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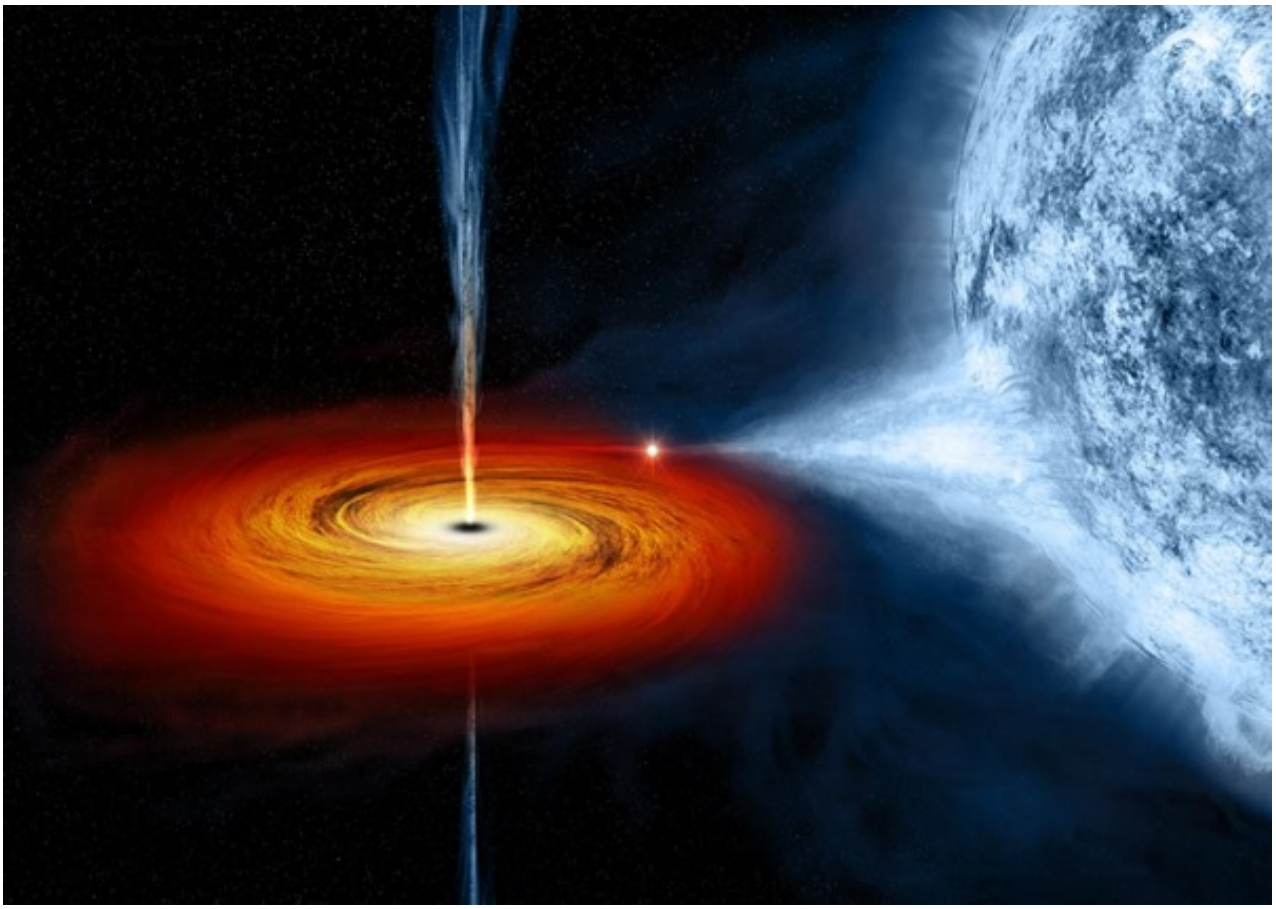

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Cover - Artist's impression of Cygnus X-1, a binary system consisting of a black hole and stellar companion. Credits - NASA/CXC/M.Weiss *See article on Bursts from Space, page 116.*

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Editorial Note

We do not believe it is necessary to continue placing a 'booklet" version of each issue of MNASSA on our website www.mnassa.org.za. If readers would prefer us to resume producing this version, please communicate with the editors.

News Note: SAAO Director resigns

On 18th August 2023, Dr Petri Väisänen announced that he will leave SAAO in early 2024. He will be returning to his native Finland where he will take up a new post as the Director of FINCA - the Finnish Centre for Astronomy with ESO.

He was first appointed Director of SAAO on a 5-year contract in January 2018. This was renewed in December 2022.

Dr Väisänen was born in Finland in 1968 and obtained his doctorate at the University of Helsinki in 2001, having previously had experience at the Harvard-Smithsonian Center for Astrophysics. He then became a Post-Doctoral Fellow at the European Southern Observatory in Chile. Following his time at ESO he came to South Africa in September 2004 as a Research Fellow at SAAO. Subsequently he became a SALT Astronomer and a member of the SAAO staff.

News Note: SKAO signs collaboration agreement with ESO

The only two intergovernmental organisations dedicated to ground-based astronomy, the SKA Observatory and the European Southern Observatory, have strengthened their ties with a collaboration agreement.

The SKAO's Director-General Prof. Philip Diamond and his European Southern Observatory (ESO) counterpart, Prof. Xavier Barcons, signed the agreement on Monday 24 July 2023 at the ESO headquarters in Garching, Germany. ESO operates three observing sites in the Chilean Atacama desert on behalf of its 16 member states.

The agreement establishes a general framework for cooperation and information-sharing between the SKAO and ESO. It will promote strategic coordination of the organisations' long-term plans, allowing them to advance their aims in science together. Potential areas of coordination that have been identified include:

- strategic planning and governance,
- international relations,
- sustainability, diversity, equity, and inclusion, and
- communication, outreach, and publishing.

Examples of collaboration between the organisations since the SKAO's establishment in 2021 include advocating for the need to protect the dark and quiet skies and organising joint workshops, including one about surveying the southern skies.

"I am happy to formalise what has been a fruitful link since before we started setting up the SKAO," said Prof. Diamond. "As ESO's junior in the intergovernmental organisation world by nearly 60 years, the SKAO has had a great example to emulate and learn from. In turn, we have been able to set up an Observatory tailor-made for the 21st century and can share the experience we have gained."

News Note: WG Professional-Amateur Relations in Astronomy

The Executive Committee WG Professional-Amateur Relations in Astronomy invites IAU members to register their projects at Pro-Am Research Collaboration (PARC) platform.

The Pro-Am WG wants to connect professional and amateur astronomers with the aim of promoting research collaborations, delivering workshops, and promoting and facilitating the integration of professional astronomers within amateur societies.

With this goal in mind, the Pro-Am WG launched the IAU Pro-Am Research Collaboration (PARC), an initiative that promotes and facilitates professional-amateur research collaborations in astronomy. PARC aims to enhance professional astronomy research capacity through collaboration with skilled and motivated amateur astronomers.

Throughout history, amateur astronomers have made significant discoveries and contributions to the field of professional astronomy. While many amateurs are observers using smaller optical telescopes to image the night sky directly with CCD detectors, others are engaged in making radio observations or designing and building their own instruments. Some amateur astronomers collect data on solar eclipses and aurorae or are making astrometric and photometric observations of asteroids and comets and reporting them to the Minor Planet Centre, while others are engaged in the precise timing of stellar occultations by bodies in our solar system. PARC will harness this knowledge base and interest from amateur astronomers to enhance the capacity for professional research.

