that night commented, after a flurry of messages and emails that afternoon in Sutherland he finally got the coordinates in time to make the observation, which was only just reachable by SALT during the twilight. The Southern African Large Telescope was only the third observatory worldwide to provide a spectrum of the target, showing its anomalous behaviour and proving that this was no run-of-the-mill transient event.

Once the target position had been determined a SALT target-of-opportunity observation was undertaken using Director’s Discretionary Time. The first SALT observation was one and half days after the initial gravitational wave trigger. This delay was due to the time it took other imaging telescopes to survey the large area where the event occurred in order to locate its optical counterpart. SALT was able to take one more observation, on 19 August, before it was well and truly lost as the kilonova faded rapidly and was overwhelmed by the bright twilight sky.

Väisänen added that they were really fortunate that the event did not happen two days later, otherwise they would never have had the opportunity to observe it with SALT. The SAAO and SALT had been poised for some time to make such an observation, since the original discovery of the first gravitational wave event in September 2015. Dr Stephen Potter, the SAAO astronomer with responsibility for attempting follow-up

observations of gravitational wave sources expressed his delight at the results. He had heard from one of our Chinese collaborators about the event and was in contact with David Buckley, who is principal investigator of the SALT transient programme, about triggering a SALT observation, once an accurate position was determined. We were getting rather desperate at the prospects of getting a precise enough position in time for a SALT observation. But in the end it came in the nick of time and it was done.

As it happened, Buckley was attending a conference on transients in Russia, when the news arrived of the detection of GW170817. However, it was only the following day, when he was travelling home, that the final all-important positional information became available. Other co-authors were able to ensure that the observations were undertaken and the data reduced quickly. Owing to the quick response of SALT and other SAAO telescopes, crucial information on the nature of the gravitational wave source was obtained. These have resulted in the publication of 8 refereed papers containing observations conducted at the SAAO with the three different telescopes (SALT, MASTER-SAAO and IRSF), including the paper which is the subject of this press release.

The detection of an electromagnetic counterpart to a gravitational wave source, coming only two years after the first gravitational wave detection, bodes well for the study of future gravitational wave neutron star merger events. The ability of SALT to respond promptly and appropriately to transient alerts, in this case the GW170817 event, is one reason for the success of the observations reported here and will hopefully result in similar successes in the future.

News release, SAAO, 22 January, 2018

1 http://www.saao.ac.za/press-release/salt-and-saao-telescopes-investigate-the-origin-of-the-first-detection-of-gravitational-waves-produced-by-two-colliding-neutron-stars/

by a slightly irregular haze extending a little to north-east. A few stars in the western part of the nebula, part of the cluster Collinder 427, could be glimpsed with some care.

Fig 4. The Iris Nebula.

The variable star PV Cephei fainter than magnitude 16 is situated half a degree south-west of NGC 7023. PV Cephei has a faint variable V-shaped nebula, known as **GM 1-29**, or Gyulbudahian's Nebula, extending north from the star but extremely difficult to spot at times. Gyulbudahian's Nebula is a little-known variable reflection nebula, similar to Hubble's variable nebula. This nebula, which changes brightness and shape over many months or even years, has been a real challenge even for an 18-inch telescope. Armen Gyulbudaghian is an Armenian astronomer at Byurakan Observatory. He discovered this nebula in 1977, apparently during a survey for new Herbig-Haro objects. The object as a whole is known as HH 215; the reflection nebula is officially catalogued as GM 1-20 (the M stands for Magakyan, the co-author of the discovery paper. (Skyhound)

The starry King Cepheus is not by any means shy to show off the rare and interesting objects in his kingdom, and rightfully so; to be part of a monarchy is not everyone's privilege, even if the monarch is a King fixed to the starry sky.

somewhat roundish shape with beautiful strings random curling through the cluster. NGC 188 is one of the oldest clusters known at an estimated 7 billion years, and more than 5 000 light-years away. Inside the four-cornered house-shaped constellation two objects reside close together in harmony. The open cluster **NGC 7142** is situated 20' south-east of the reflection nebula/cluster **NGC 7129**. The cluster is rich in starlight which could well emanate from a few dozen unresolved stars. NGC 7129 is one of a kind and one to remember: only a small group of six outstanding stars in a square shape with the four brighter ones towards the north fully covered in haziness.

