



The South African Radio Astronomy Observatory

**Scientific discovery and innovative technology
solutions for radio astronomy**



**science, technology
& innovation**

Department:
Science, Technology and Innovation
REPUBLIC OF SOUTH AFRICA



SARAO
South African Radio
Astronomy Observatory



PONTSHO
MARUPING

SARAO MANAGING
DIRECTOR

Foreword

As South Africa welcomes the G20 Science, Technology and Innovation Ministers and the SKAO leadership to the Karoo, we do so with immense pride in our rich astronomical heritage and our vibrant, forward-looking scientific community. This visit is more than a showcase of world-class scientific infrastructure, it is a celebration of what can be achieved when nations come together in pursuit of knowledge that knows no borders.

Here, in the boundless plateaus framed by dolerite-capped mountains, the South African developed MeerKAT telescope has already redefined the boundaries of radio astronomy. It stands as a testament to the power of innovation, engineering excellence, and international collaboration. This same landscape is now home to one of humanity's most ambitious scientific endeavours, the SKA-Mid, part of the global Square Kilometre Array co-hosted by South Africa and Australia, which will transform our ability to explore the Universe.

At the South African Radio Astronomy Observatory, we embrace the mysteries of the cosmos not only to advance science and engineering, but to also spark curiosity in future generations. We want young people from the Karoo to every corner of the globe to see that science and engineering open doors to discovery, opportunity, and shared human progress. Our work goes far beyond astronomy; it inspires wonder, fuels innovation, and strengthens ties between nations.

This booklet is more than a record of facts and figures. It is a tribute to the creativity, ambition, and collaborative spirit that drive humanity to seek its place among the stars. We hope it will encourage you to join us in partnership, and in vision as together we explore the Universe and expand the horizons of human understanding.

The Karoo itself is a land of contrasts: vast yet intimate, humbling yet inspiring, quiet yet rich with meaning. Its stillness and beauty remind us of our smallness in the cosmic scale and of the limitless possibilities when we work together to reach for the stars.

Pontsho Maruping
Managing Director: SARAO

Introduction

In 2023, the South African Radio Astronomy Observatory (SARAO) celebrated 20 years of radio astronomy and engineering excellence and five years of MeerKAT operations.

SARAO is a national facility of South Africa's National Research Foundation (NRF). It is responsible for managing South Africa's strategic investments in radio astronomy, including:

- Leading South Africa's participation in the international Square Kilometre Array (SKA) project;
- Development and operation of the MeerKAT radio telescope and Karoo site;
- Operation of the Hartebeesthoek Radio Astronomy Observatory (HartRAO); and
- A Human Capital Development (HCD) programme that partners with universities and institutions to develop a diverse community of scientists, engineers and technicians in radio astronomy.

Karoo Site and the Square Kilometre Array

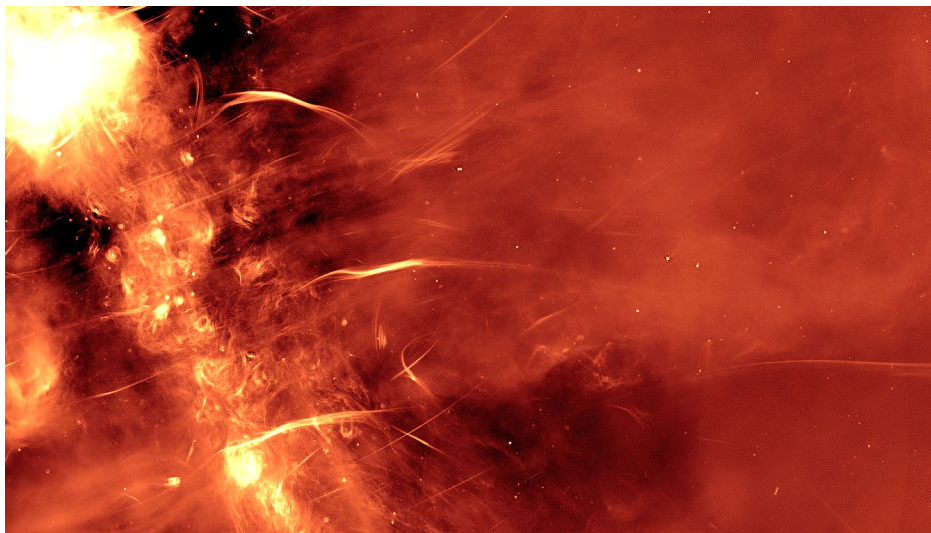
Square Kilometre Array Observatory

Establishment of the Karoo site as world-class scientific destination for the development and operation of radio astronomy facilities proved the impetus for deployment of next-generation facilities. The 130,000 hectare radio quiet zone is protected against all forms of radio frequency interference (RFI) by unique legislation - the Astronomy Geographic Advantage Act. The area is also declared as an environmentally sensitive National Park.