There is an array of useful projects that demonstrate how Pro-Am collaborations can benefit researchers. Galaxy Cruise, from the National Observatory of Japan, and Gaia Vari from the European Space Agency demonstrate the power of amateur astronomers in processing and classifying large sets of data. Individuals can recognise patterns in ways computers can't, and their efforts can save time and resources, expediting research processes. In some cases, amateur astronomers' observations have led to the creation of new sets of data used by professional astronomers. For decades amateurs have been observing variable stars and reporting data to the American Association of Variable Star Observers (AAVSO), and NASA uses amateur astronomers' Jupiter telescopic images and data of Jupiter to inform the JUNOCAM mission.

Beyond the direct impact on researchers and amateur astronomers groups, the involvement of citizens in research collaborations can increase engagement with astronomy among educators, non-profit organisations, and industry, fomenting societal support for research activities.

The Pro-Am WG calls on all IAU members who have research projects that would benefit from collaboration with amateur astronomers to register their projects on the WG website:

https://www.iau.org/science/scientific_bodies/working_groups/professional-amateur/.

Each project will be reviewed by the Working Group prior to posting. Once in the PARC system, interested amateurs will be able to sign up to participate, and research teams will have the opportunity to review amateur candidates prior to engaging with them as part of the research project.

For more information, please contact Clementina Sasso at

clementina.sasso@inaf.it.

News Note: MeerKAT Upgrades

According to a recent article on the website https://techcentral.co.za, the Stellenbosch company EMSS Antennas has just received a contract to supply 64 receivers for use with the MeerKAT radio telescope array near Carnarvon.

EMSS is a specialised company that has already supplied much of the receiving equipment for this project.

Their website: https://www.emssantennas.com gives information about the company and shows many illustrations of their work.

The image at right shows the interior of an L-band (856-1711MHz) receiver for MeerKAT. Normally it is in vacuum and cooled to 18° Kelvin (-255°C).

Many articles about MeerKAT are of a very general nature. For a more technical summary of MeerKAT as it is at present, please see: https://skaafrica.atlassian.net/wiki/spaces/ESDKB/pages/277315585/MeerKAT+specifications

The ongoing improvements to MeerKAT will result in "MeerKAT+". Technical details of the upgrades can be found at: https://www.meerkatplus.tel/mk-technical-details/

The Wikipedia article https://en.wikipedia.org/wiki/MeerKAT gives an outline of the project history up to about 2018, including some of its science projects.

The SKA Observatory has a comprehensive website at https://www.skao.int/en.

News Note: Africa Millimetre Telescope

The AMT is an international collaboration consisting of the University of Oxford, the University of Amsterdam, Turku University and other Dutch research institutes, alongside Radboud University and University of Namibia. The project is funded by the Dutch Research Council, European Research Council and Radboud University; construction is planned to start in 2026. The project involves extensive renuilding and moving the SEST (Swedish-ESO Sub-millimetre Telescope) that was built in 1987 and originally installed at the ESO Observatory on Cerro La Silla, Chile. It will receive a new lease of life in Namibia, where it will be re-located on or near the Gamsberg.

View of the SEST telescope that wil be moved to Namibia (Photo: ESO public images, F. Kerschbaum).

Because it will be located in the southern hemisphere and Africa in particular, the AMT will have a good view of the black hole in the centre of our Milky Way and will be a crucial link between telescopes in Europe, South and Latin America, as well as the South Pole. In addition to Galactic Centre studies, the telescope will look for flashes of millimetre-wave emission from cosmic explosions, providing a new window to transient phenomena in the Universe. Construction and operation of the observatory is being supported by a 12 million Euro guarantee from Radboud University over 10 years.

The European Research Council (ERC) has awarded recently a Synergy Grant, named BlackHolistic, of 14 million Euro to a team of British, Dutch, Finnish and Namibian astronomers to make colour movies of black holes. The new observatory will be part of, and extend the power of, the global Event Horizon Telescope (EHT) network that became famous for making the first image of a black hole and the new grant will additionally help to transform the network from making still images to making movies – enhancing our understanding of black holes across the entire Universe.

In June 2023 Prof Kenneth Matengu, Vice-Chancellor of the University of Namibia and Daniël Wigboldus, President of the Executive Board of Radboud University signed a framework agreement at State House in Windhoek to strengthen the collaboration

between UNAM and Radboud University and to realise the construction of the Africa Millimetre Telescope.

Some characteristics of the SEST antenna:

Main reflector paraboloid
Diameter: 15m
f-ratio: 0.325
Surface tolerance: 50 microns rms
Focus for receivers: Cassegrain
Subreflector diameter: 1.5m
Half power beam width: 50" at 3mm; 17" at 1mm
Pointing accuracy: 2"

Sources: Wikipedia, Oxford University, Prof M. Backes, UNAM.

Recent Southern African Fireball Observations Events # 448-458

Tim Cooper, Director, Comet, Asteroid and Meteor Section

Abstract: This article continues the sequential numbering of reported fireball sightings from southern Africa. By definition, a fireball is any meteor event with brightness equal to or greater than visual magnitude (m_v) -4. The following events were reported to the author and details are reproduced as given by the observer [any comments by the author are given in brackets]. Where the report originated from the American Meteor Society Fireball page, the corresponding AMS event number is given. All times were converted to UT unless stated, and all coordinates are for epoch J2000.0. Descent angles, if given, are in degrees, with directly upwards = 0°, horizontally left to right = 90°, directly downwards = 180° and horizontally right to left = 270°. Azimuth angles are reckoned from north = 0° through east = 90°.

Event 448 – 2023 June 23 – Westville, KwaZulu Natal
Observed by Neil Hinton at 18h00, duration 1-2 seconds, mainly yellow colour but green also noted, brightness said to be about that of the Moon, which was then magnitude -9.4, altitude 20° in azimuth 301°, but was obscured at the time the fireball was seen. Path from RA/Decl. 15h30, +02° to 12h23, +25°. No sounds heard. There is a good agreement with the radiant position of the Anthelion meteors. AMS Event 3165-2023.

Event 449 – 2023 June 29 – Alberton, Gauteng and Hartebeestpoort, North West

Observed by Albertus Taute from Alberton, exact time uncertain but given as about 19h10, saw a 'massive object burning through the atmosphere. It had two parts burning bright white-blue, with red orange sparks flying from it, much larger than any meteor I have previously seen'.

Fig 1: Event 449 on 29 June 2023, screengrab courtesy of Paul Ludick, GMN camera ZA0005. The stars in the image are in the constellation of Boötes, Arcturus is to the left of the fireball, which enters from the top of the frame. Upper right is the constellation of Corona Borealis.

He estimated the size of the fireball as similar to how a 10c coin would appear when held at arm's length, which is about 1.4° Duration 3-4 seconds, path from az/alt 41°, 52° to 330°, 24°, that is RA/Decl. 17h08, +04° to 13h22, +33°, path length 60°. Said 'it made a crackling sound, like fireworks sometimes do'. The fireball passed below the Moon which was 83% illuminated, magnitude -12, altitude 80° in azimuth 315°. The last part of the fireball was captured by Paul Ludick on GMN camera ZA0005 at 19h03m01s, screengrab shown in Figure 1.

Event 450 – 2023 July 2 – Hartebeestpoort, North West

Captured by Paul Ludick at 17h47m15s on GMS camera ZA0004. Path from az/alt 2.4°, 28.7° to 31.2°, 24.3°, that is RA/Decl. 179.65, -86.3° to 129.10, -61.8°. Path length 29°, duration 2.4 seconds, angular velocity 12.1°/sec. Screengrab of the image is shown in Figure 2, and shows a bright meteor with terminal flash reaching m_v -4. The event was sporadic.

Fig 2: Event 450 on 2 July 2023, captured by Paul Ludick on GMS camera ZA0004. The bright terminal flash is in Carina, just above the star epsilon Carinae. Crux is at top centre, with alpha and beta Centauri to the left.

