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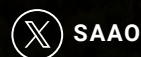
**ANNUAL
REVIEW**



NRF
National Research
Foundation

SAAO

South African
Astronomical Observatory



SAAO



SALTSAAO



SAAONEWS



SAAO_ASTRO



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ACRONYMS/ABBREVIATIONS

O *3D* – Three Dimensional

A *AAVSO* – American Association of Variable Star Observers

ADASS – Astronomical Data Analysis Software and Systems Conference

AERAP – African-European Radio Astronomy Platform

AfAS – African Astronomical Society

AGN – Active Galactic Nucleus

ALMA – Atacama Large Millimeter/ sub-millimeter Array

APA – African Planetarium Association

APASS – The AAVSO Photometric All-Sky Survey

ASSAP – African Science Stars Awareness Publication

ATLAS – Asteroid Terrestrial-Impact Last Alert System

B *BCG* – Brightest Cluster Galaxies

BiSON – Birmingham Solar Oscillations Network

BITDN – BRICS Intelligent Telescope and Data Network

BRICS – Brazil-Russia-India-China-South Africa

C *CAD* – Computer-Aided Design

CCD – Charge-Coupled Device

CEO – Chief Executive Officer

CERN – European Council for Nuclear Research

CMOS/sCMOS (scientific) – Complementary Metal Oxide Semiconductors

CNC – Computer Numerically Controlled

CSIR – Council for Scientific and Industrial Research

D *DSI* – Department of Science and Innovation

E *EDM* – Electrical Discharge Machining

ESO – European Southern Observatory

F *FRD* – Foundation for Research Development, later NRF

G *GA* – General Assembly

H *HESS* – High Energy Stereoscopic System

HMI – Human Machine Interface

HRS – High-Resolution Spectrograph

HST – Hubble Space Telescope

HWU – Heriot-Watt University

I *IAU* – International Astronomical Union

IDSAC – IUCAA Digital Sampler Array Controller

IFU – Integral-Field Units

INAF – National Institute for Astrophysics, Italy

IO/AIO – (African) Intelligent Observatory

IRSF – InfraRed Survey Facility

IT – Information Technology

IUCAA – Inter-University Centre for Astronomy and Astrophysics

J *JWST* – James Webb Space Telescope

K *KELT-South* – Kilodegree Extremely Little Telescope

KMTNet – Korea Microlensing Telescope Network

L *LADUMA* – Looking At the Distant Universe with the MeerKAT Array

LCO – Las Cumbres Observatory

LFC – Laser Frequency Comb

LIRGs – Luminous Infrared Galaxies

LJMU – Liverpool John Moores University

LMC – Large Magellanic Cloud

LSST – Legacy Survey of Space and Time

M *MASTER* – Mobile Astronomical System of the Telescope-Robots Network

MaxE – Maximum Efficiency Spectrograph

MeerKAT – Karoo Array Telescope

MIT – Massachusetts Institute of Technology

MNRAS – Monthly Notices of the Royal Astronomical Society

MONET – MOnitoring NEtwork of Telescopes

MPE – Max Planck Institute for Extraterrestrial Physics

MSc – Masters of Science

MSU – Michigan State University

N *NAOJ* – National Astronomical Observatory of Japan
NASA – National Aeronautics and Space Administration
NASSP – National Astrophysics and Space Science Program
NEO – Near-Earth Objects
NGC – New General Catalog
NGTS – Next-Generation Transit Survey
NIR – Near-Infrared
NRF – National Research Foundation
NSTF – National Science and Technology Forum

O *OAD* – Office of Astronomy for Development
OGLE – Optical Gravitational Lensing Experiment

P *PAC* – Postgraduate Advisory Committee
PhD – Doctor of Philosophy
PI – Principal Investigator
PRIME – PRime focus Infrared Microlensing Experiment

Q *QE* – Quantum Efficiency

R *ROS* – Remote Observing Station
RSS – Robert Stobie Spectrograph

S *NRF-SAAO* – South African Astronomical Observatory
SAASTA – South Africa Agency for Science and Technology Advancement
SALT – Southern African Large Telescope
SANSA – South African National Space Agency
SARAO – South African Radio Astronomy Observatory
SCBP – SALT Collateral Benefits Programme
SDSS – Sloan Digital Sky Survey
SDSU – San Diego State University Astronomy Department
SKA – Square Kilometre Array
SHOC – Sutherland High-speed Optical Camera
SIRIUS – Simultaneous 3-colour InfraRed Imager for Unbiased Survey
SMC – Small Magellanic Cloud

SMI – Slitmask IFU
SNR – Signal-to-Noise Ratio
SOFIA – Stratospheric Observatory for Infrared Astronomy
SpUpNIC – Spectrograph Upgrade Newly-Improved Cassegrain
SUNBIRD – SUpErNovae and starBurst in the InfraReD
SuperWASP – Super Wide Angle Search for Planets

T *TESS* – Transiting Exoplanet Survey Satellite
TNS – Transient Name Server
UCT – University of Cape Town
UK – United Kingdom

U *UM* – University of Miami
USA/US – United States of America
UV – Ultraviolet

V *VIS* – Visible

W *WALOP* – Wide Area Linear Optical Polarimeters
WISE – Wide-field Infrared Survey Explorer

Z *ZTF* – Zwicky Transient Facility





MESSAGE FROM THE DIRECTOR

It is my pleasure to welcome you to the Annual Review of the South African Astronomical Observatory for 2023/2024. Doing so in my role as acting director, I reflect on a significant change at the NRF-SAAO this year – our previous director, Petri Väisänen, recently moved back to his home country of Finland. We are grateful for his innumerable contributions to the NRF-SAAO over almost 20 years, with 6 years as the managing director. We will miss Petri, Minna and their family and wish them all the best as they settle into their new home.

Over the year in review, the NRF-SAAO has continued to play a large role in South African and global astronomy. Our staff and students do novel research, particularly in the fields of transient, asteroid and extragalactic astronomy, provide telescopes and data to the South African community and many international partners, develop new instrumentation for astronomical research and explore ways of transferring innovative ideas into other realms for the benefit of society. We share the wonders of the Universe with the public and contribute to teaching and training in multiple ways. Some highlights from these endeavours are shared with you in this report.

Some of the exciting science that NRF-SAAO astronomers have been involved in this year includes the discovery of 46 near-Earth asteroids and five new

comets with the ATLAS telescope in Sutherland. Rare transient objects, such as a spinning white dwarf, were observed by both of South Africa's flagship facilities, the Southern African Large Telescope (SALT) and the MeerKAT radio telescope. SALT was also used to discover a unique system of two white dwarfs that provides new insight into the evolution of stars and the formation of supernovae. A new realm is opening up, with all-sky surveys on new facilities expected to identify innumerable previously unknown sources over the next few years that will need to be studied and characterised in detail.

Our Intelligent Observatory (IO) project aims to modernise and expand South Africa's observing capabilities through hardware adaptations and innovative software approaches, linking our telescopes into a network that extends into Africa and responds to transient alerts from across the world. It will facilitate the immediate autonomous follow-up of these events. NRF-SAAO's 1.0m telescope is now a fully autonomous facility, and our much older 1.9m telescope, affectionately known as "Old Orange", was recently adapted with an instrument selector port that enables seamless switching between two instruments at any time. The IO project has now moved into a new phase that focuses on upgrades to operations and improved data provision, which will further enhance time-domain and transient science.

Other highlights from our instrumentation divisions this year include first light through a novel slitmask integral field unit and the development of a Laser Frequency Comb module that will enable SALT to discover planets around other stars. We were thrilled to recently install a

new CNC machine in the NRF-SAAO precision machining workshop that will not only enhance our abilities to produce world-class instrumentation in-house but also serve the needs of our NRF sister facilities, the South African Radio Astronomy Observatory (SARAO) and iThemba LABS.

NRF-SAAO places a strong emphasis on our human capital development and science engagement programmes. We are very proud of our students and recent graduates. We celebrated 2 PhD graduations and 4 MSc graduations over the year, and Munira Hoosain was awarded a prestigious DSI-Ndoni Mcunu Fellowship for her PhD work. We hosted the 44th International School for Young Astronomers in December and in January we celebrated 20 years of the National Astrophysics and Space Science Programme (NASSP), which has been driven and supported by NRF-SAAO staff since its inception. A two-day symposium brought together alumni, students and those involved in NASSP over the years to celebrate the success of NASSP's graduates and the great diversity of contributions being made to South African society and the science system across the world. A new Master's course on instrumentation was offered to NASSP students this year for the first time to stimulate interest and build capacity in this area. Our extensive science engagement and outreach activities include teacher training, learner support programs, and public engagement initiatives that promote astronomy and inspire future generations.

The NRF-SAAO's role in the global astronomical community is underscored by our robust international collaborations and partnerships. We engage in joint projects with renowned research institutions worldwide,

sharing expertise and resources to advance our scientific goals. Our participation in international conferences and workshops fosters knowledge exchange and innovation, strengthening our position in the global astronomy landscape.

The NRF-SAAO is committed to making a positive impact on local communities. Through initiatives like the SALT Collateral Benefits Programme, we support education and development in Sutherland and surrounding areas. Our community development projects and indigenous astronomy programs help bridge the gap between science and society, fostering a deeper appreciation for astronomy and its relevance to everyday life.

Looking ahead, the NRF-SAAO is poised for exciting developments and continued growth. Upcoming projects include the expansion of our observational capabilities and the launch of new research initiatives aimed at unlocking further scientific breakthroughs. Our goal is to enhance the observatory's global standing and continue contributing to the advancement of astronomical research, ensuring that the NRF-SAAO remains at the forefront of discovery and innovation.

I hope you enjoy reading about all of the activities and achievements of the NRF-SAAO and its people in this annual report, and feel inspired by our work to explore the Universe for the benefit of all.



Dr Rosalind Skelton
Acting Managing Director

MESSAGE FROM THE DCEO

NATIONAL RESEARCH INFRASTRUCTURE PLATFORMS

WELCOME FROM THE DCEO OF NATIONAL RESEARCH INFRASTRUCTURE PLATFORMS

At the National Research Foundation (NRF), we believe that knowledge and research are the building blocks of a better future for South Africa. We see science as a way to improve society, and the NRF, along with the South African Astronomical Observatory (SAAO), remains dedicated to this vision.

SAAO is a key part of our strategy, especially through its flagship research platform, the Southern African Large Telescope (SALT). We're working hard to make SALT even better, ensuring it remains a leader in global astronomy and attracts new partners, funding, and expertise.

We're also deeply committed to creating a diverse and welcoming research environment. We've made progress in increasing the representation of black and female researchers, but we recognise the need to intensify our efforts. A diverse team not only enriches our research but also strengthens our capacity to produce impactful outcomes.

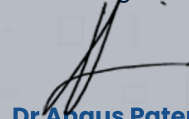
Our work focuses on sustainable and responsible knowledge, helping to create a more just, prosperous, and environmentally friendly society. We strive to address challenges faced by our nation while pushing the boundaries of what we know.

To achieve this, we rely on strong partnerships with the government, industry, and international organisations. These partnerships provide the resources and support we need to fulfil our mission and make the SAAO a key player in the global astronomy community. Our international collaborations are particularly valuable for sharing knowledge, fostering innovation, and solidifying our position in the world of science.

Developing the next generation of researchers and engineers is another major priority. By investing in postgraduate students and researchers, we're building a talented and sustainable research workforce that can drive progress and maintain our reputation for discovery and innovation.

The future looks bright for the SAAO. Exciting new projects will expand our capabilities and launch new research initiatives, further strengthening our global reputation and contributing to the exciting advancements in astronomy.