Major facilities to take advantage of the unique scientific characteristics of the site include MeerKAT, and the future Square Kilometre Array. As a founding member of the SKA Observatory, South Africa hosts the SKA-mid telescope currently under construction in the Karoo. South African scientists and engineers have made significant contributions to the design and development of the SKA telescope.

MeerKAT

MeerKAT was designed and built by SARAO in partnership with South African industry, and is also recognised as a scientific and technical pre-cursor to the SKA. The 64-dish MeerKAT array has exceeded all expectations as a scientific instrument. At the time of its inauguration in July 2018, it was already delivering spectacular scientific results, epitomised by the exquisite radio image of the Milky Way's galactic centre that was unveiled at the ceremony. Since the inauguration, more than 300 papers based on MeerKAT observations have been published in leading journals by astronomers from around the world.



This image produced from MeerKAT data shows our galaxy (the Milky Way) in unprecedented detail; it shows radio bubbles, the galaxy's four-million solar mass supermassive black hole, and numerous thin, magnetised radio filaments.

MeerKAT's primary scientific goals are studying radio pulsars transients and neutral hydrogen in the cosmos. The telescope's design was optimised for the requirements of these goals, but the telescope has superb capabilities for radio continuum and polarisation studies. The unique sensitivity and spatial dynamic range of the telescope have resulted in a new understanding of familiar astronomical phenomena and the discovery of the unexpected. The MeerKAT will eventually be incorporated into the SKA-mid telescope, adding significant sensitivity to the telescope.

The MHONGOOSE large survey project observes a selection of nearby galaxies, using the unprecedented sensitivity of MeerKAT to detect diffuse neutral hydrogen surrounding the galaxies. These observations are 100 times more sensitive than existing studies, and the resulting image for one of the galaxies (NGC 5068) is shown. It shows the distribution of the

neutral hydrogen gas as observed with MeerKAT overlaid on an optical image of the stars. The bright inner disk shows where stars are being formed. The faint outer disk is the diffuse gas that is falling into the galaxy and fuelling the star formation - the first time this process has been directly observed.



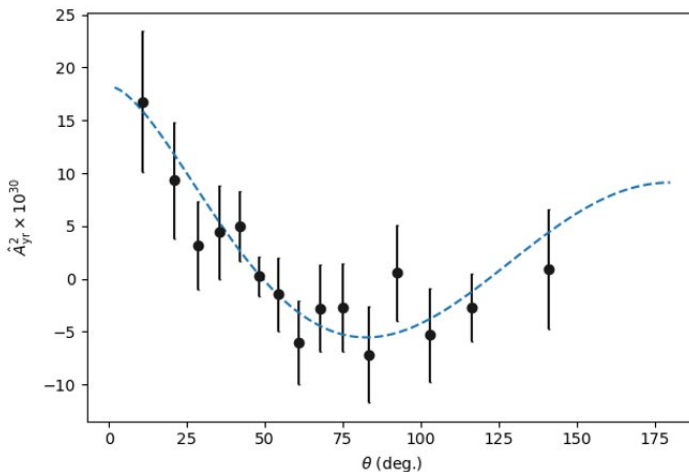
Composite image of the galaxy NGC 5068, with the MeerKAT detection of neutral hydrogen gas shown in red, overlaid on an optical image

SARAO has a strong track record of successful collaboration with international partners. MeerKAT, for example, has attracted co-investment from the international community in the form of user-supplied equipment (USE), indicating the status that the new telescope and SARAO have achieved. This USE harnesses the sensitivity and flexibility of MeerKAT and adds scientific capabilities to the telescope. Institutions from the UK, Germany, and Australia have provided equipment, resulting in MeerKAT becoming the premier radio telescope for radio pulsar studies. The MeerKAT Pulsar Timing Array, leveraging the exquisite sensitivity and cutting-edge technology of MeerKAT, has been monitoring the largest sample of pulsars to the highest precision of any existing array. Preliminary MeerKAT searches show compelling evidence for spatial correlations consistent with gravitational waves.



The 64-dish MeerKAT array has exceeded all expectations as a scientific instrument. At the time of its inauguration in July 2018, it was already delivering spectacular scientific results, epitomised by the exquisite radio image of the Milky Way's galactic centre that was unveiled at the ceremony."

Angular correlations of MeerKAT Pulsar Timing Array data.