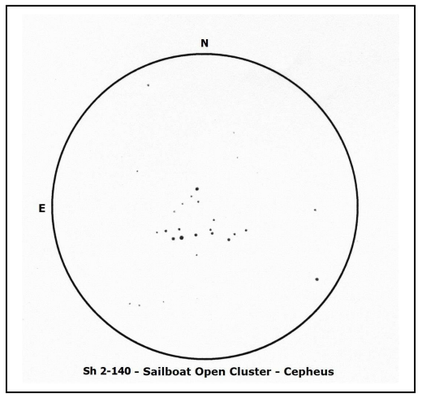


Fig 3. SH 2-140

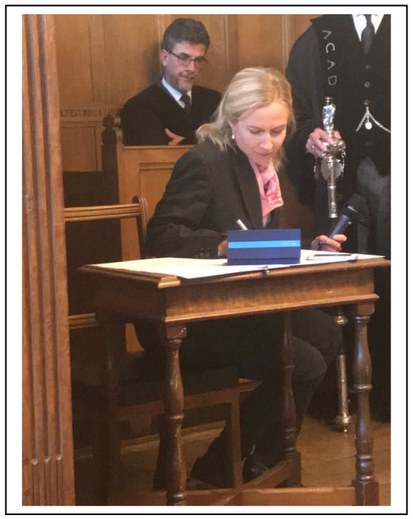
Further south-east the diffuse nebula **Sh 2-140**, a prototypical cometary globule which is part of the Cepheus bubble of expanding gas and dust around OB2 stars. The beauty enfolded in the nebulosity is the group of stars known by its nickname, the "Sailboat Cluster", giving a truly remarkable impression. When I visited the Astro Camp in Portugal a few years ago I made a sketch of it but could not detect the nebulosity around it at the time. Probably using a nebula filter would of brings it out (see sketch).

In the western part of the constellation is probably one of the most beautiful diffuse nebulae ever seen, not so much through the eyepiece of a telescope but definitely through the eye of the Hubble telescope. **NGC 7023** is popularly known as the Iris Nebula, a small reflection nebula surrounding a magnitude 7 star. When I observed this nebula through an 8-inch telescope at a northern Astro camp I had no trouble seeing its glow with an outstanding star towards the brighter centre clearly surrounded

Inauguration of 10th Regional Office Coordinated by South Africa-based OAD

The European Regional Office of Astronomy for Development was officially established yesterday at a signing ceremony in Leiden, the Netherlands. The event was attended by the then South African Minister of Science and Technology and marked the formation of the tenth Regional Office of Astronomy for Development, which is coordinated by the global office based in South Africa.

On 26 February 2018, the European Regional Office of Astronomy for Development (ROAD) was brought into existence at a signing ceremony at Leiden University in the Netherlands. It was preceded by a ceremonial address by Grace Naledi Pandor, former South African Minister of Science and Technology (now Minister of Higher Education). The occasion also marked the appointment of the minister as honorary visiting Oort Professor of 'Astronomy for Development'.



The ceremony signified the creation of the International Astronomical Union's (IAU) tenth Regional Office, coordinated by the global Office of Astronomy for Development (OAD). The OAD is hosted at the South African Astronomical Observatory through an agreement between the IAU and the National Research Foundation (NRF). The European ROAD will be operated jointly by the European Astronomical Society and Leiden University.

Fig. 1Dr Vanessa McBride signing the agreement

Professor Piero Benvenuti, General Secretary of the IAU was present to sign the agreement on behalf of the IAU: “The role of the European ROAD is a particularly delicate one because it has to operate in a Continent in which astronomical research, education and outreach activities are well developed. At the same time, it has to coordinate with the existing ROADS, which are facing different type of challenges. Given the experience of Leiden Observatory and the European Astronomical Society, I am confident the new ROAD will achieve its goals brilliantly.”
The global OAD was represented by Acting OAD Director, Dr Vanessa McBride, who said “We are delighted to welcome the European Office to our family of regional offices of Astronomy for Development, and are excited about the opportunity this will present for a fresh perspective on the role of fundamental sciences in sustainable development.”