Warm regards,

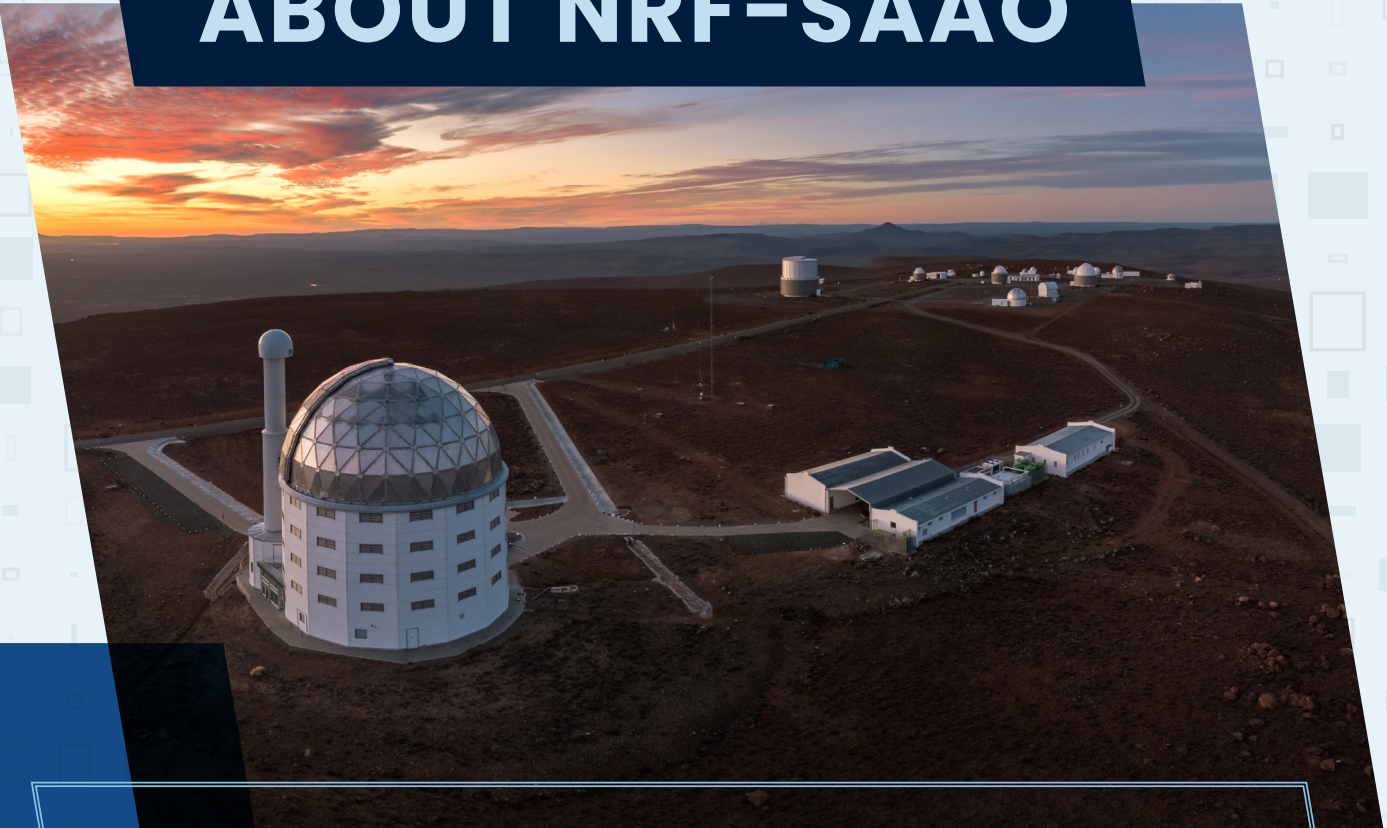


Dr Angus Paterson

DCEO National Research Infrastructure Platforms



ABOUT NRF-SAAO



The South African Astronomical Observatory (SAAO) operates as a business unit of the National Research Foundation (NRF) and serves as a National Research Facility under the jurisdiction of the Department of Science and Innovation (DSI).

It holds the distinction of being the national centre for optical and infrared astronomy in South Africa. Moreover, the NRF-SAAO stands as the foremost establishment for optical astronomy across the African continent and bears majority ownership and operational responsibility for the Southern African Large Telescope (SALT), the largest optical telescope in the southern hemisphere.

The NRF-SAAO plays a crucial role in offering state-of-the-art ground-based observational facilities to astronomers both within the nation and around the globe. Additionally, it conducts cutting-edge astronomical research through its own team of expert researchers.

BACKGROUND

Situated within the Two Rivers Urban Park in Cape Town's Observatory suburb, the NRF-SAAO's headquarters are located at the confluence of the Black and Liesbeek Rivers. Tracing its roots back to 1820 when the authorization for its establishment, then known as the Royal Observatory Cape of Good Hope, was granted, this observatory represents one of Cape Town's oldest enduring structures. Recognizing its historical significance, the Observatory was declared a National Heritage Site in 2018. Today, some of the historical telescopes in Cape Town continue to be utilized for outreach programs and public events.

The Cape Town site stands as one of the last remaining areas near the city center where the original local ecology has been preserved. The lower-lying regions are periodically subject to flooding and provide a diverse habitat for a wide array of bird and animal species, as well as a variety of flowering bulbous plants. Moreover, this locale serves as the northern boundary for the endangered Western Leopard Toad (*Amietophrynus pantherinus*) and represents the sole remaining habitat for the rare iris species, *Moraea Aristata*.

Due to the challenges posed by light and air pollution in the city, research observations are conducted at an observing site located 15 km from the small town of Sutherland in the Northern Cape. This site, situated on a plateau 1,800 meters above sea level and distanced from Cape Town's urban lights, houses 24 telescopes of varying sizes and configurations. Some of these telescopes are owned by the NRF-SAAO, while others are hosted on behalf of international research institutes. This collection of telescopes offers astronomers from South Africa and across the globe access to exceptionally dark skies. The site's strategic positioning in longitude between other prominent optical observatories in the southern hemisphere, such as those in Chile and Australia, enables continuous coverage for time-critical observations.

The NRF-SAAO fulfills a vital role in the National System of Innovation (NSI) through its foundational research, provision of research infrastructure for astronomers affiliated with South African universities, and development of innovative technologies for astronomical instrumentation.

NRF-SAAO astronomers actively engage in a wide range of international research projects. Dissemination of their research findings through publications and conference presentations serves to drive innovation both within the nation and worldwide. Moreover, the NRF-SAAO assumes responsibility for guiding numerous post-graduate students in their educational pursuits. Graduates trained

at the NRF-SAAO have gone on to become esteemed researchers and educators, leaving their mark not only in South Africa but also across the African continent.

To further enrich Southern Africa's interest in and understanding of astronomy and astrophysics, the NRF-SAAO shares its research findings and discoveries while actively participating in outreach activities. Through these efforts, the NRF-SAAO endeavors to inspire and engage citizens, fostering enthusiasm for the fields of physics and astronomy. Its overarching goal is to sow the seeds of innovation in future generations of South Africans. The NRF-SAAO proudly hosts the Office of Astronomy for Development (OAD) of the International Astronomical Union (IAU), which coordinates projects worldwide aimed at leveraging the transformative power of astronomy to improve people's lives.

In addition, the NRF-SAAO serves as the secretariat of the African Astronomical Society (AfAS), a pan-African professional society of astronomers. As a not-for-profit company registered in South Africa, AfAS aspires to create and support a globally competitive and collaborative astronomy community within Africa. Its mission is to be the authoritative voice of astronomy on the continent and contribute to addressing the challenges faced by Africa through the promotion and advancement of astronomical pursuits. A primary objective of AfAS involves fostering the development of astronomy and human capacity throughout the African continent by cultivating a vibrant and active society. At present, AfAS primarily receives funding from the Department of Science and Innovation (DSI) in South Africa.



TELESCOPE OPERATIONS



TELESCOPE OPERATIONS

NRF-SAAO TELESCOPES

SALT

(Southern African Large Telescope)



Size: 9 x 11 m

Instruments: Spectrographs (low and high resolution), CCD camera, Spectro-polarimeter.

Start of science operations: 2011

1.9M



Size: 1.9 m

Instruments: Spectrograph (SpUpNIC), Imaging CCD (SHOC), Polarimeter (HIPPO)

Start of science operations: 1976

1.0M

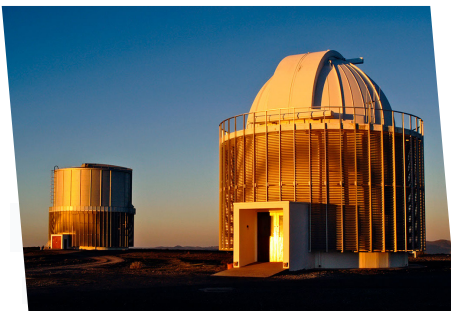


Size: 1.0 m

Instruments: CCD cameras

Start of science operation (Sutherland): 1972

LESEDI



Size: 1.0 m

Instruments: Low-resolution imaging spectrograph, wide-field camera

Start of science operations: 2019

ASTMON (All-Sky Monitor)



Size: 2 fish-eye lenses

Description: All-Sky Monitor; used to measure the sky brightness

DIMM



Instruments: Sky monitor; part of SALT

Start of science operations: 1995

TELESCOPE OPERATIONS

CO-OWNED FACILITIES

PRIME

(Prime Focus Reflector Telescope)



Size: 1.8 m

Owner: NRF-SAAO, University of Osaka, Astro-Biology Centre of Tokyo, NASA's Goddard Space Flight Centre, University of Maryland.

Description: A wide FOV 1.8m telescope with the world largest class NIR camera. The telescope is designed to perform world's first NIR (JH-band) microlensing surveys for exoplanets in the galactic center to dramatically increase detections of exoplanets.

IRSF

(InfraRed Survey Facility)



Size: 1.4 m

Owner: Nagoya Univ, Kyoto Univ, NAOJ (Japan), and NRF-SAAO

Description: IRSF has been a fruitful collaboration between Japan and NRF-SAAO since 2000 and offers a near-infrared camera (SIRIUS) and polarimeter (SIRPOL).

MEERLICHT



Size: 0.65 m

Owner: Six institutes in South Africa, the Netherlands and the United Kingdom

Description: MeerLICHT - Dutch for 'MORE LIGHT' - is fully robotic and provides a simultaneous, optical view of the radio sky as observed by MeerKAT to help identify and classify transient events.

TELESCOPE OPERATIONS

HOSTED FACILITIES

BISON

(Birmingham Solar Oscillations Network)



Size: 0.5 m

Owner: Birmingham University (UK) and NRF-SAAO

Description: BiSON is a cooperative programme between NRF-SAAO and Birmingham University, UK, to study the 5-minute oscillations of the Sun. Its Sutherland station is one of six networked solar telescopes spread around the world.

ACT

(Alan Cousins Telescope)



Size: 0.75 m

Owner: University of Johannesburg
Start of science operations: 1999

KMTNET

(Korea Microlensing Telescope Network)



Size: 1.6 m

Owner: Korean Astronomy and Space Science Institute (KASI)

Description: KMTNet is a Korean network of three identical 1.6-m telescopes situated in the southern hemisphere (Chile, South Africa, and Australia), conducting a wide-field photometric survey. The network's main scientific goal is to discover earth-mass planets using the gravitational microlensing technique.

TELESCOPE OPERATIONS

HOSTED FACILITIES (CONT.)

MONET

(MONitoring NETwork of Telescopes)



Size: 1.2 m

Owner: University of Göttingen, Germany

Description: MONET consists of two fully automatic telescopes located at the observatory sites of partner institutions in Texas and South Africa. A large fraction of observing time is available to schools.

LCO

(Las Cumbres Observatory)



Size: 3 x 1.0 m and 1 x 0.4 m

Owner: Las Cumbres Observatory

Description: The Las Cumbres Observatory is run by a private operating foundation; it consists of a global network of telescopes and operates as a single facility. LCO is used for professional research and citizen investigations. Sutherland is the location of three 1-metre and one 0.4-metre telescopes.