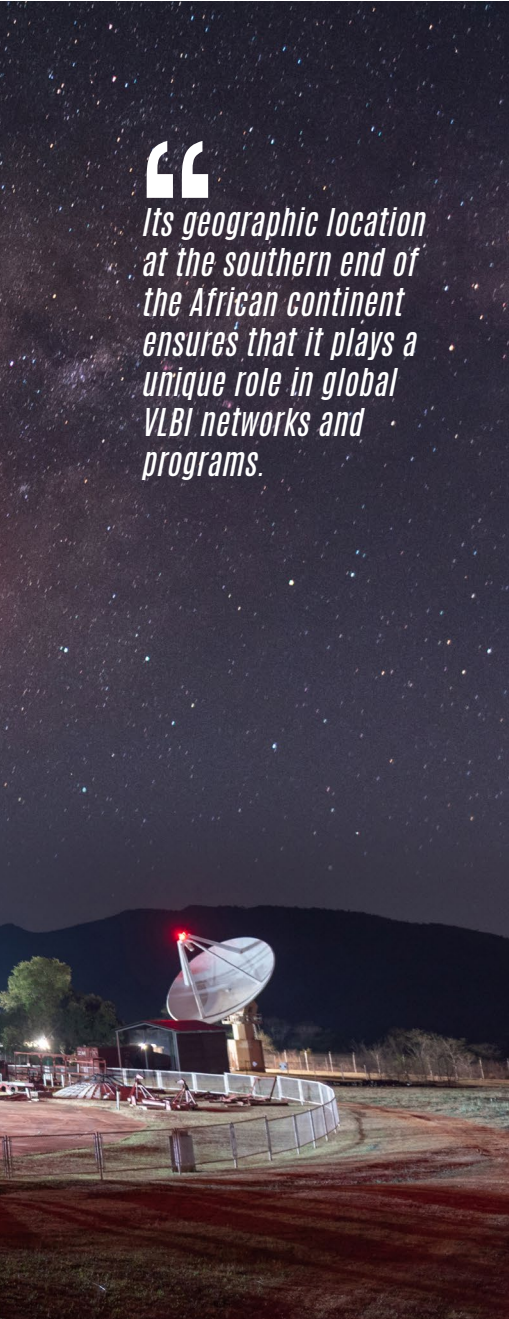


The blue curve shows the expected signature from a stochastic gravitational wave background.

USE from the UK, Germany and the USA has utilised the sensitivity of MeerKAT to search for transient events in the radio universe, in the form of astrophysical phenomena and signals from other civilisations (SETI). The S-band receivers on MeerKAT were provided by the Max

Planck Institute for Radio Astronomy (Germany). Currently, the MeerKAT extension project, a collaboration with Germany and Italy, is adding 15 antennas to the array, significantly increasing the sensitivity and resolution of the telescope.





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Its geographic location at the southern end of the African continent ensures that it plays a unique role in global VLBI networks and programs.

HartRAO and Very Long Baseline Interferometry (VLBI)

SARAO's Hartebeesthoek Radio Astronomy Observatory (HartRAO) has a long history in astronomic, astrometric and geodetic VLBI observations and associated studies. Its geographic location at the southern end of the African continent ensures that it plays a unique role in global VLBI networks and programs.

HartRAO is a fundamental geodetic and astrometric station, using the collocation of radio telescopes, GNSS reference receivers, satellite laser rangiers and other instruments to provide critical inputs into the International Celestial Reference Frame (ICRF) and Global Geodetic Reference Frame (GGRF). A 12m VGOS station is currently being commissioned at HartRAO, adding to the existing 26-m and 15-m telescopes. A new geodetic site is being established near Matjiesfontein in the Western Cape province. This will be collocated with a NASA LEGS facility being established in collaboration with the South African National Space Agency (SANSA). SARAO has established a VLBI program that will drive future developments in VLBI capabilities and instrumentation.

Guest Instruments: HERA and the Epoch of Reionisation

The Karoo site hosts a range of guest instruments, in addition to MeerKAT and the SKA. These instruments are deployed, commissioned and operated in collaboration with SARAo and include the Hydrogen Epoch of Reionisation Array (HERA), which is a multinational experiment to detect and characterise the early Universe when the first stars and galaxies reionised the intergalactic medium. In 2022, HERA completed construction on its 350 14-m antennas and, in 2023, published world-leading new limits on the 21-cm power spectrum, the primary astrophysical observable for the experiment. Other guest instruments include C-BASS, REACH and the planned HIRAX telescopes.

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Engineering

Engineering and technology development is a key pillar in SARAO's vision to provide technical and scientific solutions to astronomy and associated disciplines. With close to 1,000 person-years of astronomy engineering experience gained through the design and construction of MeerKAT, SARAO, in collaboration with local universities and industry, has significant participation in external projects such as SKA Mid, the ngVLA, the SALT optical telescope upgrade and guest instruments. SARAO is committed to the development of radio astronomy infrastructure and capacity on the African continent, specifically through its VLBI program.

This expertise is not limited to astronomy: SARAO was called upon to manage the National Ventilator Project - South Africa's strategic response to the COVID-19 pandemic, during which 20,000 CPAP ventilators were designed, manufactured and deployed.

The engineering competencies that SARAO has developed through the MeerKAT project and its long-term operation of HartRAO cover all technologies and techniques associated with modern radio telescopes and allied instruments. Local industry and universities provide specialist support to SARAO through contracts, collaboration agreements, and the Human Capital Development program. These competencies are summarised below.