Event 451 – 2023 July 10 – Fourways, Johannesburg, Gauteng
Observed by Douw Grobler at 03h33 while driving on the N1 freeway, heading 74°, saw a 'luminous green streak' duration 1-2 seconds. The trail appeared 'thick with a sharp point, [with] yellow/white fragments breaking off before it suddenly disappeared'. From a sketch provided, path very approximately from RA/Decl. 05h33, -02° to 06h28, -07°. The event was sporadic.

Event 452 – 2023 July 21 – Rosh Pinah, Namibia
Observed by Pieter Jacobs at 04h07 UT, bright bolide seen while driving towards Rosh Pinah when 'the sky suddenly became as clear as daylight and then became pitch black again. The stars in the sky were clearly visible in the bright daylight blue flash'. Appeared as a large streak of light directly above the town, and began to narrow as it moved in an easterly direction. No sounds heard. Pieter checked his security cameras when he got home and found a reflection of the fireball in a nearby window. A screengrab at maximum brightness is shown in Figure 3.

Fig 3: Reflection of Event 452 by a window in security camera footage from Rosh Pinah.

Event 453 – 2023 July 24 – Elysium, KwaZulu Natal
Observed by Wendy Collinson at 16h50, duration 3-4 seconds, yellow-orange ball with a yellow-white tail. Path from az/alt 127°, 41° to 160°, 37°, that is RA/Decl. 19h02, -46° to 19h06, -72°. Said to be as bright as the Moon, which was then a 38% illuminated crescent, magnitude -10.4, altitude 53° in azimuth 305°. She said she heard sounds like rumbling of thunder after it had disappeared. AMS Event 3757-2023.

Event 454 – 2023 July 27 – Gqeberha, Eastern Cape

Captured by Louw Ferreira on GMN camera ZA000A at 00h43m38s, bright meteor with terminal flash. Screengrab is shown in Figure 4. Path from RA/Decl. 18h39.6m, -42.7° to 18h06.0m, -47.7°. The path was consistent with an alpha Capricornid.

Fig 4: Event 454 on 27 July 2023, bright alpha Capricornid fireball captured by Louw Ferreira on GMS camera ZA000A. Stars in the constellation of Sagittarius are to the right of the fireball, with Corona Australis to their left.

Event 455 – 2023 August 6 – various, Western Cape

A bright fireball lasting several seconds was widely observed from the Western Cape region. Images were secured from three cameras which enabled a determination of the ground path approximately from south of Matjiesfontein to Velddrif on the west coast. Eye witnesses gave the predominant colour as bright white, with some reports of yellow and orange. The brightness reached apparent magnitude -10.4, duration 8.1 seconds and the fireball fragmented towards the end of its path. The fireball was also reported to the AMS Fireball page, Event 4103-2023. A full report with supporting images will appear elsewhere in MNASSA.

Event 456 – 2023 August 8 – Hartebeestpoort, North West

Captured by Paul Ludick at 17h18m30s on GMS camera ZA0005. Bright meteor with two flares which possibly reached magnitude -4, duration 3.1 seconds, path from az/alt 108.1°, 33.4° to 106.0°, 14.7°, that is RA/Decl. 12h47m54.8s, -0°17.7′ to 11h39m17.3s, +7°29.9′. Screengrab shown in Figure 5, and the fireball was possibly Anthelion.

Fig 5: Event 456 on 8 August 2023, captured by Paul Ludick on GMS camera ZA0005. The meteor passes through Virgo, Spica is top left of centre and Arcturus is towards the right of the frame.

Event 457 – 2023 August 15 – Oryx Observatory Windhoek District, Namibia

Observed by Clyde Foster at 16h35, during bright evening twilight and was bright enough to be clearly visible despite thin clouds, pure white colour and with sharp increase in brightness just before disappearing. Duration 1-2 seconds, fast-moving, path from az/alt 348°, 25° to 360°, 15°, that is RA/Decl. 14h14, +46° to 15h16, +53°. No sounds heard.

Event 458 – 2023 August 27 – Hartebeestpoort, North West
Captured by Paul Ludick at 01h14m37s on GMS camera ZA0005. Duration 4.3 seconds, path from az/alt 130.5°, 18.8° to 142.2°, 9.3°, that is RA/Decl. 21h57m21.0s, +24°27.7′ to 22h01m05.2s, +39°09.9′. Screengrab shown in Figure 6, and the fireball was possibly Anthelion.

Fig 6: Event 458 on 27 August 2023, captured by Paul Ludick on GMS camera ZA0005. Above and slightly to the right of the fireball is the Square of Pegasus. Brightest object towards upper left is Saturn, then at magnitude +0.4.

Acknowledgments
Thanks to Paul Ludick and Louw Ferreira for forwarding fireballs detected using RMS cameras as part of the Global Meteor Network (https://globalmeteornetwork.org/). Data provided for Event 455 used with kind permission of Juraj Toth and Pavol Matlovič, Comenius University in Bratislava. AMS reports are courtesy of Robert Lunsford (Secretary General of the IMO).

Bursts from Space

Shamin Doman (HSRC Intern based at SAAO)

Abstract: This article concerns the latest citizen science project by SARAO, MeerKAT and the University of Oxford. It is one that anyone can partake in, not only professional astronomers, and involves identifying radio transients (not to be confused with transits) from data captured by the MeerKAT 64-dish radio telescope array. It is accessible via the online citizen science platform Zooniverse. The project is currently being run by a team headed by Alex Andersson who is a graduate student from the University of Oxford. The main aim is to involve the public in using the most sensitive radio telescope in the Southern Hemisphere in observing interesting changes in the universe - radio transients and variables.

Fig 1: The 64-Dish MeerKAT array (SARAO).

Radio transients are astrophysical phenomena which vary in brightness over relatively short periods of time when viewed in radio light. The following represent some examples of these transients:

1. Binary black holes, neutron stars and white dwarfs which radiate massive jets from their interactions in the form of long columns of hot particles.
2. Stellar Flares from nearby stars. Supernovae and their remnants which glow brightly at radio wavelengths.
3. Kilonovae produced by colliding neutron stars.
4. Fast Radio Bursts (FRBs), which at this moment represent a huge mystery in radio astronomy.
5. Distant galaxies and their active centres.

In this project, the following 2 methods are used to detect the variability of potential radio transients:

Images: The following are actual images of radio sources seen by the MeerKAT telescope. They allow us to determine whether the source is some extended blobby galaxy, an unresolved point source (a small dot) or some processing issue.

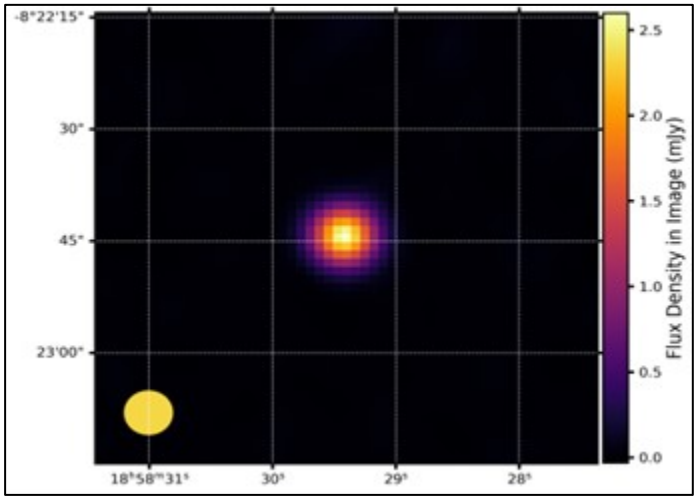


Fig 2: An example radio image of a transient

Light Curves: These describe how the brightness of an object changes over time and represent the primary tool used in identifying interesting sources.