SOLARIS-1 AND SOLARIS-2



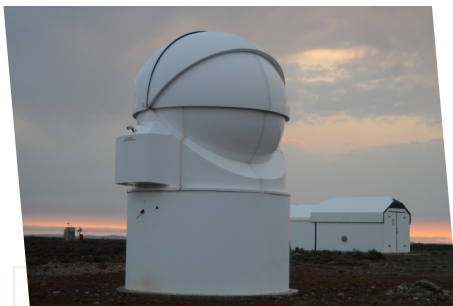
Size: 2 x 0.5 m

Owner: Poland

Description: Solaris is a Polish scientific initiative to open a new frontier in the hunt for extrasolar planets. It consists of a global network of fully autonomous telescopes: two at NRF-SAAO and one each in Australia and in Argentina.

OSR

(Optical Space Research)



Size: 0.5 m

Owner: SANSO (South African National Space Agency), DLR (the German Aerospace Centre)

Description: The OSR laboratory is a space debris tracking telescope (part of the Small Aperture Robotic Telescope Network, or SMARTnet), to enable activation of collision-avoidance measures, to ensure the safe operation of satellites.

MASTER-SAAO

(Mobile Astronomical System of the TElescope-Robots Network)



Size: 2 x 0.4 m

Owner: MASTER-Net

Description: MASTER-Net is a network of optical transient alert twin-telescopes distributed in longitude over Russia, Argentina and South Africa (MASTER-SAAO). It is a fast survey system, covering more than 2000 square-degrees of sky per night.

ASAS-SN

(All-Sky Automated Survey for SuperNovae)



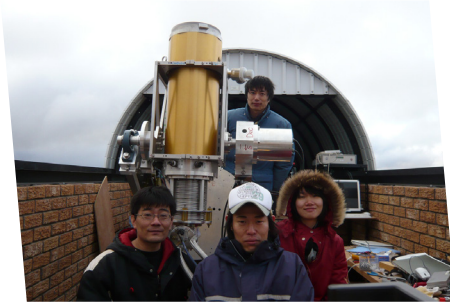
Size: 0.4 m

Owner: Las Cumbres Observatory, Ohio State University

Description: The LCO's Aqawan hut hosts both the ASAS-SN as well as the 0.4-m LCO telescope. The network comprises of five ASAS-SN telescopes.

HOSTED FACILITIES (CONT.)

WFTC II



Size: 2 x 0.5 m
Owner: Nagoya Univ, Kyoto Univ, NAOJ (National Astronomical Observatory of Japan)
Description: WFTC II is a special infrared telescope whose interior is under vacuum and cooled to cryogenic temperatures. It has not been used much in recent years. The roll-off roof building was named Sumi-hut for the Sumitomo Foundation that supplied funding.

BRING PROJECT (β Pic b ring)



Size: 2 x 2.4 cm f/1.4 wide field lenses
Owner: University of Rochester, USA; NASA Jet Propulsion Laboratory; Leiden University, Netherlands
Description: The bRing experiment consists of a twin/two-camera telescope, monitoring the bright star β Pictoris for signs of obscuration from circumplanetary dust associated with the young gas giant exoplanet β Pic b.

SOUTH AFRICAN NATIONAL SPACE AGENCY



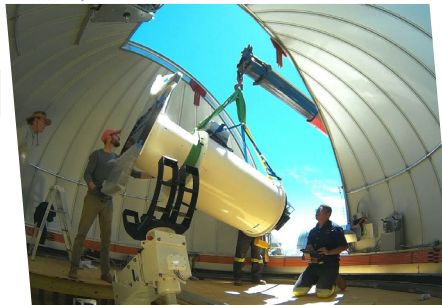
Owner: SANSa
Description: The SANSa container comprises several instruments (airglow imager, night-vision video cameras, extremely low-frequency receiver, mesospheric temperature mapper and satellite-based augmentation system receiver) to study the Earth's atmosphere and ionosphere, including research into how sprites are triggered and their effects on the upper atmosphere.

SAGOS (South African Geodynamic Observatory Sutherland)



Owner: German Research Centre for Geosciences (GFZ)
Description: The SAGOS seismograph is a superconducting gravimeter providing continuous high-resolution monitoring of changes in the Earth's gravity field.

ATLAS-STH (Asteroid Terrestrial-impact Last Alert System - Sutherland)



Size: 0.5 m
Owner: University of Hawaii Institute for Astronomy
Description: The Sutherland node of the four-telescope ATLAS system that surveys for hazardous near-Earth asteroids. The system also detects and reports many transient objects to the Transient Name Server (TNS).

The primary objective of Telescope Operations (TOPS) at the South African Astronomical Observatory (NRF-SAAO) is to operate and maintain the NRF-SAAO telescopes located in Sutherland on behalf of the South African astronomy community. This includes managing the assessment and allocation of observing time, maintaining and repairing the telescopes, liaising with the owners of the hosted facilities and NRF-SAAO telescope users, and ensuring that all research facilities at Sutherland operate effectively and efficiently, fully utilised for their intended research projects.

The NRF-SAAO's telescopes, including the 1.9m, 1.0m, and Lesedi, continue to function efficiently in a hybrid model of local and remote observing. Over the financial year from April 2023 to March 2024, these telescopes experienced an average technical downtime of only 1.6%. To enhance usability and safeguard the telescopes, operational protocols, software watchdogs, and web interfaces have been developed. Lesedi supports observations in queue schedule mode using the Observatory Control System (OCS) developed by the Intelligent Observatory project. Users submit applications through the OCS, which autonomously schedules and executes observations each night, a method encouraged over traditional local or remote observing modes. Experienced national and international telescope users can observe remotely with Lesedi or the 1.0m telescope from their respective institutes. Normality in operations has returned, allowing telescope users to choose their preferred observation mode, whether from Sutherland, remotely, or in queue schedule mode for Lesedi.

The InfraRed Survey Facility (IRSF) has resumed operations and is available for infrared observations. Remote observing with the IRSF was tested from Japan in 2023/2024, revealing issues related to internet speed and stability, as well as hardware problems that require human presence at the telescope, particularly at the beginning and end of the observing night. These issues will be addressed over the next few months to prepare the IRSF for fully remote observations.

Two new Polish telescopes have been installed in Sutherland. Solaris-5, part of the existing Solaris telescopes, is being commissioned. Additionally, the Polish Space Agency (POLSA) has installed four 0.35m

astrograph telescopes in a single enclosure. These telescopes will conduct survey and tracking observations of satellites across all orbital regimes, from Low Earth orbit (LEO) to Geostationary equatorial orbit (GEO), and possibly Medium Earth orbit (MEO). The telescopes will be exclusively used by POLSA.

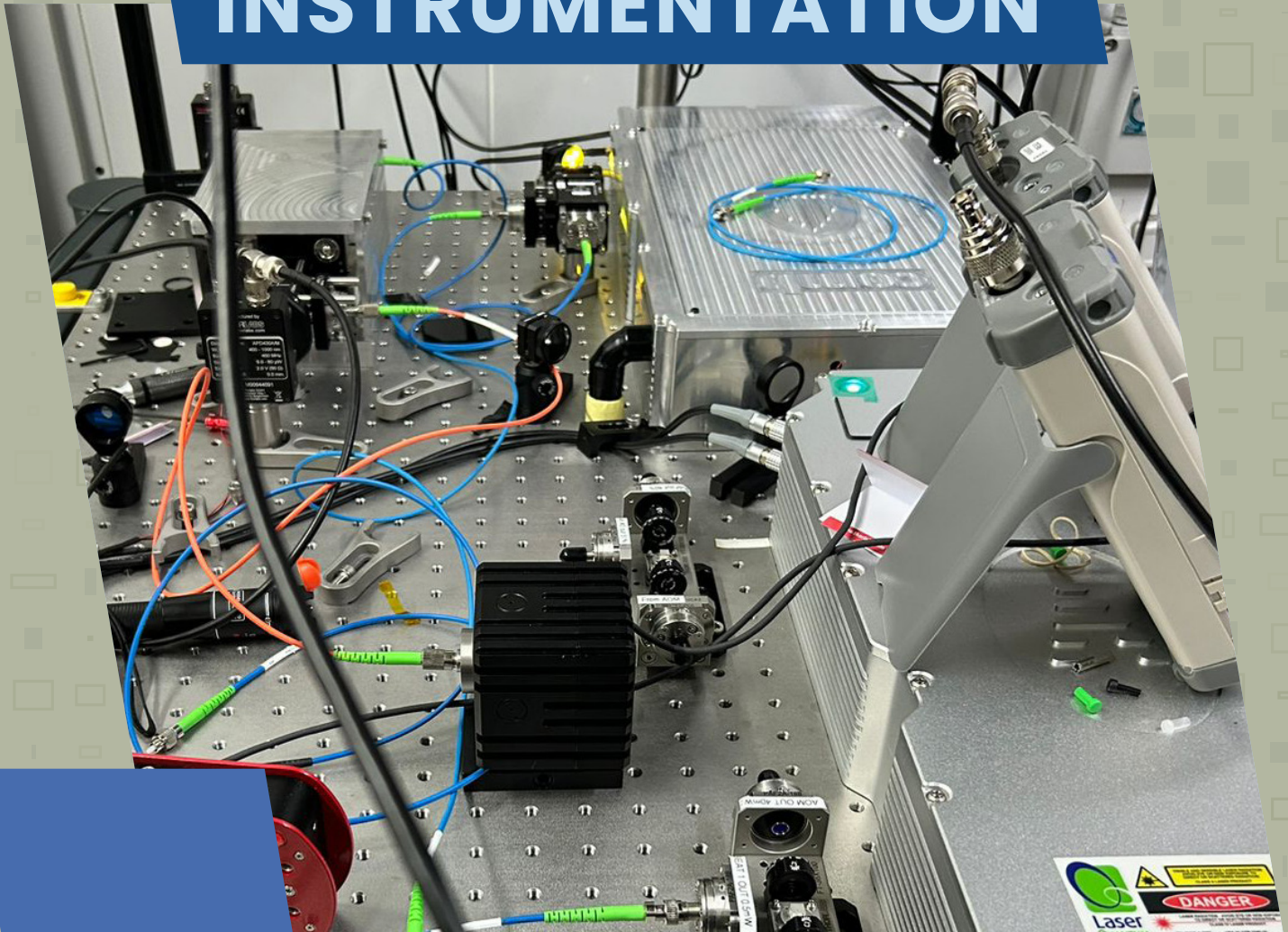
In terms of human resources, following the resignation of our mechanical technicians in Sutherland in 2022/2023, a fully renewed mechanical team with a range of new skills and experience is now in place. This team is conducting a thorough assessment of all telescope subsystems and implementing new maintenance plans and procedures. The operational standby routine, altered during the Covid-19 pandemic to have one technician covering both mechanical and electronics standby, has reverted to the pre-Covid-19 status quo, with separate standby technicians for electronics and mechanical engineering. Waterproofing of the 1.9m telescope, Lesedi, and MeerLICHT domes has been successfully completed. Although there were initial issues with the 1.9m telescope and MeerLICHT waterproofing, these have been resolved. Lesedi still requires some fixes to the dome rubbers, but the overall sealing is satisfactory. Challenges remain with fixing the wind blinds on the 1.9m and 1.0m telescopes. For the 1.9m, the wind blind mechanism has been redesigned, with parts manufacture imminent. For the 1.0m, the plan involves contracting experts experienced in working at heights to assist in removing the old wind blind rails and installing the new ones.

HIGHLIGHTS

The newly assembled TOPS team completed its first aluminising process together, with great results. The aluminising of the 1.0m telescope primary mirror was done in February 2024, and it was the first time our new-look mechanical team was involved in this kind of a delicate process.

Progress continues on the road towards more flexible and responsive observing with an instrument selector port having been commissioned on the 1.9m telescope to allow both a SHOC camera and SpUpNIC to be mounted at the same time. Users can now apply to use both instruments in the same time allocation, and can switch between photometry and spectroscopy at the touch of a button.

INSTRUMENTATION



THE NRF-SAAO INSTRUMENT WORKSHOP

RSS DETECTOR UPGRADE

With the onboarding of IUCAA as full project team members, confidence in the performance of the 6k x 6k CCD with IDSAC controller architecture, as installed on the NRF-SAAO Sibonise instrument, has increased significantly. Major changes implemented this year include new firmware, which speeds up CCD line transfer, thereby eliminating some image effects associated with the previous firmware, as well as improvements in the control software to drastically improve instrument stability.