Systems engineering

A systems engineering philosophy and methodology underpins all aspects of engineering projects undertaken by SARAO. SARAO introduced the advantages of applying this methodology to large projects to the radio astronomy community, and the success of the MeerKAT project in delivering a product on schedule, on budget and above specification has ensured that this approach has been adopted by other large astronomy projects, including the SKA and ngVLA. Through staff transfers and collaboration agreements, SARAO systems engineers are playing a vital role in the SKA project.

Antenna Optics and Receivers

In line with its systems engineering approach, SARAO treats radio telescope receptors as a system that includes all aspects of the signal paths, from sky to digital signal. In conjunction with EMSS Antennas, the MeerKAT reflector optics and feeds were designed as a combined system to ensure optimal performance in terms of sensitivity and primary beam characteristics. This experience was refined and applied to the SKA-mid receptors by the same team. The MeerKAT cryogenic receivers represent the pinnacle of high-performance, broadband single-pixel receptors, again designed with a systems engineering approach that focused on the critical requirements derived from the science objectives.

Digitisation

One of SARA0's innovative engineering achievements for MeerKAT was the direct digitisation of radio frequency signals at the output of the feed/receiver subsystem - a significant departure from the traditional heterodyne systems employed on most existing radio telescopes. The design and manufacture of the MeerKAT digitizers overcame a range of engineering challenges to deliver a product that archives the scientific requirements of dynamic range, gain and phase stability, timing precision and electromagnetic interference (EMI) suppression. SARA0 has completed a licence agreement with Wideband Receiver Solutions,

which resulted in the commercialisation of the MeerKAT digitiser and other associated receiver technology ready for deployment within the defence, telecommunication and space sectors. SARA0 is currently developing next-generation, high-bandwidth digitiser technologies for astronomy and broader applications.



Back view of a vacuum pump and a digitiser.



A receiver on a MeerKAT antenna.

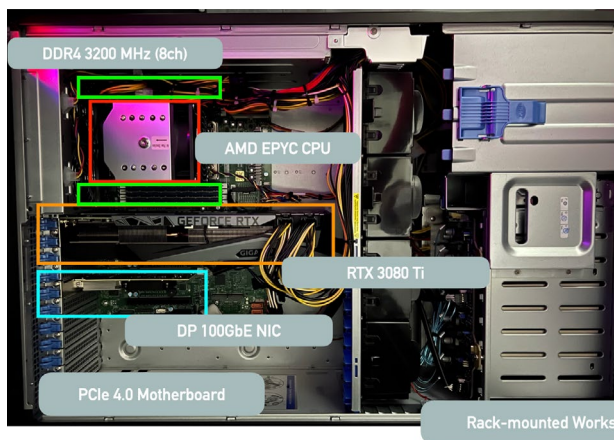


Image of the GPU-based processing nodes that are being used for the MK+ CBF.

Digital signal processing

The MeerKAT correlator is based on the CASPER architecture that uses a combination of commodity and bespoke components to provide the required functionality for the central digital signal processor (or correlator/beamformer). SARA0 has played a leading role in the international CASPER collaboration, providing hardware, firmware and software solutions. The processing elements in the current MeerKAT correlator are field programmable gate arrays (FPGAs), the technology that was most appropriate at the time of the design. A new correlator is currently under development for the MeerKAT extension project that is based on graphical processing units (GPUs), illustrating SARA0's agile approach to tracking appropriate technology solutions.

Software

The software group plays an indispensable role in ensuring the smooth operation of the MeerKAT telescope, and they contribute to SKAO software development through the provision of developer teams in the SAFE environment. They have expertise in all aspects of telescope operation, from proposal management and UI/UX to implementing dynamic schedulers and low-level communication protocols. Their proficiency in Data Storage Solutions has been crucial for efficiently managing the vast amounts of data generated by MeerKAT, ensuring secure storage and facilitating easy access to archived data for future analysis and comparison.

Mechanical

The mechanical team is responsible for the design and implementation of mechanical and mechatronic systems related to radio telescopes and associated instrumentation. The team has a broad range of competencies, including CAD and product data management, Structural Analysis (FEA, Static, dynamic, fatigue), Computational Fluid Analysis (CFD) and Thermal Analysis. The services provided by the team include product development, the generation of

configured production data packs, qualification testing, quality investigation and service failure investigations (root-cause analysis). They have specialist experience in the requirements of radio astronomy, including mechanical design for EMI performance.

Science Data Processing (SDP)

Through various mechanisms, SARAO manages collaborations with partner institutions to produce data processing pipelines and develop new algorithms and tools for radio astronomy science data processing, specifically interferometric calibration and imaging. Participants in these collaborations include the internal SDP and Radio Astronomy Research Group (RARG), local university research groups (through the HCD program) and other radio observatories and institutions. These collaborations have added significant scientific value to MeerKAT and other telescopes, providing high-quality imaging data products by applying cutting-edge calibration and imaging techniques.