Fig. 2 Group image of the dignitaries at the signing ceremony. Dr. Vanessa McBride is second from left and Minister Pandor 4th from the left.

Regional offices work closely with the OAD to execute the vision of “Astronomy for a better world”, with a focus on a geographic or cultural region. The other regional offices are located in: Colombia, Jordan, Ethiopia, China, Portugal, Thailand, Armenia, Zambia and Nigeria. The newest regional office in Europe will carry out and coordinate relevant astronomy-for-development activities in all three Task Force areas defined in the IAU Strategic Plan – Universities and Research, Children and Schools and Public Outreach, focusing on accomplishing the United Nations Sustainable Development Goals in Europe. These tasks will be carried out in cooperation with existing activities of Pan-European and national astronomical organisations.

comprises only a handful of stars in a loose irregular triangular shape and is relatively outstanding against a busy star field.

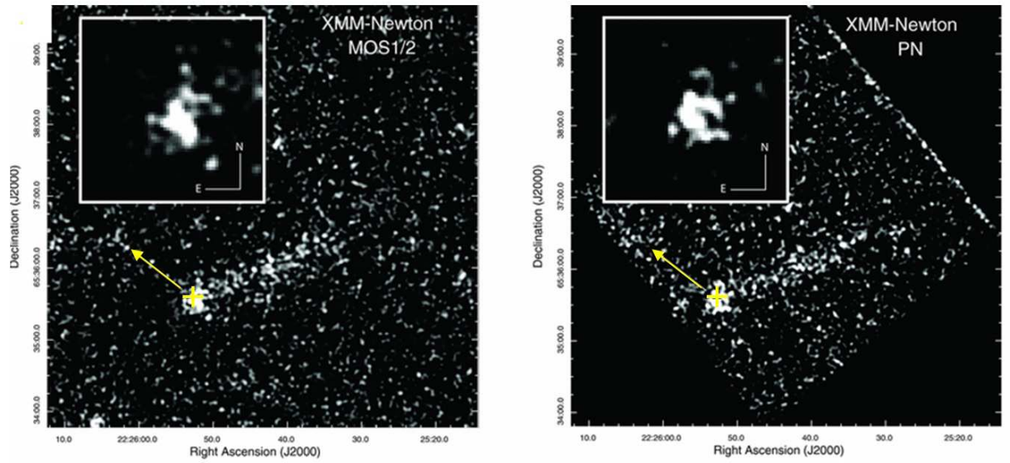


Fig 2. PSR B2224+65 and its jet, observed in x-rays by XMM-Newton. The inset is an enlargement and the arrow gives the direction of the proper motion of the pulsar.

Open clusters always show some sort of special character, bringing pleasure to the eye. One such cluster is **NGC 7510**, situated to the east from King 19. The cluster contains about a dozen faint stars in a close, elongated, strange bar formation south to west, an attractive sight. The thin arrowhead bent at the south-western tip and barely seen covered in a nebulosity glow.

Close to the Cassiopeia border in the northern part of the constellation an outstanding planetary nebula can be found, one not shy to make itself known to the observer. **NGC 40**, is bright and easy to see as a north-south oval with a prominent central star known as a short-lived Wolf-Rayet type. The planetary displays a smoky grey colour with a tint of blue.

Probably the most northerly open cluster is **NGC 188**, out of sight but not out of mind for us in the south. It comprises a swarm of faint stars in a

A twosome can be seen in the open cluster **NGC 6939** and galaxy **NGC 6946** with a low-magnification eyepiece of a moderate telescope, situated in the far western part of the constellation. NGC 6939 is a fan-shaped mass of faint stars, spraying out towards east quite orderly and well seen. The surface has a granular appearance, indicating fainter members, and with averted vision some of these faint stars may perhaps be spotted. A lovely knot of faint stars can be glimpsed north-east of the cluster core, but only with the utmost care. David Knisely called the open star cluster the "Right-angle Cluster", due to its oddly well-ordered rows of stars that seem to form a distinct right angle. Others have referred to the cluster as the Seacrest Cluster in reference to the stadium lights at Lincoln, Nebraska's Seacrest field, but that name has more or less faded.