The detector control system architecture and hardware details were finalised through a series of reviews, and the hardware components are now in hand for control algorithm development in the coming months. On

the mechanical design, the assembly and alignment processes for the cryostat were designed and detailed, ensuring the tight tolerances required on assembly could be achieved. Flexure behaviour analysis shows that the CCD mounting arrangement is expected to flex no more than 5% of a pixel width during a one-hour track, promising excellent image stability.

The critical optical element, the cryostat window/field flattener lens, was ordered from Bertin Winlight in France and is expected to be delivered in May 2024. Work is continuing to manufacture an advanced development model, which will enable the team to qualify all the procedures developed over the previous year.

CNC HORIZONTAL MILLING MACHINE

In April 2024, the NRF-SAAO machining workshop took delivery of a new high-end CNC Horizontal Machining Centre. The culmination of a long and thorough procurement process, the CNC machine is geared towards 'lights out' manufacturing, which means that once it is loaded, the machine can produce a large quantity of parts unattended. Post-commissioning, this will drastically improve the workshop's throughput for the routine production items it delivers to its NRF partners, and frees up the other workshop machines for the development of the precision astronomical instrumentation that the workshop has come to be known for.

Figure below. Delivery of the new machine on a truck to the NRF-SAAO workshop loading bay



Figure above: The new CNC Horizontal Machining Centre in its final position on the NRF-SAAO workshop floor.

SOME BRIEF FACTS AND FIGURES:

Model: Kitamura Mycenter-HX400iG/500
Mass: 9,800 kg
Spindle speed: 15 000 rpm
Positioning accuracy: +/- 0.002 mm
Positioning repeatability: +/- 0.001 mm
Max: workpiece size: 630mm diameter x 745mm height

SALT LASER FREQUENCY COMB AND HIGH STABILITY MODE PIPELINE DEVELOPMENT

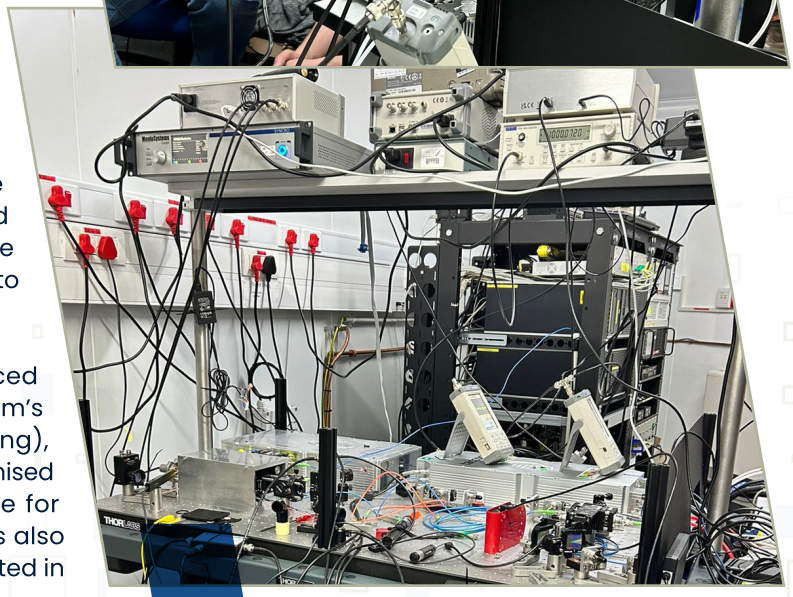
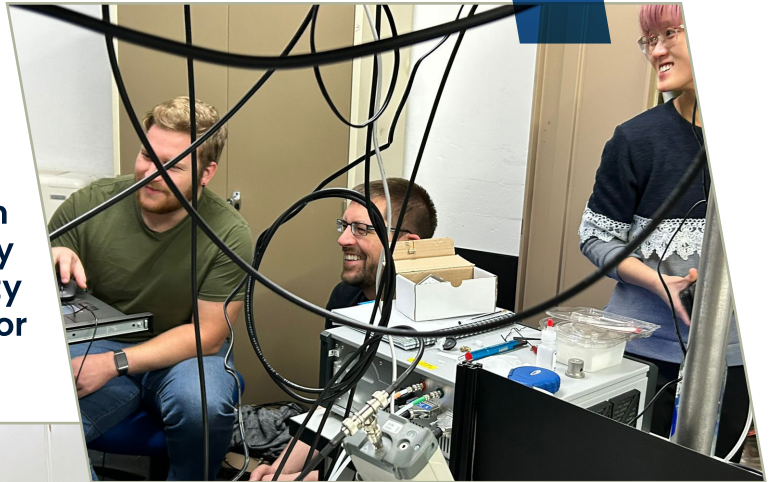
Considerable progress was made towards completing the integration of the laser frequency comb (LFC) for SALT's High-Resolution Spectrograph (HRS) during 2023. The LFC is a state-of-the-art wavelength-calibration device that will equip the HRS for highly demanding precision radial velocity studies, such as those used to search for and characterise exoplanets.

Astrocombs tend to be prohibitively expensive and complicated systems. Rather than simply contracting Heriot-Watt University (HWU) in Edinburgh to build and deliver a comb for SALT, a collaborative approach has been adopted, allowing the assembly and integration to take place at the telescope. This affords SALT staff and students a unique opportunity to participate in the development of an LFC that is specifically tailored to suit the HRS.

Phase I of the integration campaign commenced during the first week of August. Prior to the LFC team's arrival (Richard McCracken and Yuk Shan Cheng), members of the Technical Operations team reorganised the HRS electronics room to prepare the space for the astrocomb installation. All the hardware was also transported to SALT and carefully packed and sorted in anticipation.

The ensuing week involved intense activity with lasers, numerous optics, and various electronic devices as the team assembled, aligned, tested, re-aligned, and re-re-aligned the various modules that comprise the LFC. The system's main titanium-sapphire laser encountered an issue when it suddenly refused to operate. However, after obtaining permission from the UK-based supplier to open the controller unit, a faulty connection was identified and rectified. Subsequently, the manufacturer's laser technicians were able to connect to the laser unit and adjust various parameters (including increasing the pump laser's power from 11 to almost 12W) to restore reliable operation. The single-mode fibre left behind at the end of the LFC field trial at SALT in 2016 was also tested and found to be operational, allowing for the brief injection of faint super-continuum light into the spectrograph on the final evening of the campaign. While the resulting image was not spectacular, this milestone was significant given the short timeframe.

In addition to the mechanical parts produced by the NRF-SAAO workshop team in Cape Town, and the



support from SALT Technical Operations at the telescope, numerous individuals in Sutherland and Cape Town provided assistance during this busy period. By the end of the campaign, a comprehensive to-do list was compiled to address ahead of the HWU team's return, including parts to remake or modify and orders to complete the construction of various electronics boxes needed for the different locking loops.

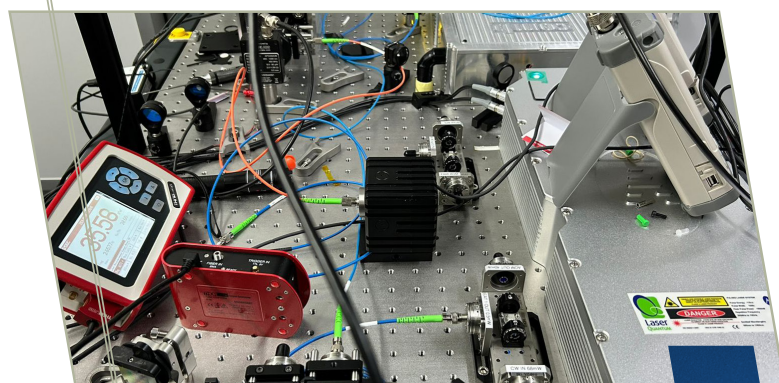
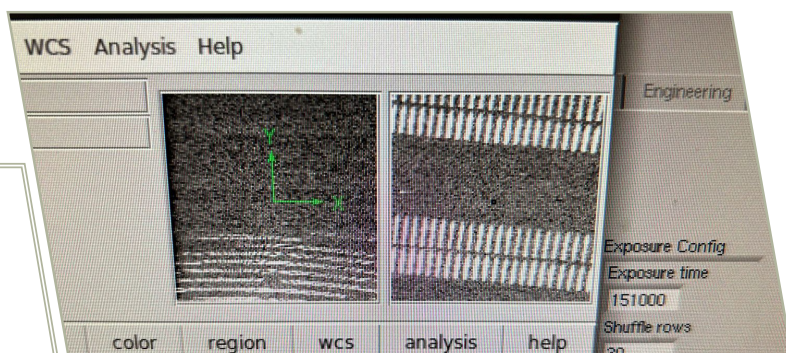
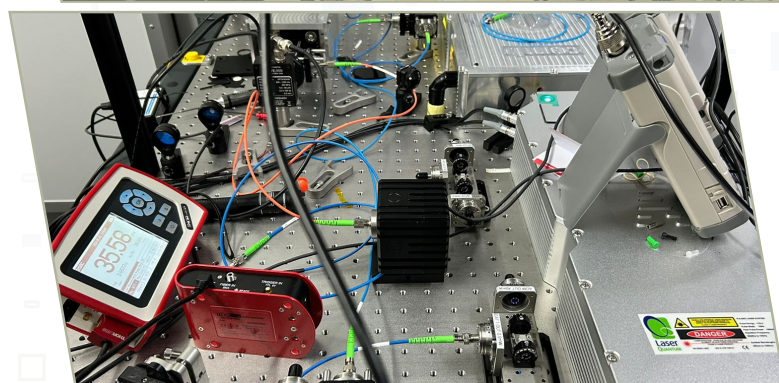
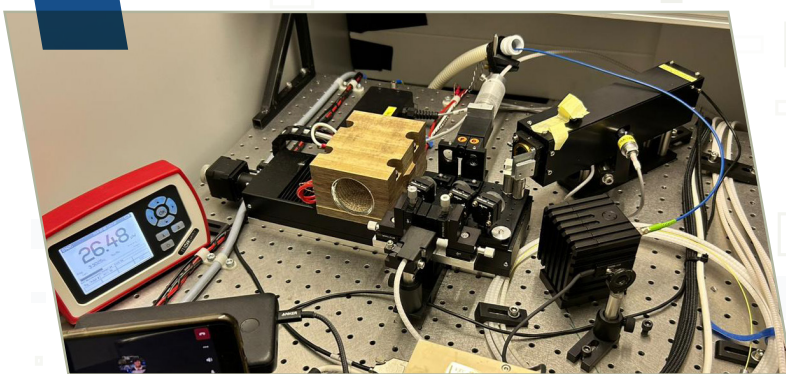
Richard and Shan returned to Cape Town at the end of November and promptly resumed the laser comb integration at SALT. Many more parts had either been delivered, modified, or completed in the interim, and the components were eagerly utilised to progress the systems. The main titanium-sapphire laser again required remote attention from the vendor in the UK, but all other equipment performed well. SALT software developer Malcolm Scarrott quickly established a software interface for the new frequency counter, and the new mounting blocks manufactured in the NRF-SAAO workshop a few months earlier greatly simplified the alignment of the photonic crystal fibre. A powerful super-continuum (a brilliant array of individual laser spots that

blur into a red-through-greenish spectrum) was promptly generated, alleviating concerns after the difficulties experienced in August.

The team worked extensively, often exceeding 14-hour days, and despite some challenges, overall progress was achieved at a commendable pace. Derryck Reid (also from HWU) and pipeline developer for the high-stability (HS) mode of the HRS, Daniel Holdsworth, joined the effort at SALT during the latter half of the 12-day campaign. The remaining time was densely packed with optical alignments, adjustments to electronic locking loops, and the development of various software interfaces to control all equipment from the dedicated comb laptop. However, a firmware update to the main laser caused an issue, preventing both the vendor and the LFC team from accessing or controlling the laser. Despite this setback, the team continued to make productive use of their time on-site. The laser vendor resolved to send a physical dongle with the necessary software to regain access to the laser, which arrived in early 2024 and successfully resolved the issue, allowing the team to plan their next visit.