Radio Frequency Interference (RFI)

The SARAO RFI team ensures the continued protection of radio astronomy assets from radio frequency interference. The key areas of expertise are the design of EMI-compliant devices, RFI compliance testing and qualification of telescope components, the design, deployment and operation of RFI monitoring infrastructures, the management of RFI at telescope sites, and spectrum management. The RFI team interacts closely with other engineering teams where domain knowledge transfer is required. The team are playing a critical role in the SKA-mid project, particularly in the RFI qualification of the dish structure and management of the RFI consequences of on-site construction activities.

SARAO, working with national administrations and other key international stakeholders within the global radio astronomy community, drove the development of a successful African Telecommunications Union proposal to consider the impact of mega-constellations on astronomy at the International Telecommunications Union World Radio Conference in 2027.

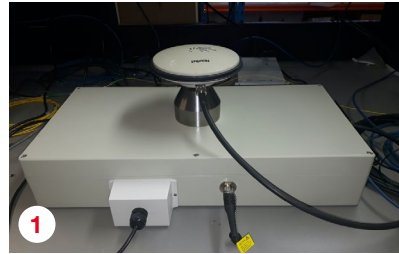
Passive radar system.



Beyond Astronomy

Through the delivery of astronomy-based projects and facilities, SARAQ has developed cutting-edge technologies and competencies that have broader applications across markets such as the telecommunications, space, medical, and defence sectors. To maximise opportunities for realising technology transfer, SARAQ implements an innovation and commercialisation value chain to identify, develop and transfer high-tech SARAQ products and skills — through internal development, licensing and joint development with industry — to potential external markets. This internal function is supported by a range of funding instruments to support innovation across the organisation. Physical products that have been delivered through this process include a wideband digitiser, GNSS time transfer system and a passive radar system.

Through a joint venture with Tsolo Storage Systems, know-how from the development of the MeerKAT data processing and storage systems has been harnessed to develop novel, low-cost, high-performance computing and data storage systems for commercial and government sector applications. These include CEPH-based storage solutions (including hardware and application layer software), energy-efficient and ruggedised microservers and robotic tape storage archives (including software and hardware).



1. GNSS time transfer system

2. Tsolo data storage

3 Tsolo Storage Systems



The DigiSkills Africa short course in digital transformation applied to the life sciences industry is offered to South African and African graduates.

Radio Astronomy University Research

When South Africa submitted its expression of interest to host the SKA back in 2003, radio astronomy research was limited to the then Hartebeesthoek Radio Astronomy Observatory and a small number of universities, involving a very small number of faculty with limited postgraduate supervisory capacity. To address these various limitations, SARAO initiated a

human capacity development programme (HCD) to broaden the participation by South African (and African) universities in radio astronomy and to increase the number of faculty who could provide the necessary postgraduate supervision in scientific and engineering topics that are fundamental to participation in the SKA.



“The SARAO HCD programme has been pivotal in helping us to build radio astronomy scientific and engineering capacities for the MeerKAT and SKA projects, and it continues to develop a pipeline of young professionals that would be needed to grow the African astronomy community.”

Takalani Nemaungani

Chief Director: Astronomy, Department of Science and Innovation

Research capacity and development

The culmination of SARA0's research capacity development efforts has been the creation of internationally recognised university research centres, which have constituted a large cohort of university faculty and students who are making significant advances in radio astronomy research.

University of Pretoria – Department of Electrical, Electronic and Computer Engineering

The University of Pretoria established Multifractal Semiconductors (Pty) Ltd - www.multifractalsemi.com – a company based on microelectronics research work of engineering postgraduate students.

The pioneering work in low-cost water vapour radiometry, also by the University of Pretoria students, is currently deployed on Mt Gamsberg in Namibia for the proposed African Millimetre Telescope as part of the next-generation Event Horizon Telescope's meteorological and RFI site characterisation.



RFI testing at a candidate AMT site in Namibia.

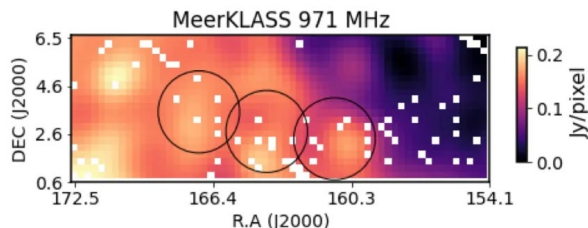
Student research on low-cost solutions for receiver components is contributing to the K-band observations at the Tulancingo Telescope in Mexico, the expansion of the Korean VLBI network, as well as the preliminary design studies for the Atacama Large Aperture Submillimetre Telescope.



PhD student programming an FPGA Spectrometer for the K-band receiver, Tulancingo, México.



University of the Western Cape's Centre for Radio Cosmology is leading the effort on the world stage, developing algorithms and software capable of tackling the vast data volumes produced by MeerKAT (and SKA) and ultimately providing exquisite cosmological constraints.



MeerKLASS, a cosmology survey by the university's radio cosmology centre, is paving the way for the development of expertise that is readily transferable to other experiments worldwide.

"SARAO HCD has been instrumental in the development of my research group. After only ten years, the impact of the group is obvious, with many South African and African students graduating every year. These graduates are the next generation of radio astronomers across Africa and the prime users of the amazing radio astronomy facilities being built in South Africa."