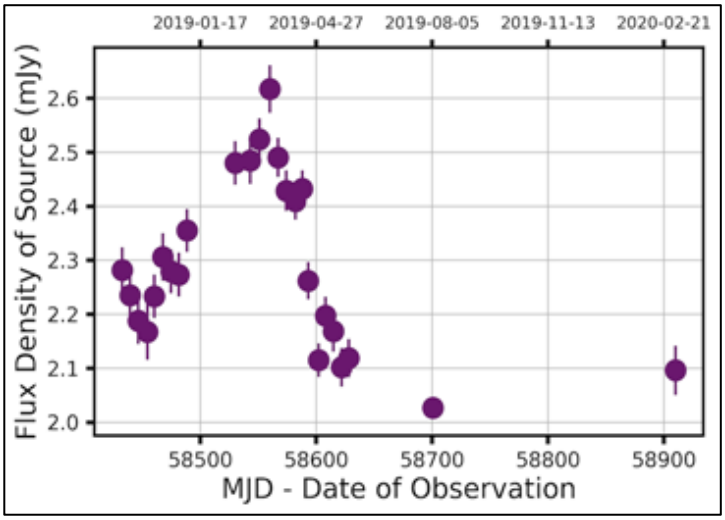


Fig 3: An example of the light curve of a radio transient thought to be the active centre of a galaxy. Credits: Zooniverse, bursts-from-space-meerkat

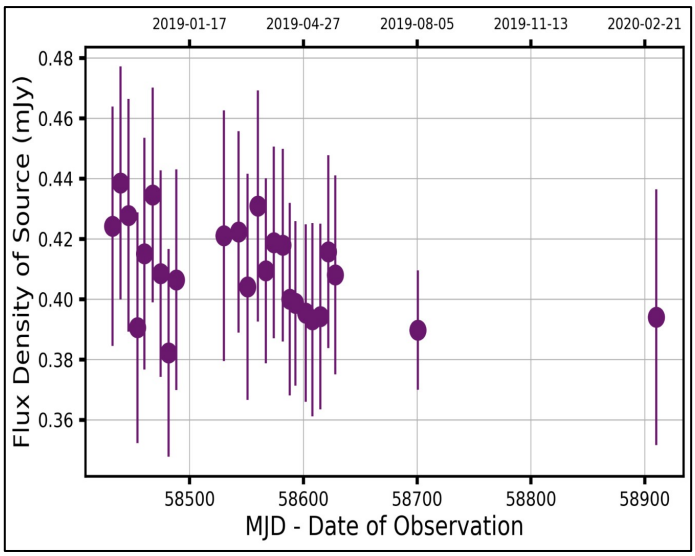
Amateur astronomers and others interested can take part in this project by employing the following simple steps:

Go to www.zooniverse.org and create an account, then locate the bursts-from-space: MeerKAT project which will be found under the “Space” section of available projects. You can then choose to get started right away or learn more by following a short tutorial. It is strongly suggested that the tutorial shoulld ne followed first.

A picture and a light curve such as the ones above will appear and you will be prompted to classify the object in the centre of the image as one of the following:

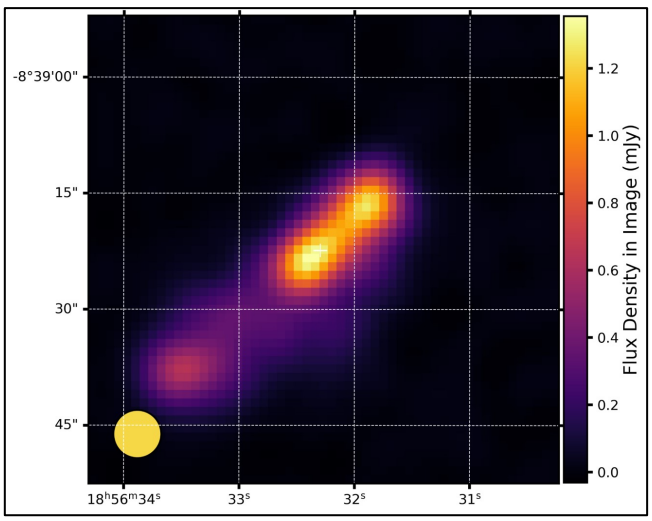
Stable sources: Most of the objects will show some small level of variability, however a large uncertainty (size of the error bars) means we do not truly know if the source is variable or not. These make up the majority of what you will classify.

Fig 4: The light curve of a stable source, Note the error bars representing the uncertainies.



Extended Blobs: These objects literally look like smeared blobs of radio light and are always bigger than the PSF (The circle in the bottom left of the image).

Fig 5: An image of an extended blob showing how much larger it is than the PSF (Point-Spread Function).



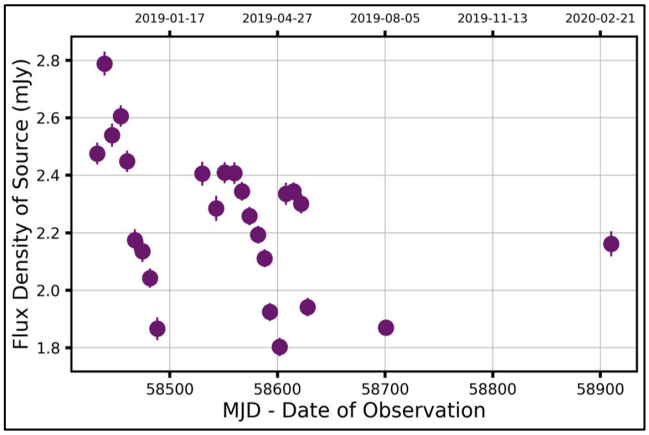
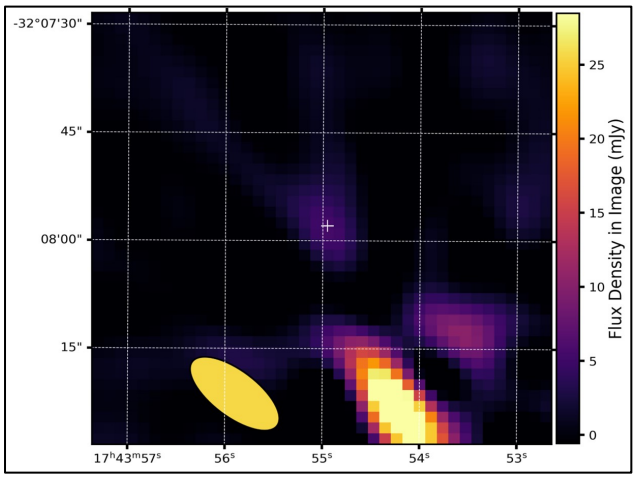


Fig 6: The light curve of an extended blob. Note the smaller error bars representing higher certainties.

The light curve is very similar to that of a transient and it is only by looking at the radio image that we are able to spot the difference.

Artefacts: These are the very few anomalous images you will come across, it is advised to have a look at the field guide (found as a bar on the right-hand side of the screen) for more information as to what these images look like and what causes them.

Fig 7: Artefact Image. These are often located near very bright sources.