Richard and Shan are scheduled to return at the end of April 2024 to continue the integration work. In the meantime, additional tasks include running more HRS stability tests and developing further software tools to interface with the various devices and subsystems. The next phase of the integration process is eagerly anticipated, followed by lab and on-sky commissioning of the astrocomb. The HS pipeline development continues in parallel, with the goal of gathering science verification data during the second half of 2024.

Subsequently, the manufacturer's laser technicians were able to connect to the laser unit and adjust various parameters (including increasing the pump laser's power from 11 to almost 12W) to restore reliable operation.



WALOP-S UPDATES

The Wide-Area Linear Optical Polarimeter (WALOP)-South instrument is one of the two WALOPs being developed by IUCAA in collaboration with NRF-SAAO to function as the workhorse instrument for the upcoming PASIPHAE program. The assembly and characterization of the WALOP-South instrument, to be mounted on the old 1m NRF-SAAO telescope at Sutherland, is underway at the instrumentation laboratory of the Inter-University Center for Astronomy and Astrophysics (IUCAA), Pune, India.

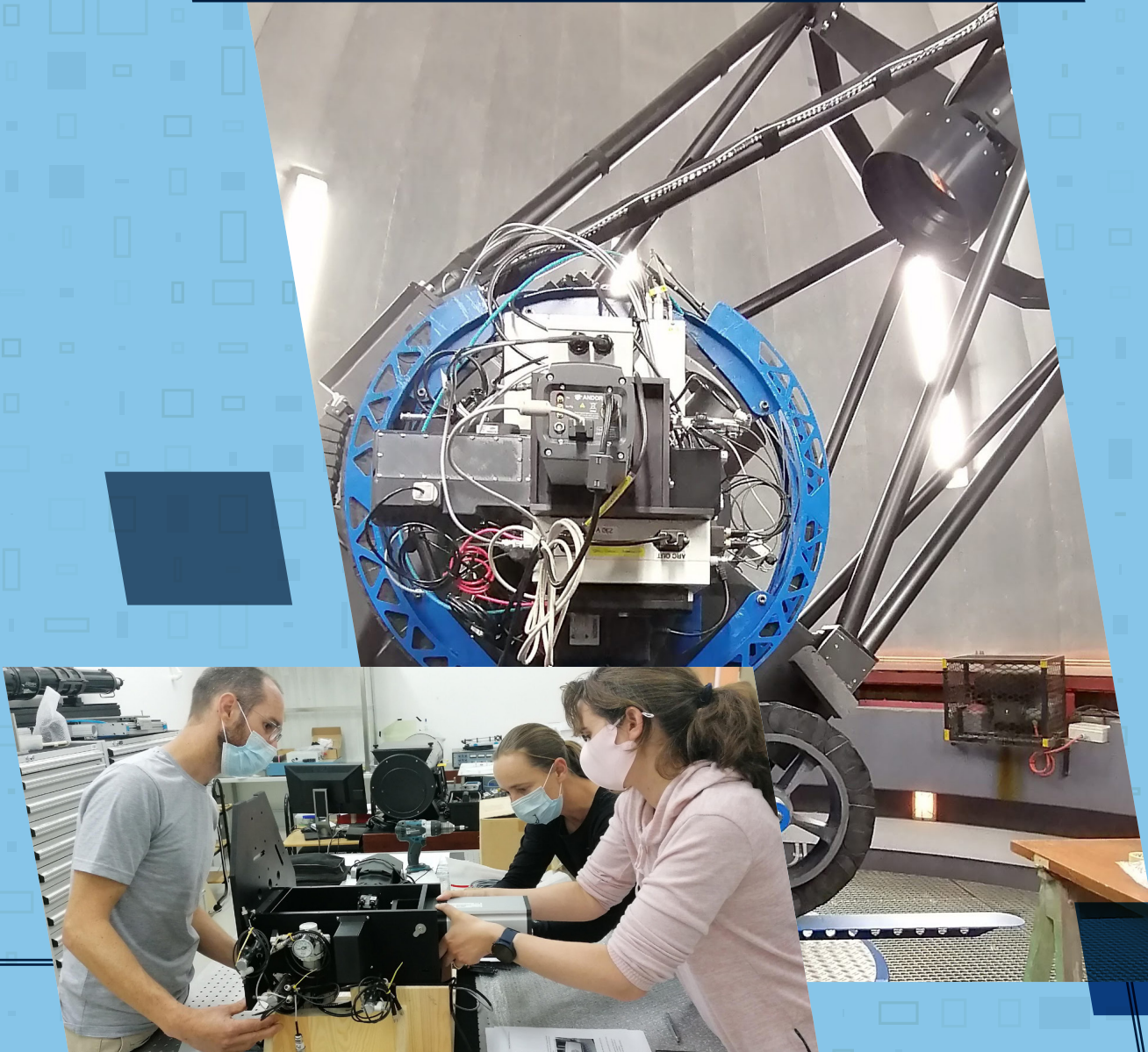
The PASIPHAE program aims to create the first large optical polarimetry map of the sky, enabling astronomers to pursue long standing puzzles on the physics of the dust and magnetic fields permeating in the interstellar medium, which together influence almost all processes in our and other galaxies.

WALOP is being designed to obtain polarimetric accuracy of 0.1 % over an unprecedented large field of view of 35-by-35 arcminutes (diameter of the full-Moon is 30 arcminutes), making it a unique polarimeter. The instrument is in advanced phases of assembly and is scheduled for commissioning in the later part of 2024/ early 2025.

To achieve the challenging optical and polarimetric performance goals of the instrument, the optical assemblies of the instrument (including four cameras and a collimator) required to be aligned within accuracy of 20 to 50 micrometers. To meet this goal, the NRF-SAAO workshop has fabricated the lens mounts for the instrument to accuracies better than 20 micrometers. What makes the fabrication of the components challenging is their large dimensions: some of the components are as big as 35 cm in diameter. Obtaining these accuracies over such large spatial dimensions entails high end machining tool and jig development, innovative methodology development through an iterative learning process and a very strict quality control at each step of machining.

CURRENT STATUS:
All the optical subsystems of WALOP-South, that includes four cameras, a collimator and very large and complex polarizer assembly system have been assembled, aligned and optically tested. The last major subsystem, the CCD dewars, are in their advanced stages of development, scheduled to be completed in the next 2-3 months. Once accomplished, we will move towards complete instrument testing and subsequent preparation for on-sky commissioning of the instrument.

THE INTELLIGENT OBSERVATORY (IO)

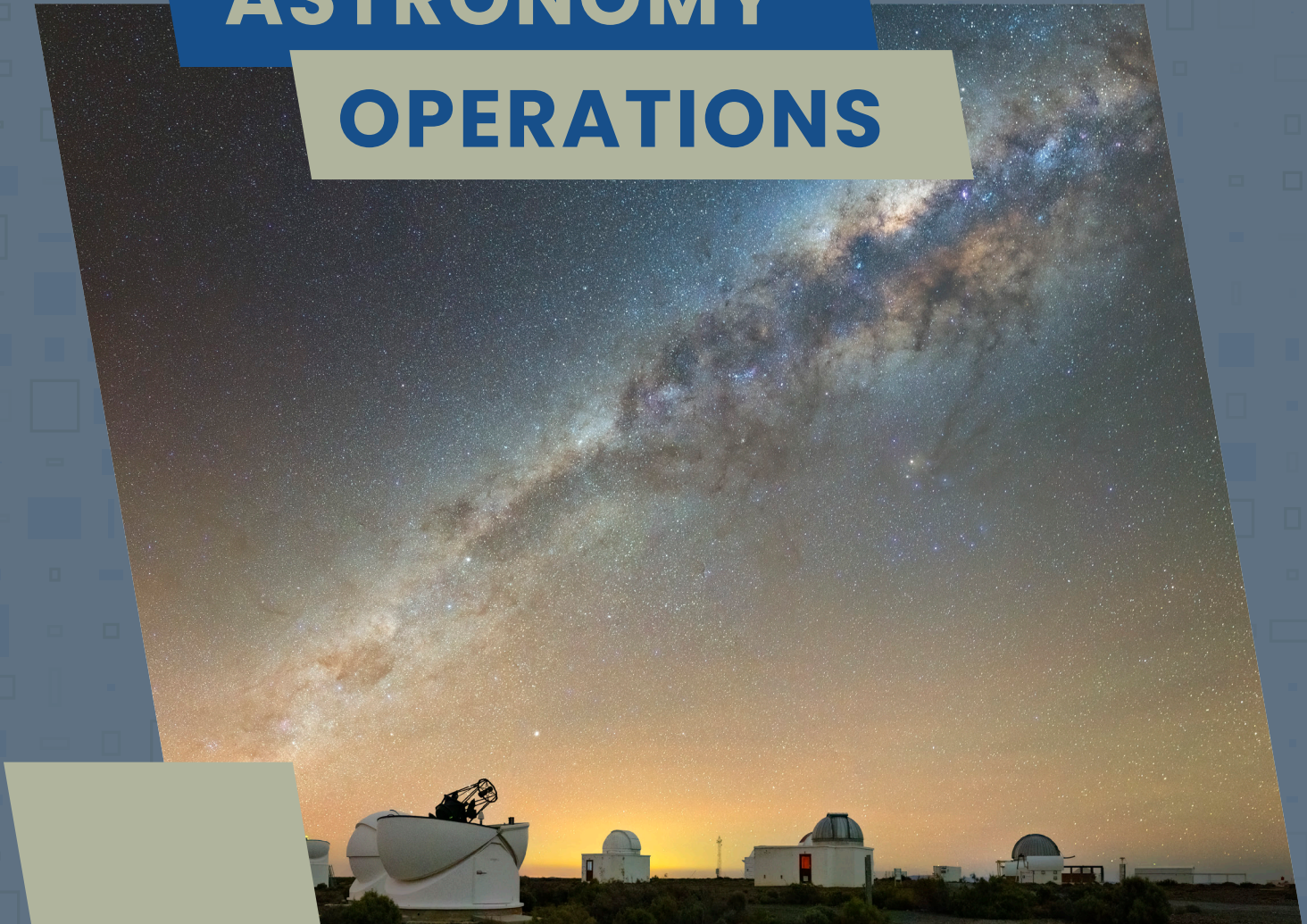


The South African Astronomical Observatory (NRF-SAAO) has embarked on an ambitious initiative to upgrade its telescopes, instruments, and data analysis capabilities, facilitating their intelligent integration and seamless coordination. This endeavour aims not only to improve efficiency and agility but also to unlock exciting scientific possibilities within the realms of multi-messenger and time-domain astronomy.

The programme encompasses hardware enhancements enabling autonomous operations, complemented by the development of sophisticated software solutions. Intelligent algorithms have been meticulously crafted to promptly and autonomously respond to real-time alerts from telescopes worldwide and space-based observatories. Overseeing this sophisticated framework is the Observatory Control System (OCS), actively managing the observing queue in real-time.

ASTRONOMY

OPERATIONS



OVERVIEW

The South African Astronomical Observatory continues to lead in diverse astronomical research areas, including extragalactic science, planetary science, and stellar astrophysics. Our researchers investigate phenomena such as star formation, active galactic nuclei, galaxy dynamics, and the transformation of galaxies. Significant milestones include breakthroughs in understanding galaxy outflows, asteroid characterization, and stellar phenomena.

Our extragalactic research explores the complexities of galaxy interactions and the baryon cycle, while planetary science focuses on small bodies within our Solar System, utilizing advanced instruments like SALTICAM and Mookodi. The stellar astrophysics group advances knowledge on star formation and evolution, contributing significantly to global astronomical research.

Key achievements include the discovery of unique white dwarf systems and evolving material around Centaur (2060) Chiron, underscoring the NRF-SAAO's pivotal role in pushing the boundaries of our cosmic understanding. These efforts, supported by state-of-the-art facilities and international collaborations, highlight the NRF-SAAO's commitment to advancing astronomical knowledge.