The soft oval galaxy NGC 6946 is barely 40' towards the south-east, one of the nearest open spirals, but still very much further away in the distance from the cluster. It is a typical SC spiral galaxy, hazy at the edges, with several knots and patches in the spiral arms, with a barely seen brightening towards the small nucleus. Several supernova explosions have been detected over time in this galaxy. The contrast in brightness between the two objects lend a special touch to this field of view.

The very large emission nebula **IC 1396**, close to the southern border with Cygnus is easily seen through binoculars in transparent really dark skies. The large hazy nebula is home to a number of various magnitude stars in knots and strings, a denser concentration towards the middle and patches of dark areas. Always wondered where to find the famous Herschel's Garnet Star? Well, wonder no more; simply find the 3.9 magnitude mu Cephei in the northern fringes of IC 1396. Herschel's Garnet Star (mu Cephei) stands out proudly in a rich orange-red colour.

Barely a degree west of the border with Cassiopeia, Ivan R. King of the Harvard College Observatory discovered an open cluster, now catalogued as **King 19**, which reigns over its own kingdom domain so to speak; it

"Europe has its own unique development challenges. We look forward to working with the other regional offices in using astronomy and its related tools and skills to impact socioeconomic development" said Prof Roger Davies, President European Astronomical Society. The signing ceremony will be followed by a symposium on "Science Diplomacy and International Development" on 27 February, organised jointly by the European Commission Space Awareness project, Leiden Observatory, the Leiden African Studies Centre, the Leiden University Faculty of Governance and Global Affairs and the Leiden University Hague Campus. Minister Pandor will give a lecture on "Science Diplomacy and the Square Kilometre Array" and Dr. Vanessa McBride will present at talk titled "IAU Astronomy for Development Programme".

Prof. Donald Lynden-Bell CBE, FRS

(5 April 1935 – 5 February 2018)

We regret to announce the death in Cambridge on 5 February 2018 of Prof Donald Lynden-Bell who was a board member of the South African Astronomical Observatory in its early days and a good friend to South African Astronomy. He knew several members of the SA astronomical community personally.

Donald was well-known for several important contributions to astrophysics. He first suggested that galaxies contain black holes at their centres and that they are responsible for the energy of quasars. He, Sandage and Eggen developed the influential idea that our galaxy formed from a gigantic gaseous cloud. He was also one of the "Seven Samurai" who postulated the existence of a "Great Attractor" partly responsible for the motion of local galaxies (a former SAAO astronomer, Gary Wegner, was also one of this group).

Donald was Professor of Astrophysics at Cambridge University since 1972 and the recipient of many honours including the Kavli Prize and Fellowship of the Royal Society.

Fig 1. L-R Bernie Fanaroff, George Nicolson (HartRAO) and Donald Lynden-Bell met at the retirement conference in honour of MW Feast in 1992, held at UCT.

A few personal anecdotes: Donald, though fundamentally kind, could be demanding but also could play the part of eccentric professor. I first met him at Caltech in 1970 and it was he who interviewed me for a job at the Royal Greenwich Observatory - a somewhat terrifying experience. He seems to have approved of me nevertheless! In Cape Town, some years later, he turned up for a dinner appointment at our house and as I opened the door he asked immediately if he could have a bath! On another occasion, a cloudy night at Sutherland, we were talking of interesting numbers, including 1729 - the subject of a famous Ramanujan-Hardy story in which the former identified it as the smallest number that could be expressed as the sum of two cubes in two different ways. This we had to verify immediately! Donald was not one to tolerate idle minds.

We have lost a valued friend.

Ian Glass

Sky Delights: King Cepheus

Magda Streicher

The constellation Cepheus, known as the King of Ethiopia, can be found suspended from the northern Milky Way, accompanied by his queen, the constellation Cassiopeia and their daughter Andromeda. The shape of the constellation strongly resembles that of a square house with a pitched roof. Cepheus is a northern constellation which borders on the polar constellation Ursa Minor. It is not visible to southern hemisphere observers, but can be seen throughout the year from northern hemisphere areas. Cepheus is a constellation that holds a few exceptional objects, some of them having been given the strangest names, like the Cave Nebula, the Bubble Nebula, the Elephant Trunk, the Guitar Nebula, the Iris Nebula, the Bow-tie Nebula, the Wizard Nebula, the Fireworks Galaxy, and then in that mix of objects also Gyulbudaghian's Nebula. Some of these objects will be described in this article. The King is also proud to have under his rule the pulsar PSR B2224+65 and its X-ray jet (Fig 2.). A former binary companion of the pulsar is perhaps a runaway star, identified as the fastest known neutron star racing through space at an estimated 7.75 million km per hour, and about 6 000 light-years distant. The richness of objects in King Cepheus's domain is amazing and it is up to us to explore it.