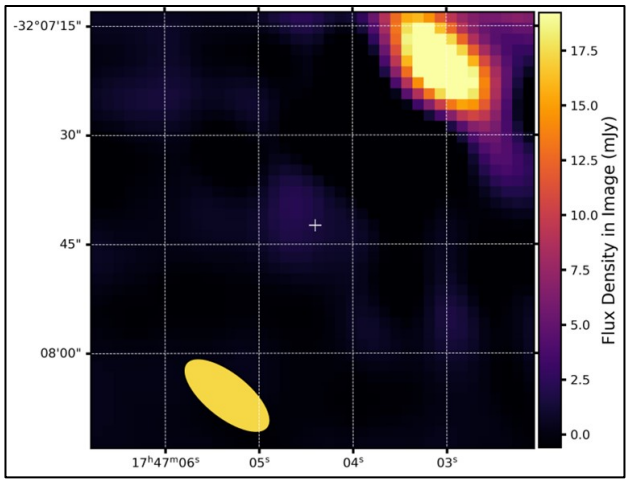


Fig. 8: Artefact Image. Such images can also be the result of data processing

Transients and variables: These are what we are looking for. Expect them to appear as consistent increases or decreases in our light curve (some will even have a “wave” pattern to them) and small dots in our images.

Fig 9: The light curve of a transient.

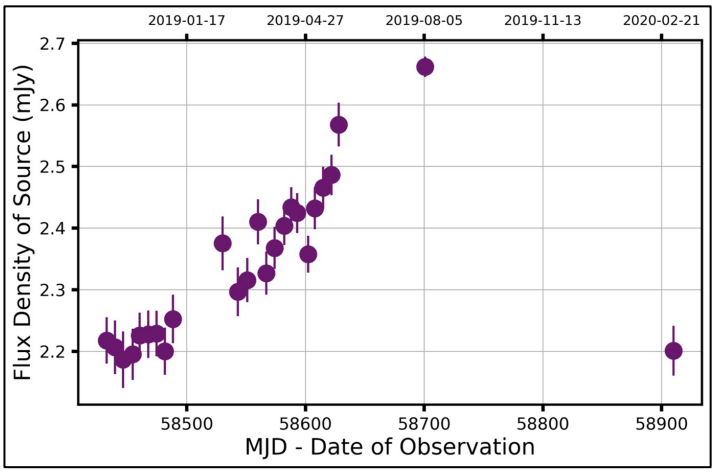
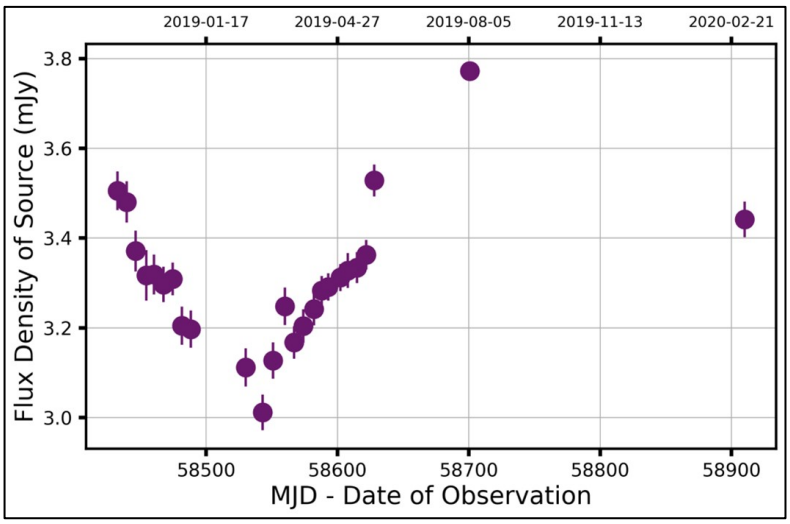


Fig 10: The light curve of a transient, a very nice gif showing the transient image can be found in the field guide



Unsure: If you have had a look at the field guide and still are not able to classify then you can select this option.

Finally, click on done and the next object to classify will appear.

HOT TIP: Focus on the object in the centre of the image as that is the object to which the light curve corresponds.

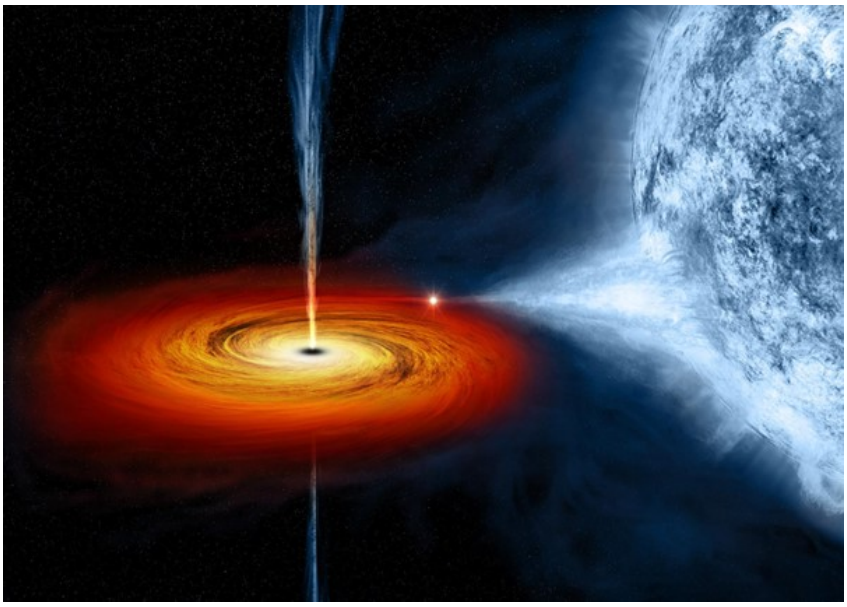


Fig 11: Artist's impression of Cygnus X-1, a binary system consisting of a black hole and stellar companion. Credits - NASA/CXC/M.Weiss

The majority of the known radio variables and transients in our sky are the result of small black holes, neutron stars & white dwarfs, which are what is leftover at the end of most stars' lives. These objects can exist in binaries (two objects in the same stellar system, usually a compact object and its partner star), where the heavier object actually feeds on matter from the smaller object via the force of gravity. The compact object might then eject long streams of particles which themselves release radiation arriving in the radio bands here on Earth.

The question can be raised as to why we can't use computers to assist in this project. The simple answer relates to the fact that humans are still better at subtle pattern recognition and nuance. For example, there are many data processing and telescopic effects that a computer may identify as an interesting astrophysical source. Humans are much better at understanding these "systematic" effects and screening them out from the really interesting astronomy.

Citizen scientists already involved in this project have identified 142 transient and variable sources that had not been seen before. The classifications volunteers submit will also be used to develop machine-learning techniques for identifying transients. More information about the results can be found at https://arxiv.org/abs/2304.14157.

Glossary of Acronyms:

- SARAO (South African Radio Astronomy Observatory): This is the organisation responsible for operating the MeerKAT Telescope.
- MeerKAT: A radio telescope array consisting of 64 dishes found in the Karoo Region of Southern Africa. "Meer" means more in the language of Afrikaans and KAT stands for Karoo Array Telescope.
- FRBs (Fast Radio Bursts): A transient radio pulse lasting a very short length of time, between fractions of a millisecond to 3 seconds.

- mJy: Millijansky (mJy) is a unit of measurement for the flux density of electromagnetic radiation, equal to one-thousandth of a jansky (Jy).
- MJD: Modified Julian Date (MJD) is a system for expressing dates and times commonly used in astronomy, obtained by subtracting 2,400,000.5 from the Julian Date (JD).
- PSF (Point Spread Function): The Point Spread Function (PSF) is a mathematical description of how a point source of light appears in an image due to the optical characteristics of a system.