Prof. Mario Santos

Research Chair, University of the Western Cape,
Centre for Radio Cosmology

"The SARAO HCD programme is, in my experience, by far the most impressive project for training and supporting previously disadvantaged students. It is truly world-leading. SARAO HCD has been, and remains, critical for the success of South Africa's building of MeerKAT - and of a local community that can do science with MeerKAT and the SKA."

Prof. Roy Maartens

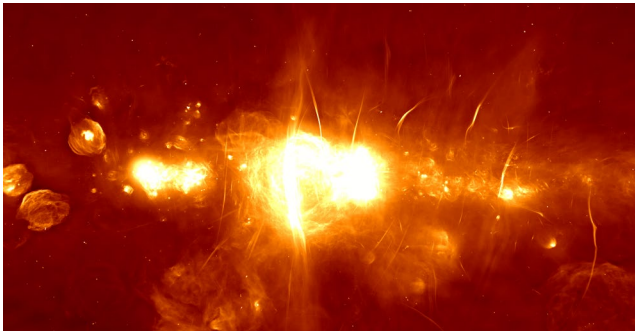
SARAO/SKA Research Chair, University of the
Western Cape

**Rhodes University – Centre for Radio Astronomy Techniques and Technologies
& University of the Witwatersrand – Centre of Astrophysics**

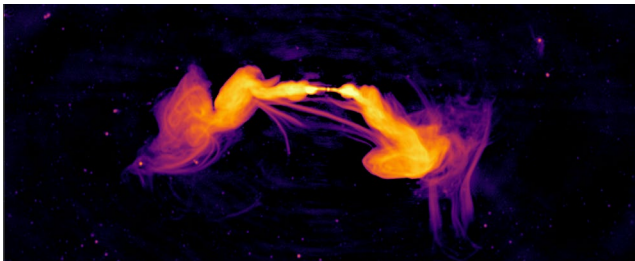
In partnership with the SARAQ, Rhodes University and the Witwatersrand have produced some of the most widely used algorithms and software tools for radio interferometry data synthesis, imaging, calibration and compression. These tools are behind some of the most spectacular MeerKAT images published to date and are also widely used in the worldwide radio astronomy

community with other current and future radio telescopes (VLA, LOFAR, uGMRT, SKA, DSA-2000). The development of some of these tools has formed the basis of SARAQ-funded postdoctoral and postgraduate research: the CARACal pipeline, CubiCal, Codex-Africanus and Dask-MS libraries, and Ragavi (MSc project) and shadeMS

In just over a decade, this work has placed SARAQ, and South African radio astronomy in general, at the very forefront of innovation in radio astronomy algorithms and software development.



MeerKAT image of the Galactic Centre was calibrated using the CubiCal package.



MeerKAT image of collimated synchrotron threads was primarily processed using the WITYS/RU software tools.

“Over 12 years, the SARAQ capacity development programme has enabled Rhodes University to build the world’s best technical radio astronomy group from ground zero. No other country in the world is fortunate to have anything near this program. It hasn’t just put South Africa on the map - it’s taken over the map!”



- Prof. Oleg Smirnov,
SARAQ/SKA Research Chair, Rhodes University

Stellenbosch University - Department of Electrical and Electronic Engineering

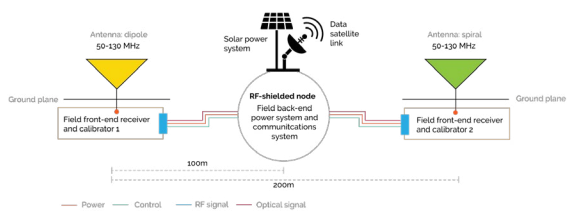
In partnership with industry, the SARAQ-funded Research Chair at Stellenbosch University designed the MeerKAT and SKA antennas and, using the acquired expertise, went on to produce

the award-winning design for the 18-m, offset Gregorian antenna for use in the 244 antennas that will make up the ngVLA.



Artist's impression of the ngVLA antennas.

Postdoctoral and postgraduate research contributed to the antenna design and site infrastructure development and deployment for the REACH Telescope.

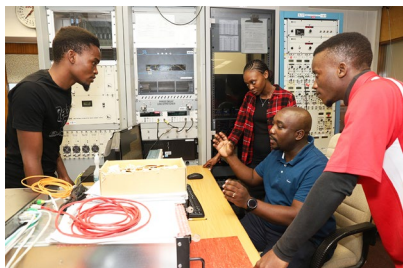


“The SARAQ HCD programme has had an enormous positive impact on Astronomy in South Africa. Not only has it driven a huge increase in the number of South African students trained in radio astronomy, but it has also led to a sharp increase in the quality of radio astronomy research produced in South Africa through funding a thriving postdoctoral programme and supporting staff positions at universities across the country.”