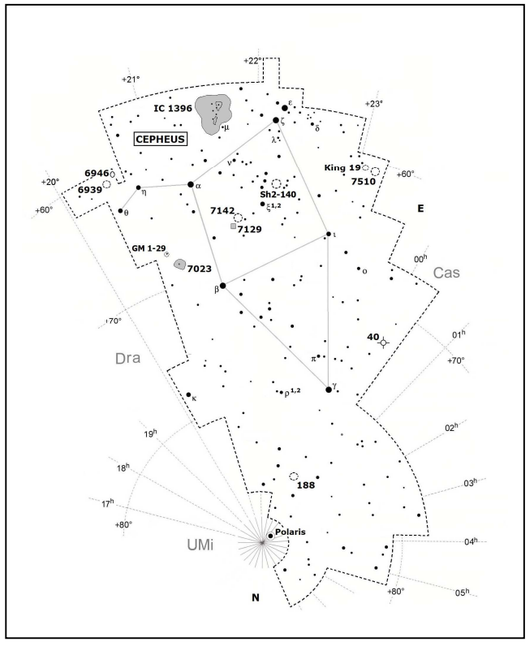


Fig 1. Map of the constellation Cepheus.

include the surprising discovery of a transient source just 400 pc from the central black hole, and preliminary results from polarimetric imaging derived via the Rotation Measure Synthesis method. I will conclude with an update on the 'Next Generation Very Large Array' -- a proposed major high frequency synthesis array, to replace the JVLA sometime after 2025.

Astro-Coffee

Title:
Speakers: Catherine Cress, Sean February, Matthew Cawood & Israel Tshililo
Date: 29 June
Time: 13h00 – 14h00
Venue: 2nd floor auditorium SKA office, Pinelands

NASSP

Title: Travel through Space and discover the mysteries of Sprites: First recordings of these dazzling lights in South Africa
Speaker: Professor Michael Kosch from SANSA.
Date: 12 April
Time: 10h00-11h00
Venue: Astronomy Seminar Room, 5th Floor RW James Bld

AIMS

Title: Machine learning for supernova classification
Speaker: Anais Moller from the Australian National University
Date: 20 November
Time: 14h00
Venue: Upstairs Hall

None given.

Landmark First Group Visit to Completed MeerKAT

Pierre de Villiers, Hermanus Astronomy Centre

Eighteen members of the Hermanus Astronomy Centre were privileged to be the first group visit to Square Kilometre Array's ("SKA") MeerKAT site since the completed installation of all 64 antennae on Friday 24 November. SKA's Stakeholder Manager, Anton Binneman, was dubious about the possibility of such a visit *at all* to what is essentially still a construction site. Fortunately John Saunders' dogged perseverance since the beginning of the year resulted in the landmark visit.

Fig 1. The Hermanus Group that visited the MeerKAT

All the participants who undertook the 660 km trip to Carnarvon to visit the biggest science experiment in the history of humankind were well prepared for the visit and understood the basic principles involved in this unique facility. However, the visit to the actual site rammed home a condensed and awesome perspective of the magnitude and complexity of the facility, to leave an unforgettable memory in all participants' minds.

The sensitivity of the antennae is best described by equating the switching on of a cell-phone next to an antenna to switching on a lighthouse "bulb" next to a dark-adapted observer's eyes – it would simply blind it. Differently stated the sensitivity of the completed SKA array, extending from its core 100 km West of Carnarvon to Ghana and Mauritius, will be analogous to observing a candle on the Moon.

As such all cell-phones and DSLR cameras were prohibited. The tour guide noted that two of the visitors used hearing aids, which will be evaluated for admissibility in future, as will be the potential impact and therefore admissibility of pacemakers!