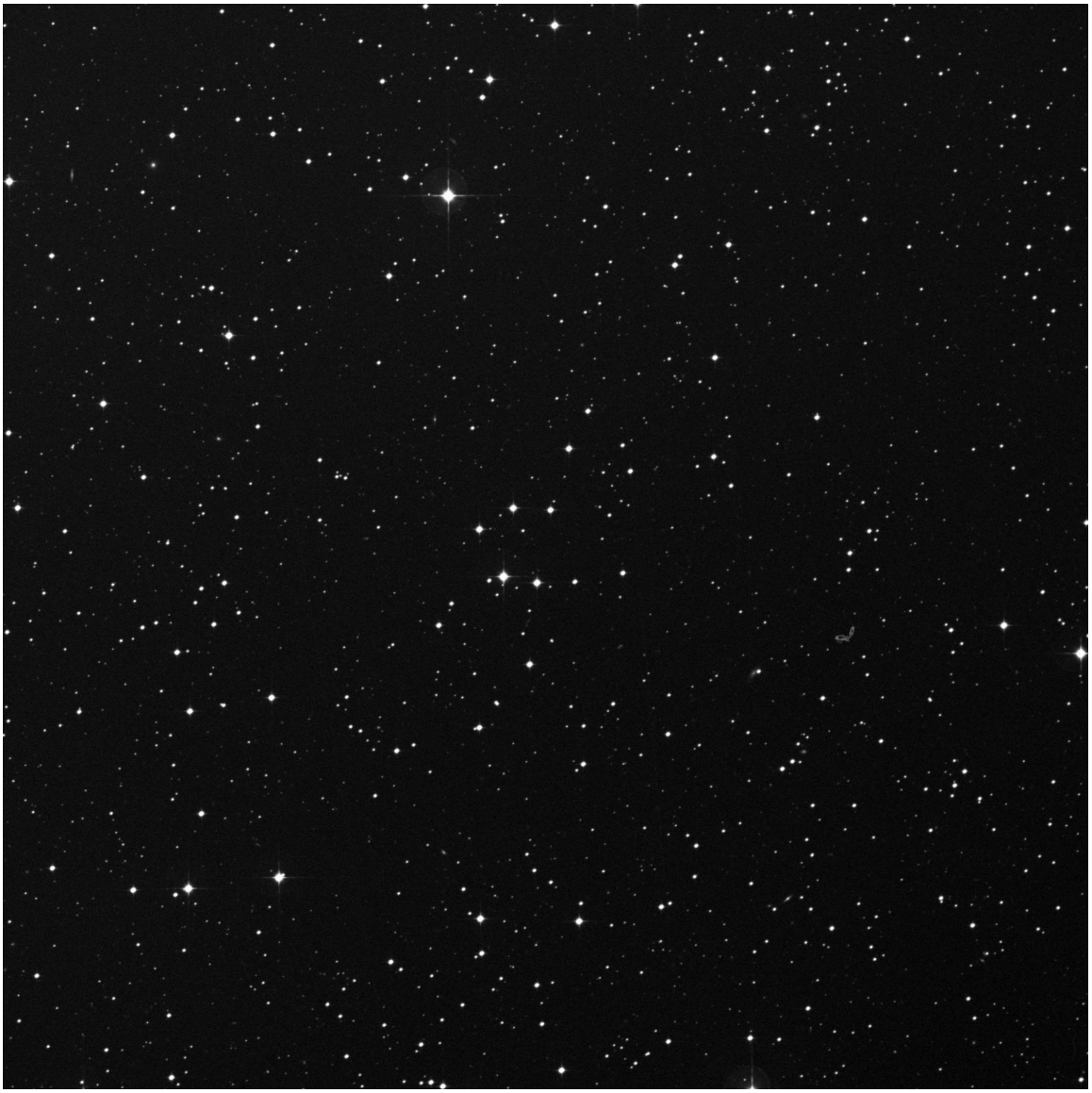
Streicher Asterisms

Magda Streicher

STREICHER – J0553-42
Columba

A relatively close horseshoe grouping of similar yellow-coloured magnitude 10 stars. Stars to the north and south gave an impression of a shaded hat in a way, lying on its side. This little hat is just a degree north-west from eta Columbae and draws the eye immediately.

OBJECT	TYPE	RA	DEC	MAG	SIZE
STREICHER DSH J0553-42	Asterism	05h53m.30	-42°26'.36	9.5	4.5'



Picture Credit: http://archive.stsci.edu/cgi-bin/ds

STREICHER – J1810-37
Corona Australis

This grouping had the looks of just a busy star field. Barely visible is a long faint scoop composition of more than a dozen faint stars in an east-west direction. Three brighter stars in a triangle is situated towards the western edge. The eastern star had a close companion clearly seen.

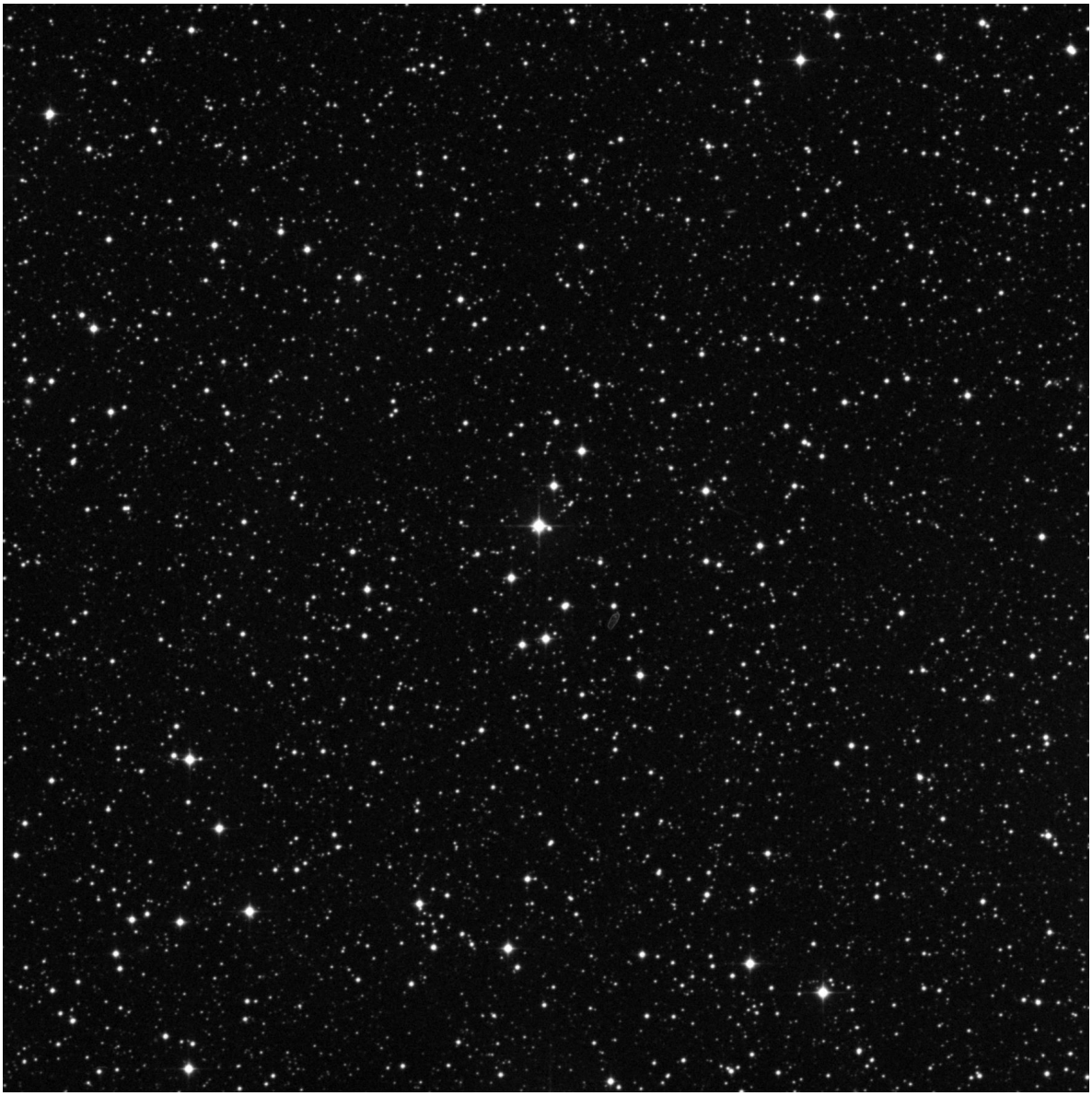
OBJECT	TYPE	RA	DEC	MAG	SIZE
STREICHER DSH J1810-37	Asterism	18h10m.56	-37°12’.11	12	9.5’

Picture Credit: http://archive.stsci.edu/cgi-bin/ds

STREICHER – J1910-40
Corona Australis

A starry spoon shape impression in a north-south direction slightly outlifted against a busy starfield. The brightest star, HD 178441 with a magnitude of 9.4, is situate in the middle area of this elongated string. Lovely yellow coloured delta Coronae Australis is only 25' further south-west.