Professor Sarah Blyth,
Head of Department: Astronomy, University of Cape Town

Development in Africa with Radio Astronomy (DARA)



DARA provides radio astronomy training in the 8 SKA Africa partner countries. DARA is funded by the UK government (under the Newton Fund) with matched funds provided by the South African Department of Science and Innovation. SARAO is the main delivery partner.



DARA Big Data project

SARAO partnered with DARA Big Data initiative to increase Africa's research and skills base in data-driven science and associated technologies needed for handling extremely large data sets. Big Data Africa Schools introduce students to the fundamentals of data science and machine learning through exposure to various tools and techniques that can be used to work efficiently on large data sets.

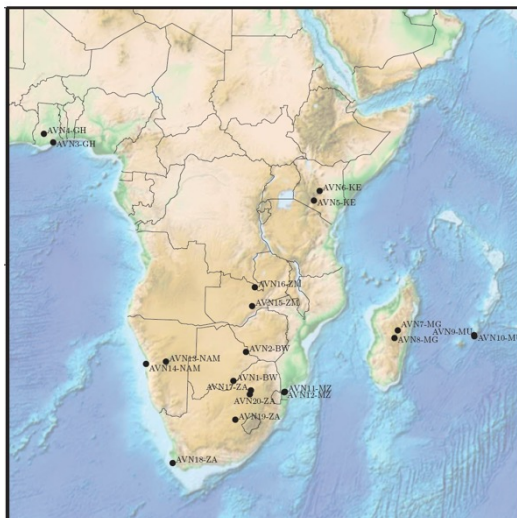
RESEARCH CAPACITY AND DEVELOPMENT

Institutions

University of Pretoria – Astronomy Group, Department of Physics

The astronomy group at the University of Pretoria is a focal point for Very Long Baseline Interferometry on the African continent. It is fast developing new and advanced methods for studying the Universe at the highest angular resolution. It aims to create new and binding collaborations that will soon realise scientific and societal impact with the African VLBI Network.

The main research goals are to test models for dark matter, better understand galaxy formation and trace black hole growth across cosmic time.



University of KwaZulu-Natal - The Hydrogen Intensity and Real-time Analysis eXperiment (HIRAX)

The Hydrogen Intensity and Real-time Analysis eXperiment (HIRAX) is a 128-dish array that will map a large part of the southern sky in radio continuum and neutral hydrogen line emission over a frequency range of 400 to 800 MHz.

It is a partnership between the University of KwaZulu-Natal, Durban University of Technology,

AIMS, Rhodes University, SARAQ, University of the Western Cape, Nelson Mandela University, as well as many international universities.

It will produce large volumes of data and will work closely with industry to develop innovative solutions in Big Data processing that can directly impact other economic sectors.



University of KwaZulu-Natal Research Team.



HIRAX dish assembly by Dr. Kabelo Kesebonye.

The Institute for Data Intensive Astronomy (IDIA)



Dr Charissa Button (under the supervision of Prof. Roger Deane, right) was the University of Pretoria's first PhD graduate in Astrophysics. During her PhD research, she used IDIA infrastructure and MeerKAT data to study how gravitational lensing can be used to probe the more distant universe.

It is a collaboration between the University of Cape Town, The University of the Western Cape and the University of Pretoria, in partnership with SARAQ, and partly funded by the Department of Science and Innovation. IDIA established and supports the ilifu cloud, which provides a dynamic platform for processing and analysing MeerKAT data, and that of other SKA pathfinders. Ilifu is the first research cloud facility of its kind in South Africa and is currently used by more than 500 South African and international researchers.

The Transient Array Radio Telescope (TART)

Rhodes University, SARA0, University of Otago, and DARA



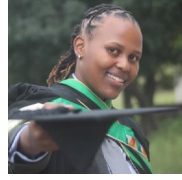
TART deployed at the Université des Mascareignes, Bel Air Campus in Mauritius.

TART is a low-cost, open-source telescope design which boasts all the functional components of a fully-fledged radio interferometer, including a 24-antenna correlator, making it a unique educational and outreach instrument.

SARA0 is now funding the deployment of TARTs to university campuses across African countries. The first of these was successfully deployed in April 2024 at the Bel Air campus of the Université des Mascareignes (Mauritius).



TART volunteers Keshav Sewraj, Max Scheel, Oleg Smirnov, Nadeem Oozeer during assembly of the TART array at the workshop. Image courtesy of Oleg Smirnov, licensed under CC BY 4.0.