EXTRA-GALACTIC SCIENCE

Extragalactic astronomy continues to be a key research area for the South African Astronomical Observatory. Researchers at the NRF-SAAO actively investigate a wide range of extragalactic phenomena, encompassing various areas of interest such as star formation, super star clusters, active galactic nuclei (AGN), feedback processes in starbursts and AGN, ultra-diffuse galaxies, brightest cluster galaxy (BCG) evolution, galaxy mergers and disc assembly dynamics, the baryon cycle in galaxy groups, and the transformation of galaxies from active to quiescent states.

The Extragalactic Discussion Group has provided a valuable platform for students and staff to interact and learn about new developments and research in the field. One of the highlights of the year was the visit and talk given by Dr. Michelle Cluver (Swinburne University of Technology, Melbourne, Australia).

Antoine Mahoro graduated with his PhD, titled "Outflows from Active Galactic Nuclei (AGN) and star-forming galaxies," under the supervision of Dr. Petri Väisänen. His research utilised various data sets, including observations from the Southern African Large Telescope (SALT), to study outflows and their impact on galaxies. He was recently awarded an African Astronomical Society prize for his thesis work. He is now a postdoctoral fellow at the NRF-SAAO. Sriram Sankar completed his MSc thesis, which involved studying atomic hydrogen gas in nearby galaxy groups using MeerKAT, under the supervision of Dr. Moses Mogotsi and Prof. Matt Bershady. Brian Bichanga, also supervised by Prof. Matt Bershady, received an

African Astronomical Society award for his MSc thesis.

Munira Hossain, one of our PhD students, won the DSI-Ndoni Mccunu Fellowship in the Doctoral Awards category at the DSI Women in Science Awards.

Dr. Sabyasachi Chattopadhyay has been leading the NRF-SAAO's involvement in the Affordable Multiple Aperture Spectroscopy Explorer (AMASE) project, which will study the Milky Way and nearby galaxies at high spatial and spectral resolution. He is also spearheading the development of slitmask integral field units for use on SALT, which will be the first optical integral field units on SALT and in Africa. Dr Ros Skelton and Dr Moses Mogotsi have continued their involvement in various MeerKAT Large Science programmes, which are beginning to produce scientific results. This is in addition to the exciting 4HS, an all-southern-sky survey of nearby galaxies conducted by the 4MOST instrument.



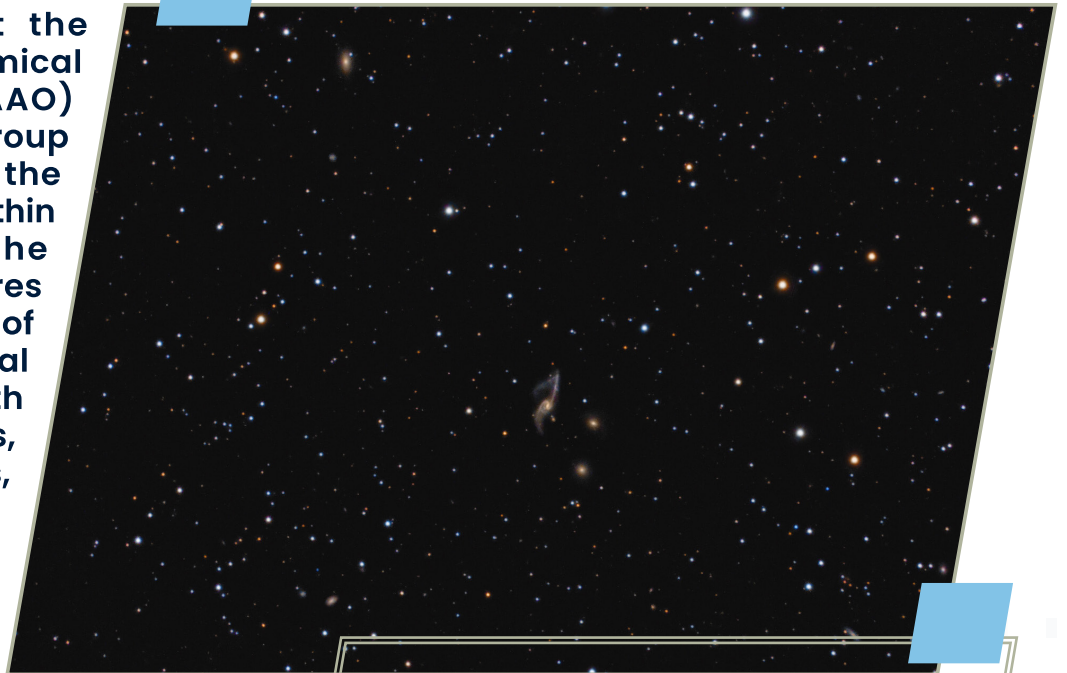
PLANETARY SCIENCE

Planetary science at the South African Astronomical Observatory (NRF-SAAO) is a small but active group focusing primarily on the study of small bodies within the Solar System. The research group measures the physical properties of populations or individual high-interest near-Earth and main-belt asteroids, Jupiter Trojans, Centaurs, and Kuiper belt objects.

The research group utilises various instruments built, operated, and maintained by the NRF-SAAO, including SALTICAM on the Southern African Large Telescope (SALT), SHOC on the 1- and 1.9-metre telescopes, and the versatile Mookodi instrument on the 1-metre Lesedi telescope. Mookodi, with its capability for multi-filter photometric imaging and low-resolution spectroscopy in robotic mode, is ideal for the group's near-Earth asteroid programme, which necessitates rapid response capabilities. Thobekile Ngwane's MSc project focuses on this near-Earth asteroid programme, serving as the primary research topic. Mookodi is also used by another MSc student, Mandlenkosi Mnisi, to investigate surface inhomogeneity of small bodies through time-resolved spectroscopy.

Some notable highlights of the year included the group's participation in a global planetary defence exercise organised by the International Asteroid Warning Network (IAWN), involving the characterisation of the newly discovered close-approaching asteroid 2023 DZ2 (Reddy et al., submitted). The group also successfully applied to host a dedicated "Focus Meeting" at the IAU General Assembly in Cape Town, titled "Follow-up Observations of Small Bodies in the Solar System in the Era of Large Discovery Surveys". One of the main goals of this meeting is to expose local attendees to global cutting-edge research and techniques in planetary science, aiming to grow and enhance the field within the African astronomical community.

The NRF-SAAO's ongoing collaboration with the ATLAS group at the University of Hawaii has been instrumental, particularly with the use of the large ATLAS photometry dataset for various asteroid studies.



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Two NASSP honours students, Kale Boyes and Omri Scannell, completed their research projects using this ATLAS dataset and will present their work at the IAU GA. Access to this data, not only for asteroid science but also for other research, has been made possible through the partnership with ATLAS, linked to the fully operational third node in Sutherland of the global four-telescope ATLAS network. In its second year of operation, ATLAS-Sutherland has begun to reach its optimised performance, increasing its near-Earth asteroid discovery rate by 65%. In 2023, ATLAS-Sutherland discovered 46 near-Earth asteroids (of the 115 discovered in total by the ATLAS network), most of which were rapidly followed up and characterised by Thobekile using the robotic Lesedi telescope with the Mookodi instrument as part of her MSc project. ATLAS-Sutherland was also prolific in comet discovery, with five of the nine ATLAS comet discoveries in 2023, including the co-discovery of Comet C/2023 A3 (Tsuchinshan-ATLAS), which some predict may become a naked-eye or even a "great" comet later in 2024.

STELLAR ASTROPHYSICS

The Stellar Astrophysics group at the South African Astronomical Observatory (NRF-SAAO) remains an active and vibrant research community. The group holds regular discussions that are open to non-NRF-SAAO-based researchers, fostering broader collaboration and knowledge exchange.

The discussions within the group cover a wide range of topics in stellar and binary astrophysics, from observational techniques to theoretical and computational astrophysics. The primary objective is to deepen the understanding of the processes driving star formation and evolution.

Recent research by the group includes the investigation of the nature of CXOU J005440.5-374320, a soft X-ray transient in the NGC 300 galaxy, and the discovery of a magnetar candidate X-ray pulsar in the Large Magellanic Cloud, 4XMM J045626.3-694723. These studies have been pivotal in advancing our understanding of stellar phenomena and demonstrate the group's ongoing contributions to the field.

The Stellar Astrophysics group at NRF-SAAO continues to make significant strides in understanding stellar phenomena through regular discussions and impactful research. The group's collaborative efforts and cutting-edge research promise to further enhance the field of stellar astrophysics and contribute to the global astronomical community.

The primary objective is to deepen the understanding of the processes driving star formation and evolution.

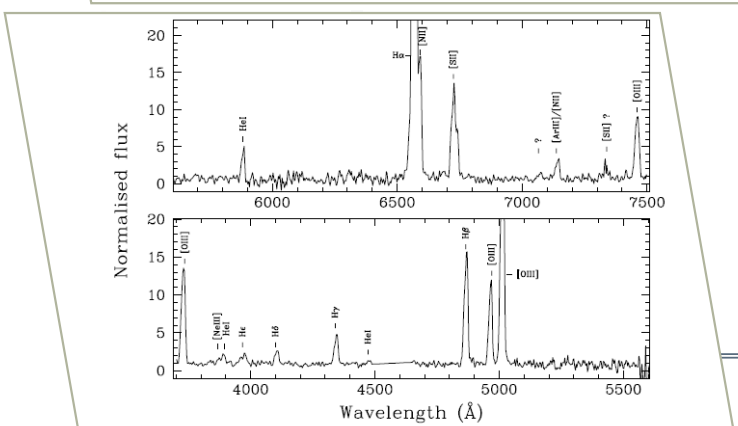
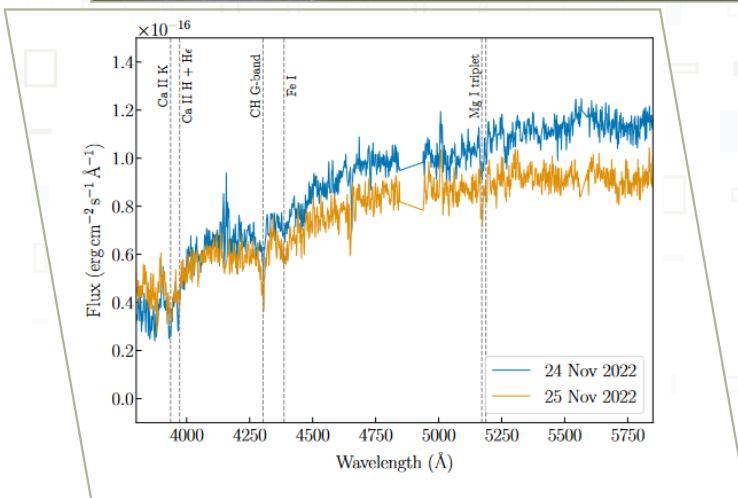
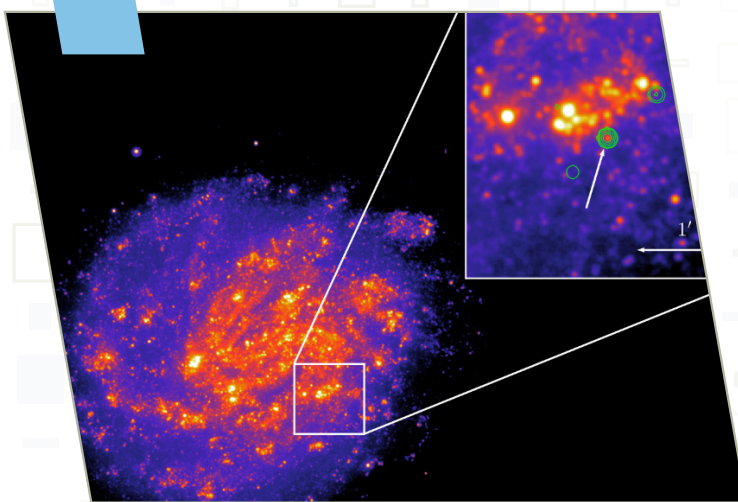
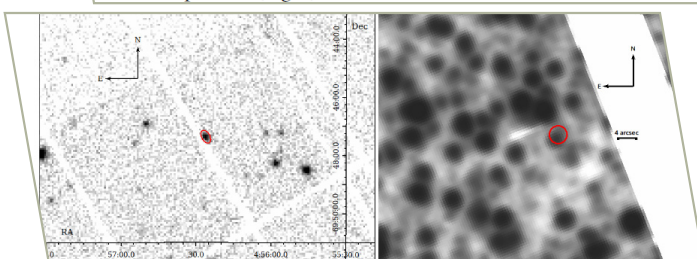


Fig. B.1. The SALT spectrum (PG0300) of J0054. Note that the lines labelled with a question mark are better identified and resolved in the PG0900 spectrum (Fig. 7).