OBJECT	TYPE	RA	DEC	MAG	SIZE
STREICHER DSH J1910-40	Asterism	19h10m.30	-40°20'.23	9.8	6'



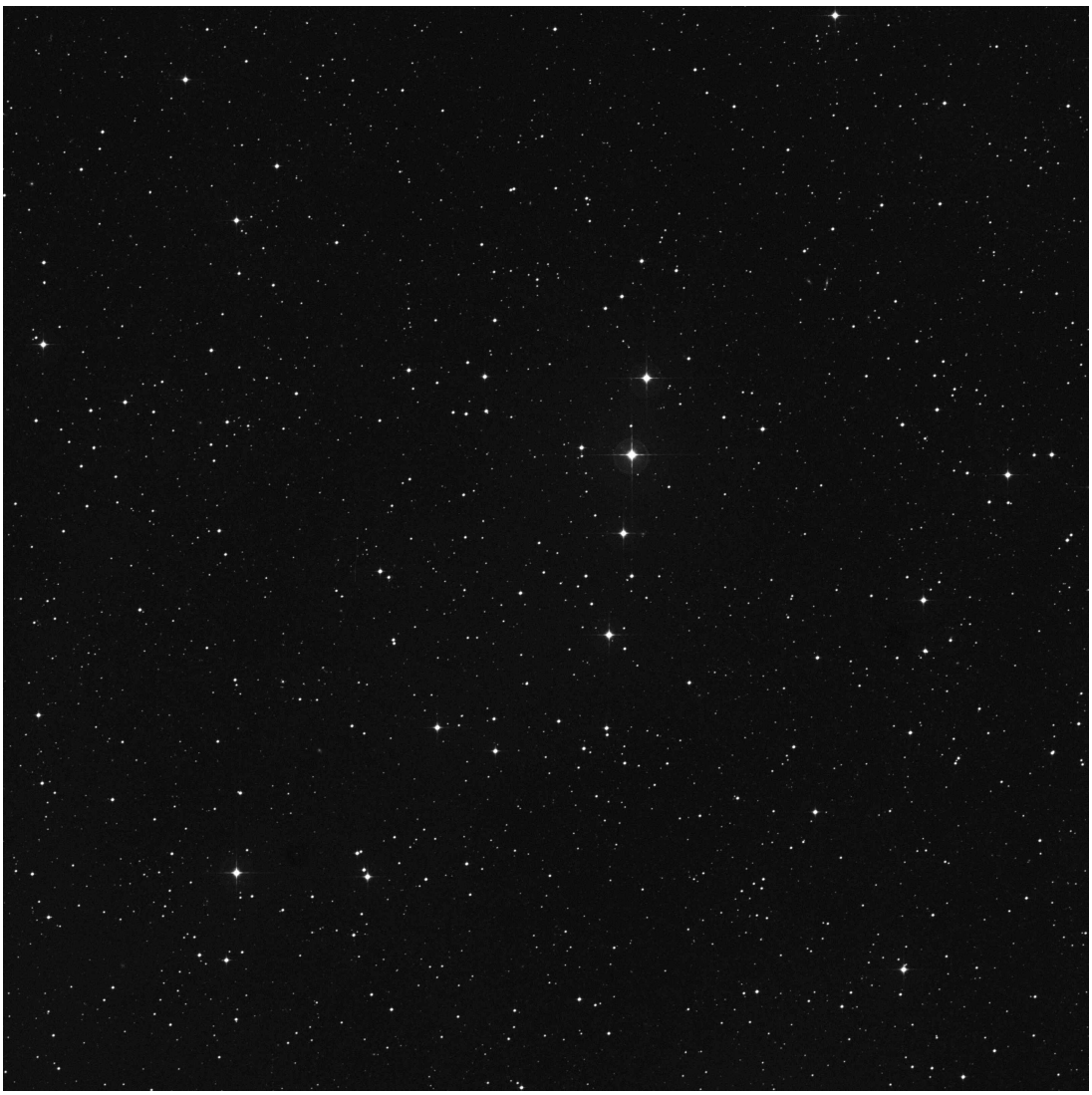
Picture Credit: http://archive.stsci.edu/cgi-bin/dss

STREICHER – J2132-58
Indus

A delightful ray of a few bright stars, quite outstanding. This lovely spacious string is situated just a degree from the galaxy's IC 5110, IC 7059 and IC 5095.

OBJECT	TYPE	RA	DEC	MAG	SIZE
STREICHER DSH J2132-58	Asterism	21h32m.34	-58°53'.42	8.8	22'