Many of the events in the universe – including the formation of the first stars after the Big Bang – generate radio waves. The science of Radio Astronomy utilising intricate antenna systems such as MeerKAT was developed to observe and study these stellar phenomena

KAT7 ("Karoo Array Telescope") with 7 x 13 m single frequency antennae was essentially a technology demonstrator to confirm that South Africa had the technology to construct an array of radio telescopes with an effective collection area of one square kilometre. This is the area required to detect radiation from the era of recombination about 300 000 years after the Big Bang when the universe had cooled sufficiently to become transparent (as opposed to its higher temperature opaqueness).

MeerKAT has 64 x 13.5 m antennae of offset Gregorian layout (to maximise collective efficiency). Each antenna has four receivers, the first two of which will be L- and UHF-bands. MeerKAT will form part of the core of SKA1's 197 antennae. This will be followed by SKA2 and SKA3, increasing the total number of antennae to 3,500, located at locations throughout Southern Africa, each location carefully designed to achieve optimum resolution and sensitivity.

Fig 2. One of the 64 Offset Gregorian dishes that make up the MeerKAT

Each antenna will send the time (based on signals from the most accurate atomic clock in the Southern Hemisphere), its own – Latitude & Longitude

data analysis team, which aims to analyze various types of observed data with the AKARI satellite and publicly release science-ready data products.

Abstract: 2 (Natsuko Izumi (NAOJ)) The outer Galaxy provides a good opportunity to study star formation in an environment significantly different from that in the solar neighbourhood including lower gas density and lower metallicity. However, star-forming regions in the outer Galaxy have never been comprehensively studied or catalogued because of the difficulties in detecting them at such large distance. We searched for star-forming regions with WISE MIR all-sky survey data and FCRAO CO northern outer Galaxy survey data. As a result, we successfully identified 711 new candidate star-forming regions in 240 molecular clouds up to Rg ~ 20 kpc, which enable statistical studies of star-formation activities up to the extreme outer Galaxy for the first time. Using the new identified star-forming regions, I will report the global properties of star-formation activities in the outer Galaxy. I will also report our new star-forming region survey in the southern outer Galaxy and our future plan.

UWC

Title: Recent Results from Jansky Very Large Array observations of Cygnus A -- and a look towards the future of the VLA
Speaker: Rick Perley (NRAO, Socorro, New Mexico)
Date: 2 February
Time: 14h00 – 15h00
Venue: Rm 1.35 New Physics Building, UWC

Abstract: The completion of the EVLA project (now called the JVLA) in 2012 provided astronomers with an effectively new radio telescope with orders of magnitude improvement in sensitivity and frequency coverage (not to mention similar orders of magnitude increase in data volumes and data processing requirements). To illustrate the fabulous new powers of this upgraded telescope, I will present recent results coming from wideband observations of the classic high-luminosity radio galaxy Cygnus A. These

Subaru/HDS in the north and SALT/HRS in the south, we commenced a high-resolution survey of hydrogen-depleted subdwarfs to discover new members of the class. The first major discovery, UVO 0825+15, was found to exhibit strong lead lines, to be an intrinsic variable in K2 field 5, and to have a relatively high space motion. The talk will discuss the observations of UVO 0825+15, new results for other chemically-peculiar subdwarfs, recent discoveries with SALT, and implications for our understanding of these stars

Title: 1 Spatial variations of PAH properties in star-forming regions; 2 Star formation in the outer Galaxy
Speakers: 1 Mitsuyoshi Yamagishi (ISAS/JAXA) 2 Natsuko Izumi (NAOJ)
Date: 18 January 2018
Time: 11h00 – 12h00
Venue: SAAO Auditorium