SCIENCE

HIGHLIGHTS



SALT AIDS IN THE DISCOVERY OF A UNIQUE WHITE DWARF SYSTEM THAT MAY HELP EXPLAIN SUPERNOVA ORIGINS

Researchers from the Max Planck Institute for Extraterrestrial Physics, in collaboration with South African astronomers, made a significant discovery of a rare white dwarf binary star system located in the Large Magellanic Cloud, providing new insights into supernova explosions. The system, named [HP99] 159, was identified using the Southern African Large Telescope (SALT), contributing to the understanding of the conditions under which white dwarfs explode. The findings were published in the journal *Nature*.

White dwarfs are known to explode as supernovae when their mass exceeds a certain threshold, known as the Chandrasekhar limit. This research aimed to elucidate the processes through which the mass of a white dwarf can increase to this critical point. The system [HP99] 159 was observed to be unique among Super Soft Sources (SSS) due to its helium accretion rather than the commonly observed hydrogen accretion.

Through detailed optical spectroscopy using SALT's two spectrographs, the research team confirmed that the optical spectra were consistent with helium accretion. The luminosity measurements suggested that the mass accretion rate of the white dwarf was slower than previously expected, which may influence the understanding of the frequency of supernovae resulting from white dwarf explosions.

The identification of [HP99] 159 prompted further questions about the progenitors of Type Ia supernovae (SN Ia), which are critical for cosmology as the primary source of iron in the Universe. Theoretical models have suggested that 2–5% of the helium companion star's matter would be ejected during an SN Ia explosion, but this has not been widely observed. The unique characteristics of [HP99] 159 indicated that it might belong to a subclass of SN Ia known as SN Iax, which have weaker explosions and consequently less helium ejection.

The collaboration also included plans to identify additional similar sources in the Magellanic Clouds using the eROSITA telescope, with the goal of further refining the conditions necessary for SN Ia progenitors.

This discovery highlighted the capabilities of SALT's spectrographs and underscored the fruitful collaboration between South African astronomers and the German

eROSITA team. Professor David Buckley at the South African Astronomical Observatory (NRF-SAAO) led the SALT transient programme, with Dr. Itumeleng Monageng and other team members contributing to the follow-up optical observations that confirmed the nature of the source. The combined efforts have advanced the understanding of supernova mechanisms and the role of white dwarfs in these cosmic events.

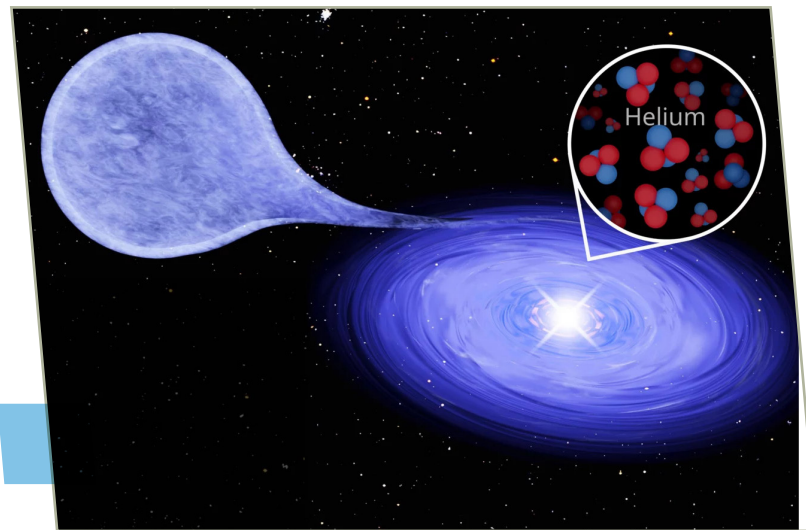


Fig 1: Artist's impression of a supersoft X-ray source: the accretion disk around a white dwarf star is made mainly of helium.

© schematics: F. Bodensteiner; background image: ESO

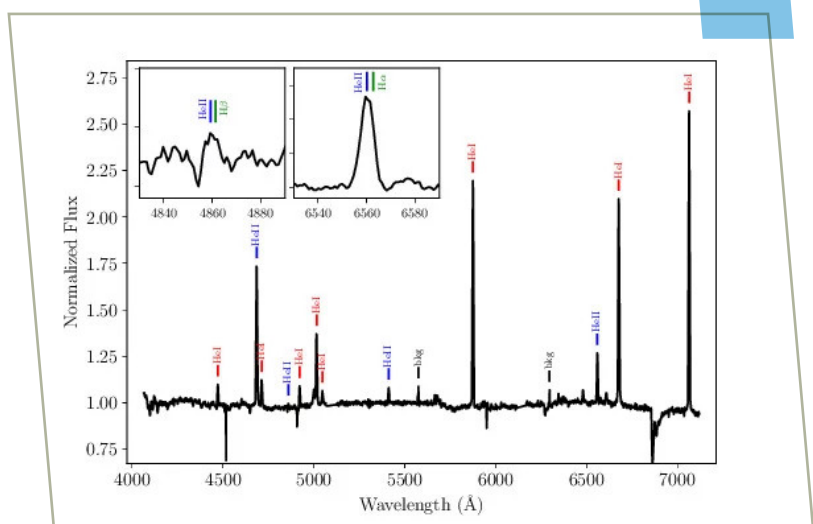


Fig. 2 | Low-resolution optical spectrum of [HP99] 159, taken with the SALT/RSS spectrograph, with labels for the main emission lines, which are all due to helium. (The two 'bkg' labels are residuals of removing sky lines). The insets demonstrate that at two wavelengths, where He- and H-lines are close together, the signal results from He II and not hydrogen.

CONTRIBUTION OF SOUTH AFRICAN TELESCOPES TO THE DISCOVERY OF A NEW WHITE DWARF PULSAR

In a significant advancement in stellar evolution research, an international team of astronomers, including South African researchers from the South African Astronomical Observatory (NRF-SAAO), the University of Cape Town (UCT), and the South African Radio Astronomy Observatory (SARAO), discovered a rare spinning white dwarf star in a binary system. This discovery, made using various telescopes including the Southern African Large Telescope (SALT) and the MeerKAT radio telescope, provides new insights into the role of magnetic fields in stellar evolution. The study, published in *Nature Astronomy*, describes the white dwarf pulsar J191213.72-441045.1 (J1912-4410), a system with an orbital period of just over 4 hours and a white dwarf rotation period of approximately 5 minutes.

White dwarfs, the remnants of low-mass stars that have exhausted their fuel, offer valuable insights into stellar formation and evolution. This newly identified pulsar system, only the second known of its kind, supports the dynamo model, which posits that white dwarfs have powerful electromagnetic generators in their cores. The research highlighted the capabilities of South African telescopes in providing critical data, including pulsed polarization and spectral lines from SALT and precise radio pulses from MeerKAT, confirming the white dwarf pulsar nature of J1912-4410. This discovery aligns with predictions of the dynamo model and underscores the collaborative efforts of South African and international astronomers in advancing the understanding of supernova origins and stellar magnetic fields.

Fig 1: An artist's impression of a White Dwarf pulsar (credit: Mark Garlick)

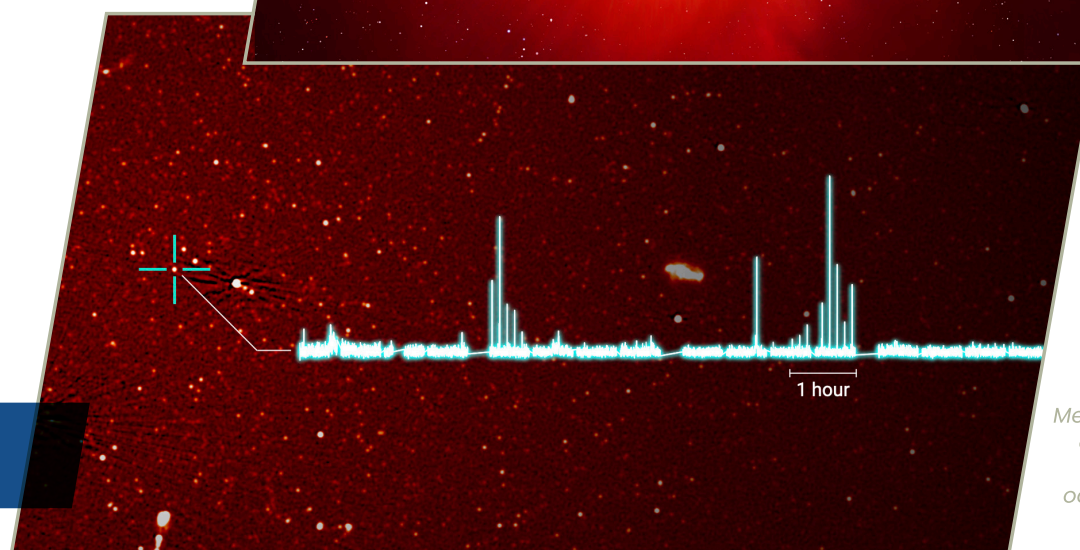
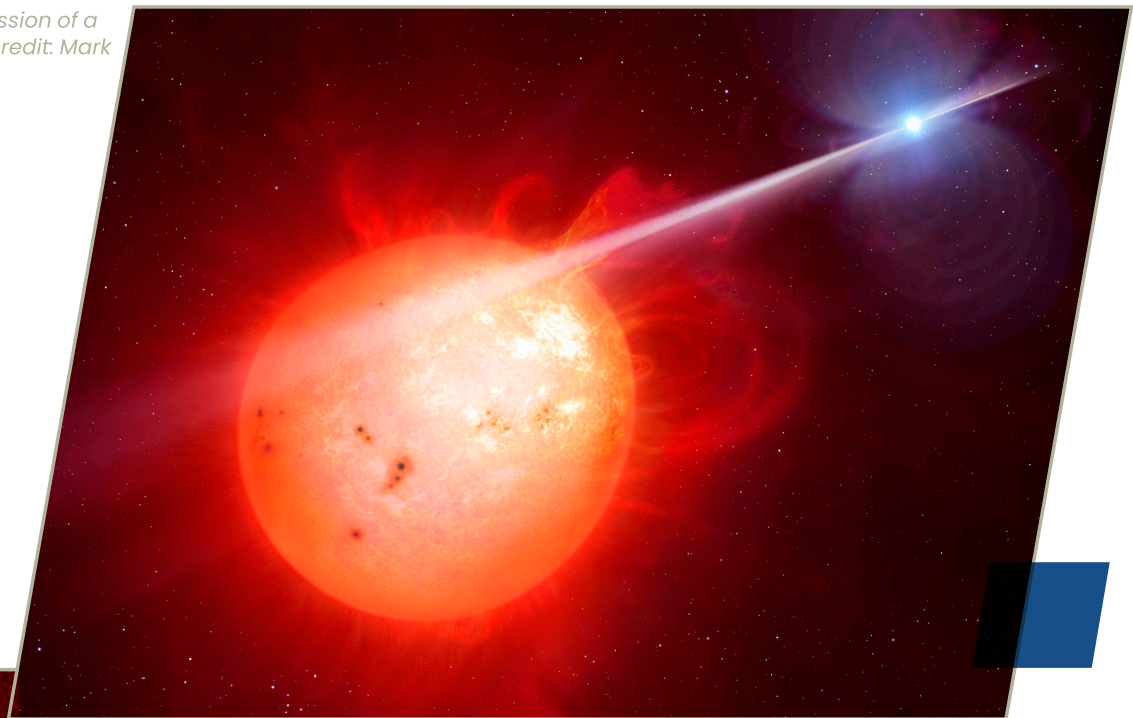


Fig 2: A radio image from MeerKAT showing the position of J1912-4410, plus the radio light curve showing the occasional 5 min spin pulses (credit: Ian Heywood).