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

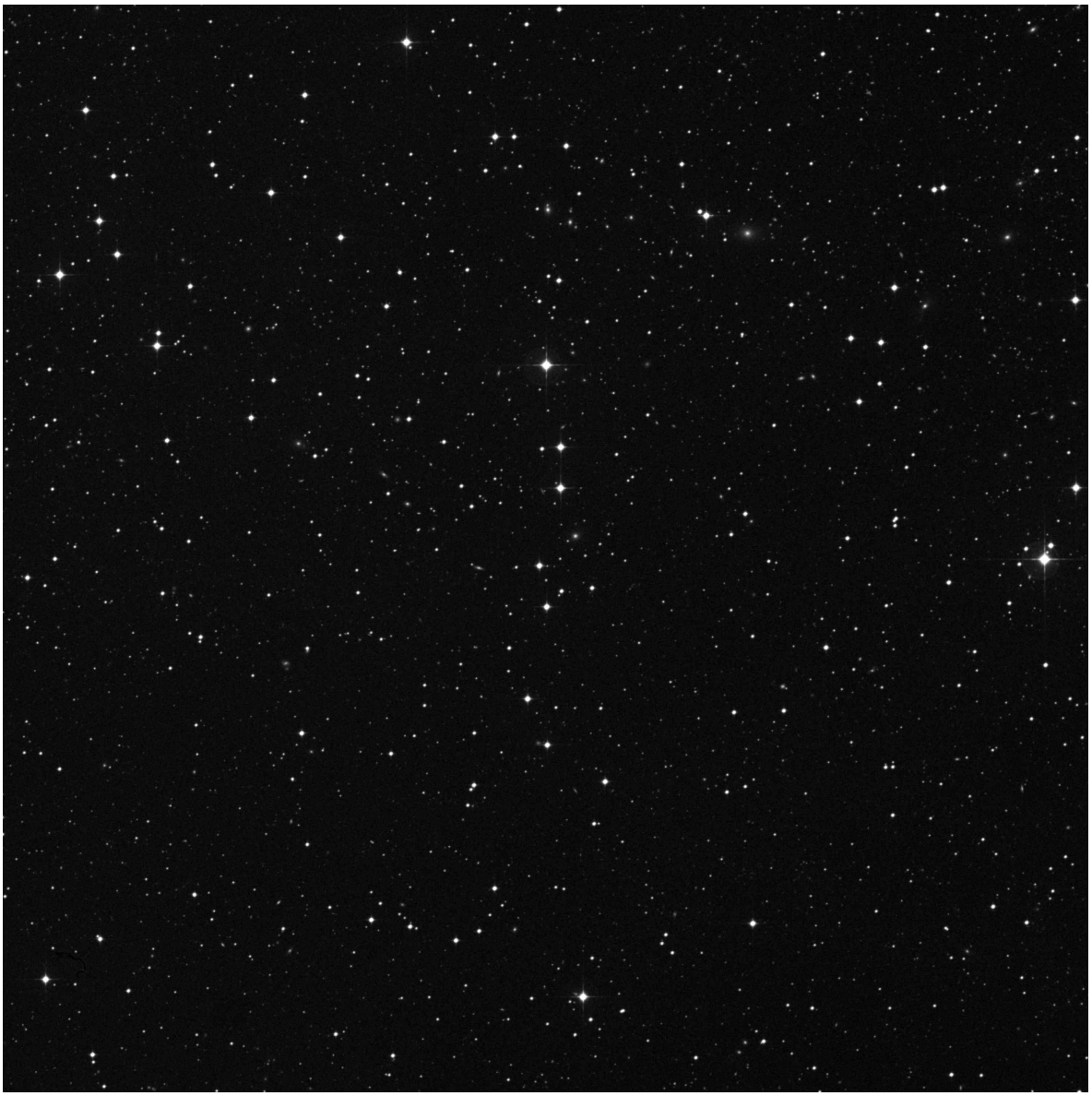


STREICHER – J2147-44
Grus

A lovely long chain of stars draped from north to south only a degree north-east of the galaxy NGC 7107. The stars all display a slight yellow to orange colour in this outstanding string. Quite amazing!

OBJECT	TYPE	RA	DEC	MAG	SIZE
STREICHER DSH J2147-44	Asterism	21h47m.44	-44°08'.42	9.5	26'

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



Colloquia

Colloquia and Seminars (now Webinars) 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 passing of CV19, these Colloquia and Seminars are returning slowly to their normal face-to-face format, but a spin-off from the pandemic is that Colloquia and Seminars are often Hybrid sessions. It has also meant that now there are Webinars on interesting topics from around the globe! The editor however still focusses very much on sessions held locally, by South African astronomers or visitors to South Africa

Title: Galaxy evolution in dense environments: a study of the cold ISM in dwarf galaxies in the Fornax cluster
Speaker: Dr Nikki Zabel UCT
Date: 13 July
Venue: SAAO Auditorium – Hybrid
Time: 11h00

Abstract: It has long been known that galaxies in dense environments differ from their counterparts in less crowded spaces. Most notably, the fraction of elliptical galaxies is significantly higher in galaxy clusters compared to the "field". This also applies to dwarf galaxies, which are abundant both in clusters and the field, and are believed to be the building blocks of more massive galaxies. Therefore, studying the formation and evolution of dwarf galaxies is essential for the study of galaxy evolution as a complete picture. While dwarf ellipticals at first glance look smooth and featureless, the recent discovery of structures such as spiral arms and nuclei has re-kindled the debate around the origin of these systems in dense environments.

Being one of the two galaxy clusters closest to us (along with Virgo, both at ~20 Mpc), the Fornax cluster is essentially the only target in the Southern hemisphere where dwarf galaxies in dense environments can be studied in detail. In this talk I will present a multi-wavelength analysis of six gas-rich dwarf galaxies in the Fornax cluster, using

the state-of-the-art telescopes ALMA, VLT/MUSE, and, of course, MeerKAT, to try and piece together their history and the environmental processes they may be experiencing.

Title: Clouds over middle-earth: using ilifu to combine the MeerKAT and the EMU for ORCs
Speaker: Dr Jordan Collier
Date: 27 July
Venue: SAAO Auditorium – Hybrid
Time: 11h00

Abstract: Combining ASKAP's EMU survey and MeerKAT enables complementary science; ASKAP's large FoV enables the discovery of new/rare types of objects, like Odd Radio Circles (ORCs), while MeerKAT's sensitivity enables deep follow up of such objects. I will speak about both instruments and how they are being used to open up new phase spaces of discovery, with a particular focus on the spectral indices and polarisation of ORCs, and my experience using these telescopes within the clouds across the continents of middle-earth!

As an essential part of this research, I will speak about a number of tools and systems that have been developed or adopted to deal with the PB scale of MeerKAT data at the Inter-University Institute for Data Intensive Astronomy (IDIA). I will present a number of these tools and underlying systems, deployed on IDIA's ilifu facility, including those for storage, processing, visualisation, and data transfers

Title: Multi-frequency dark matter searches
Speaker: Dr Geoffrey Beck, University of Witwatersrand
Date: 17 August
Venue: SAAO Auditorium – Hybrid
Time: 11h00

Abstract: The fundamental nature of dark matter is a pressing open question in modern cosmology and astrophysics. One approach to uncovering it is through the use of the consequences of dark matter particles annihilating or decaying within dense cosmic structures (so-called indirect detection). The bulk of the literature on indirect detection is focussed upon the use of gamma-ray instruments, as they are seen as a "cleaner" setting for detecting dark matter emissions, with fewer background sources and a simple dependence on the target halo density. In this work we will explore the combination of both radio and gamma-ray instruments including MeerKAT, Fermi-LAT, HESS, and the up-coming CTA. We show that radio instruments act as a powerful

compliment to gamma-ray experiments and, despite magnetic field uncertainties, even provide the strongest probes of WIMP dark matter in some mass ranges.

Title: The discovery of a rare type of spinning white dwarf star in a binary star system
Speaker: Dr Stephen Potter, SAAO
Date: 23 August
Venue: SAAO Auditorium – Hybrid
Time: 19h30

Abstract: The rare type of white dwarf "pulsar" was discovered by an international team of astronomers, including from South Africa, namely the South African Astronomical Observatory (SAAO), the University of Cape Town (UCT) and the South African Radio Astronomy Observatory (SARAO), where a number of different telescopes were used to observe this new object. Some of the researchers were also involved in the discovery of the nature of the very first such system, found only in 2016, and known as AR Scorpii. These rapidly rotating and strongly magnetic (about a billion times the Earth's magnetic field) white dwarf pulsars lash their stellar companion – a red dwarf – with powerful beams of charged particles and radiation, causing the entire system to brighten and fade dramatically over the minutes-long rotation period of the white dwarf.

Title: Pulsar Timing Arrays: A New Window on the Gravitational Wave Universe
Speaker: Prof. Maura McLaughlin from West Virginia University.
Date: 25 August
Venue – UKZN – Hybrid
Time: 15h00

Abstract: Millisecond pulsars are rapidly rotating neutron stars with phenomenal rotational stability. Pulsar timing arrays world-wide monitor over 100 of these cosmic clocks in order to search for perturbations due to gravitational waves at nanohertz frequencies. The tell-tale sign of a stochastic background of gravitational waves in pulsar timing data is the presence of quadrupolar spatial correlations. Recently, and for the first time ever, pulsar timing array collaborations have found evidence of these spatial correlations in multiple independent pulsar datasets. The signal is consistent with that expected from an ensemble of supermassive black hole binaries, but could also be attributable to more exotic sources, such as cosmic strings or early universe inflation. I will describe these experiments and the most recent results, concentrating on those from the North American NANOGrav collaboration, and will discuss the increases in sensitivity expected from the combination of data observed with new and existing telescopes across the globe.

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 Southern Africa*.
Membership: Membership of the Society is open to all. Potential members should consult the Society's web page : https://assa.saao.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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