Abstract: 1 Mitsuyoshi Yamagishi (ISAS/JAXA) PAHs (polycyclic aromatic hydrocarbons) are large organic molecules observed in MIR spectra. Since PAHs are excited by FUV photons, PAH emission is the major emission from PDRs. It is well known that the PAH properties are different from region to region. However, continuous mapping observations to examine the relation between the PAH properties and the surrounding interstellar environment have not been fully performed yet. We, therefore, examined spatial variations of the ionization degree and structure of PAHs around M17SW using Spitzer, IRSF, and Nobeyama 45m. As a result, we found that the PAH ionization degree is locally enhanced inside the molecular cloud possibly due to deeply embeded excitation stars, and that PAHs in irregular structures are dominant at the interface between PDR and HII region. In order to expand this study, we are conducting the Pa-beta and Br-gamma narrowband imaging survey for Galactic star-forming regions with IRSF. In this talk, I will review previous PAH studies in star-forming regions, and report the current status of the Pa-beta and Br-gamma survey. In addition, I would like to briefly introduce activities of the AKARI

- and the targets - RA & DEC - coordinates as well as observation data at a sampling frequency of 1,712 million samples per second for the L-band to the central correlator via 172 km of optical fibres. It is therefore not surprising that each antenna will generate the equivalent of almost one DVD per second in data. On completion the SKA will generate double the world's current internet traffic in data!

See www.ska.ac.za for more technical details.

What an outing!

HERA: Hydrogen Epoch of Re-ionization Array

Pierre de Villers, Hermanus Astronomy Centre

The Hermanus Astronomy Centre's ("HAC") visit to SKA's Meerkat site included the HERA facility.

HERA is an array of 133 antennae measuring 14 meters in diameter. It was designed to detect radio waves in the low-frequency range of 100-200 MHz, which allows it to detect fluctuations in the emissions from neutral hydrogen in the Epoch of Re-ionisation before the first stars, galaxies and black holes were formed. This will allow astronomers to understand the formation and evolution of these very first luminous sources.

Fig 1. Part of the HERA array under construction.

Once completed, HERA will observe the universe for a three month period when the Milky Way does not flood the very faint sought after signals, building a 3D map of the universe during this era.

HERA is an American, British and South African collaboration. SKA South Africa provides site and logistical support and numerous SA Universities (Wits, KZN, UCT, UWC, US and DUST) are involved in the research and design of the project.

It is notable that the antennae are constructed from plastic piping and chicken mesh by local unskilled labour which was up-skilled to do the construction.

Equally notable is the fact that on completion of the three month observation period success will be a likely candidate for a Nobel prize, whereas failure will require a different approach to achieve the primary objective of the experiment.

Whatever the outcome, the array will be dismantled after completion of its observations. Six or Nix indeed!

Colloquia and Seminars

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

Also included in this section are the colloquia/seminars at the SAAO, UWC, the Astrophysics, Cosmology and Gravity Centre at UCT, ACGC and the NASSP lectures, aimed the at the students and interested astronomers. In addition there are the SAAO Astro-coffees which are 15-20min informal discussions on just about any topic including but not limited to: recent

astro-ph papers, seminal/classic publications, education/outreach ideas and initiatives, preliminary results, student progress reports, conference/workshop feedback and skills-transfer.

SAAO

Title: Neutral hydrogen in gas-rich spiral galaxies
Speaker: Dr Gyula I. G. Jozsa (SKA SA)
Date: 14 December 2017
Time: 11h00 – 12h00
Venue: 1896 Building

Abstract: Spiral galaxies are building stars on larger time scales than the depletion time of the gas available in the galaxies themselves. Hence, a replenishment of the star formation reservoirs has to be supplied from the environment. But how this happens in detail is not well known. Spiral galaxies with an excess in their HI mass as compared to the average population are an obvious target in the hope to learn more about this process: one can speculate that their large HI mass is a result of recent gas accretion. I will report about some results from recent campaigns to observe HI in gas-rich spiral galaxies and discuss future possibilities to shed more light on gas accretion with MeerKAT.

Title: Heavy-Metal Subdwarfs and SALT
Speaker: C. Simon Jeffery (Armagh Observatory and Planetarium)
Date: 16 January 2018
Time: 11h00 – 12h00
Venue: SAAO Auditorium

Abstract: The majority of hot subdwarfs lie on or close to the helium main-sequence. Many have hydrogen-rich surfaces, but a substantial fraction of the hotter subdwarfs have hydrogen-depleted or hydrogen-deficient surfaces. Amongst the former, three were known to show extraordinary overabundances of heavy elements including zirconium and lead. Using