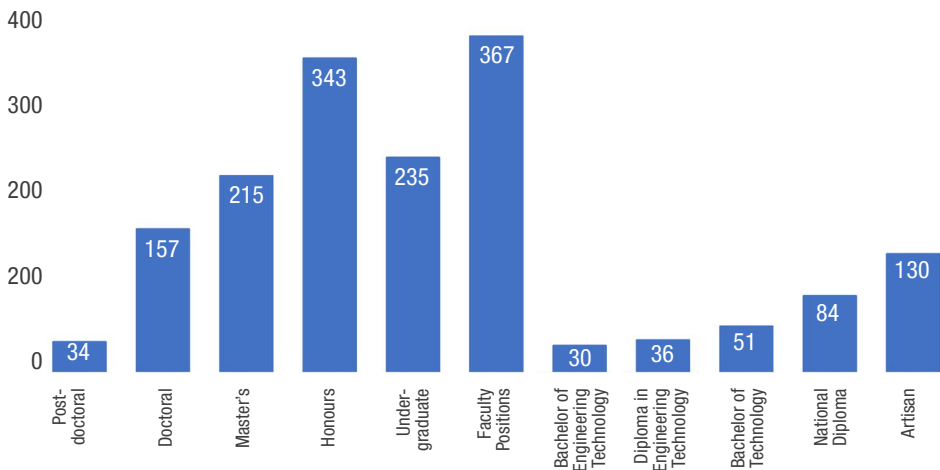


Creating a workforce for radio astronomy facilities in Africa

The core functions of SARAO's Human Capital Development Programme are to provide a platform that facilitates the training of the human capital required to design, build, commission and operate world-class radio telescopes that have been constructed in South Africa and the broader African continent and catalyses the growth and sustainability of a cohort of scientists in African institutions that are equipped to derive significant scientific knowledge from these telescopes. The scope of disciplines encompassed by the programme is necessarily broad to match the requirements of radio telescopes and the scientific programmes associated with them. The programme also

needs to extend across a wide range of academic levels to provide a pipeline that facilitates the progress of individuals from school, through higher education, to world-class scientists and engineers and to provide an appropriately skilled workforce for the functioning of radio astronomy facilities.

Since the start of the capacity development initiative in 2005, more than 1600 grants have been awarded to undergraduate and postgraduate students, early-career researchers and high-level faculty positions, as well as to students studying towards technical and artisanal qualifications.





Impact on the Karoo Communities

1. Cultural Preservation and Social Investment

Swartkop Multipurpose Community Centre

A space for various community services - an early childhood development centre, community library, and a soup kitchen.





IMPACT



Community Development Grants

Funding for broader socio-economic development initiatives.

Indigenous medicinal plant studies



Medicinal and edible plants of Bushmanland gives a review of more than 60 important plant species that are traditionally used in southern Bushmanland for medicine, food and other purposes.



Annual Riel Dance Festival

Preservation of local cultural heritage

2. Development of Business Enterprise and Entrepreneurial Skills



Astro-Tourism

Training Astro-Guides as part of the National Astro-Tourism Strategy for South Africa.



Karoo Innovation Challenge

A competition to foster innovation and entrepreneurship, in collaboration with the National Youth Development Agency and the Small Enterprise Development Agency.

Siyafunda Community Technology Centre

Access to ICT training and services.





Wi-Fi

Installation of Wi-Fi in libraries.

3. Education and Skills Development



Development of local business enterprise and entrepreneurial skills

Training on procurement opportunities to enable small businesses to access and be successful in procurement opportunities during long-term operations of radio astronomy facilities.

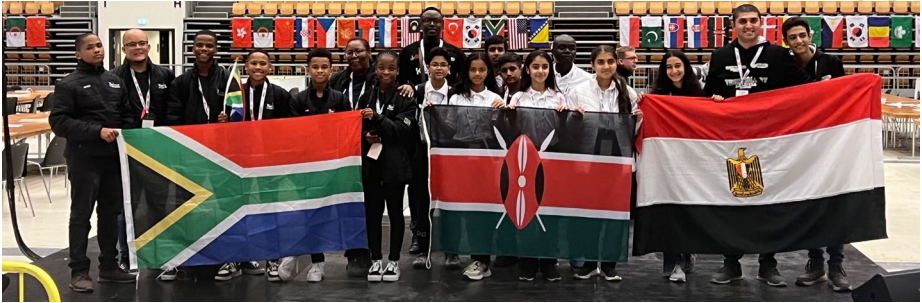
Mathematics and Science Teaching and Learning



The maths and science teaching and learning programme at Carnarvon schools include:

- Bursary programme for Grade 8 to 12 learners
- Secondment of qualified and experienced mathematics and science educators
- Summer/winter revision schools
- Wi-Fi connectivity and other ICT infrastructure, including a Cyberlab
- Lego robotics programme
- Undergraduate scholarships to study at local universities

Robotics



Carnarvon High School robotics team, Toxic Legos, participated in the FIRST LEGO League International Open Competition in Marrakesh in May 2023.

Artisan Training Programmes

Support for youth to train as Artisans to increase employment opportunities



Training centre with electrical training panels, all of which were built by students.

Organogram



SARA0
Managing Director
Ms Pontsho Maruping



Strategy & Partnerships
Deputy Managing Director
Dr Adrian Tiplady



Human Resources
Head
Mr Barney Msiza



Science
Chief Scientist
Dr Fernando Camilo



**Finance & Supply
Chain Management**
Head
Mr Shawn Basson



**Engineering &
Technology Development**
Head
Ms Keitumetse Molamu



Operations
Head
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