DISCOVERY OF EVOLVING MATERIAL AROUND CENTAUR (2060) CHIRON

Observations made during a stellar occultation by the 1.9-meter telescope at the South African Astronomical Observatory (NRF-SAAO) have revealed evolving material orbiting around the enigmatic Centaur (2060) Chiron. This groundbreaking discovery challenges previous interpretations of Chiron's structure, suggesting dynamic changes rather than a stable two-ring system.

Led by Amanda Sickafoose, Principal Investigator and Senior Scientist at the Planetary Science Institute, the study titled "Material Around the Centaur (2060) Chiron from the 2018 November 28 UT Stellar Occultation," published in *The Planetary Science Journal*, showcases dips in starlight as Chiron's nucleus and surrounding material obscured the stellar background. The findings indicate that the observed material, located 300 to 400 kilometers on either side of Chiron, is dynamically variable, contradicting the notion of a stable ring system.

The observations effectively ruled out the presence of a substantial global atmosphere around Chiron, marking a departure from past interpretations and pointing towards a dynamic environment surrounding this Centaur. This contrasts with the stable two-ring system detected at Chariklo, the largest Centaur object.

Continued observations of Chiron and other minor planets are essential to unravel the unique characteristics of these objects. Understanding the mechanisms governing the formation and evolution of ring-like structures around small celestial bodies remains a key focus for future studies.

This discovery, funded in part by the National Science Foundation (NSF) Astronomy and Astrophysics Research Grant and a NASA grant awarded to the Planetary Science Institute, underscores the crucial role of the NRF-SAAO telescope in unveiling the mysteries of celestial bodies within our solar system. Amanda Sickafoose conducted these observations remotely from the NRF-SAAO in Cape Town, using the 1.9-meter telescope situated at the NRF-SAAO site in Sutherland, South Africa.



Image: The 1.9-meter telescope at Sutherland, South Africa, shown from the base, with the SHOC (Sutherland High-Speed Optical Camera) instrument. Amanda Sickafoose was the Principal Investigator in the project to build SHOC using a grant from the S. African National Research Foundation. Credit: A. Sickafoose/PSI.



SUPPORTING DEPARTMENTS

LIBRARY/INFORMATION SERVICES

DEVELOPMENTS IN THE NRF-SAAO LIBRARY SYSTEM

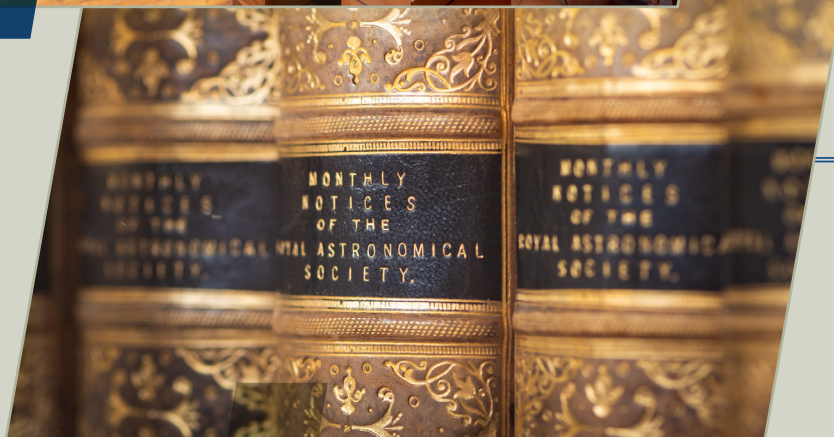
Significant advancements have been made within the South African Astronomical Observatory (NRF-SAAO) library system, primarily driven by the migration to a Software-as-a-Service (SaaS) environment. This transition was necessitated by a crash that occurred at iThemba LABS, the previous hosting site for the library system. By moving to a SaaS environment, the library system now operates on a shared platform that facilitates resource sharing among various facilities within the National Research Foundation (NRF), including the NRF-SAAO, iThemba LABS, and the South African Radio Astronomy Observatory (SARAO).

Despite the migration efforts, there has been a backlog in updating the system due to the transition process. To expedite the updates, assistance was sought from students at the University of the Western Cape (UWC), who played a crucial role in accelerating the progress. Their involvement has been instrumental in addressing the backlog and ensuring that the library system remains up-to-date and efficient.

The NRF-SAAO library actively celebrated South African Library Week this year. The primary aim of this initiative was to raise awareness and promote the library services among NRF-SAAO staff, particularly new members. During this event, staff members were informed about the wide range of services offered by the NRF-SAAO library and the vital role that librarians play within the organisation. It was also an opportunity to address misconceptions among non-astronomers who believed that the library primarily caters to astronomers. Librarians emphasized that the services provided by the library are available to all staff members, irrespective of their specific fields. Additionally, the NRF-SAAO library has established Memoranda of Understanding with other higher education institutions, allowing NRF-SAAO staff members to access resources from these institutions, even if they are not registered there.



Looking ahead, the NRF-SAAO library has a series of activities planned for the remainder of the year. These initiatives aim to further enhance the library's services and ensure its continued relevance and effectiveness.



INFORMATION TECHNOLOGY (IT) SERVICES

The past year at the South African Astronomical Observatory (NRF-SAAO) has been marked by a series of challenges alongside significant achievements. Among the hurdles faced were prolonged periods of load-shedding and generator malfunctions at both the Sutherland and Cape Town sites. These issues resulted in considerable downtime across the data centres and throughout the observatory. Following extensive repairs, the generators are now on standby, and a welcome reduction in load-shedding has greatly enhanced the reliability of services.

Network security and email reliability have been top priorities due to their impact on all staff members. Earlier this year, network issues related to the firewalls were successfully resolved through collaborative efforts with TENET and SARAO.

In November of last year, the departure of a team member from the Cape Town site necessitated the redistribution of their workload among the remaining staff. In March 2024, the loss of a senior team member was also experienced. Recruitment efforts are currently underway to ensure operational continuity.

Despite these challenges, significant milestones have been achieved. Replacement storage units were procured and deployed at each site, mitigating the risk of running out of storage space and minimising potential issues from aging hardware. The migration to these new units has progressed smoothly, demonstrating their resilience and ease of maintenance.

Efforts have also been directed towards improving network reliability between the Cape Town and Sutherland sites through multiple fibre connections. In response to a comprehensive security audit, servers have been diligently patched to bolster defence mechanisms. Additionally, the replacement of outdated network switches has effectively minimised the risk of future network outages. These proactive measures underscore the commitment to fortifying infrastructure and ensuring uninterrupted operations.

Network security and email reliability have been top priorities due to their impact on all staff members.



SCIENCE ENGAGEMENT AND OUTREACH



SALT COLLATERAL BENEFITS PROGRAMME (SCBP) EDUCATION AND OUTREACH IN 2023

The year 2023 has been prosperous and successful for the SALT Collateral Benefits Programme (SCBP). With the support of the NRF-SAAO staff, the team has continued to implement science education, communication, and awareness programmes, alongside community development and support initiatives in Sutherland. The SCBP has relentlessly communicated the beauty, relevance, and power of astronomy through tangible programmes aimed at diverse audiences, including school-based learners, teachers, university students, women and girls, media, indigenous knowledge holders, science centres, and the general public. Activities have included teacher training and support programmes, curriculum-based learner activities, extra-curricular learner activities, job shadow and career programmes, collaborative outreach with other organisations, day and night tours, capacity-building programmes, open nights, stargazing sessions, and public lectures.

TEACHER TRAINING, DEVELOPMENT, AND SUPPORT

Empowering and inspiring teachers is fundamental to improving classroom practice and enhancing the appreciation of mathematics and science. The SCBP facilitates teacher development and support workshops designed to improve teacher content knowledge, attitudes, and pedagogical skills. These workshops share relevant astronomy-related content and innovative pedagogical approaches, including hands-on activities, computer-based simulations, model use, direct sky observations, and internet-based activities.

In 2023, the SCBP teacher development and support team, comprising Buzani Khumalo and Sivuyile Manxoyi, conducted a series of intensive workshops based on the theme “Earth and Beyond” in the Eastern Cape, Western Cape, and Gauteng provinces, reaching a total of 757 teachers. The first workshop, held on 20 February in collaboration with the IAU Astronomy Office for Development, involved 8 primary school teachers and utilised the “Blue Dot” resource material developed by the IAU office for astronomy education.

Working with the Association for Education Transformation (ASSET), two sessions at Zandivliet Secondary School and Wallacedene Secondary School reached 41 and 38 high school teachers respectively. These sessions used astronomy as a context for teaching mathematics and physical science. Further workshops were held in Sterkspruit and Aliwaal North from 19–21 September, focusing on senior phase natural science topics such as seasons, tides, telescopes, the solar system, galaxies, and the lifecycle of stars. The interactions with teachers in Aliwaal North were particularly enlightening, providing valuable insights into teaching challenges and solutions. A joint workshop was held at the SAASTA offices in Pretoria on 4 October, focusing on Grade 8 and 9 teachers from

Limpopo and Mpumalanga. This workshop aimed to demonstrate the application and relevance of physical science and mathematics content using astronomy. The SCBP team also shared their experiences at the IAU OAE workshop at NRF-SAAO on 5 October, discussing effective teaching strategies, misconceptions, and the use of various educational tools and methods.

The final phase of workshops, held virtually from 10–12 October in collaboration with the Western Cape Education Department, drew over 500 participants from across the Western Cape. These workshops, hosted at the Cape Town Science Centre, covered content for Grades 3–4, 5–6, and 8–9, with positive feedback from teachers and curriculum advisers. The WCED plans to send Natural and Physical Science curriculum advisers to Sutherland next year for further engagement.



LEARNER SUPPORT PROGRAMMES

The SCBP learner-based programmes include curriculum-aligned activities such as lab-based workshops, co-curricular activities like astronomy quizzes and debates, and extra-curricular programmes focusing on career information, robotics, holiday activities, and girls' programmes.

Career-Based Programmes

The Job Shadow Programme resumed full capacity in 2023, accommodating 29 learners in Grades 10, 11, and 12 during two sessions in June and October. The programme continues to attract learners from various provinces and has grown in popularity. Participants gain insights into various careers in astronomy, engineering, and information technology, with many pursuing degrees in Science and Astrophysics. The programme manager, Mrs Natalie Jones, also assisted a French-South African student who job shadowed with the NRF-SAAO director, Professor Petri Väisänen.

Career-based exhibitions included participation in the CHIETA Career Exhibition in Westridge, Mitchells Plein, and a career exhibition organised by the Seventh Adventist Church in Langa. Additionally, a National Student Financial Aid Scheme (NSFAS) workshop in Sutherland informed learners and parents about funding opportunities for technical studies.

Curriculum-Aligned Programmes

The Rising Star Tutoring Project, launched in collaboration with Thandokhulu High School in Mowbray, aims to improve Grade 12 physical science performance through extra classes and curriculum-based exercises. The project achieved excellent results in its first year, with all participating learners passing and the top learner achieving 97% in physical science.

Girl-Focused Programmes

A hybrid event at Langa High School in May, led by Ms Buzani Khumalo and Mr Cedric Jacobs, involved 24 girl learners and served as a precursor to the national women's programme in August. A subsequent Women's Day event at the NRF-SAAO auditorium in September featured female scientists and engineers addressing and inspiring 70 girl learners.

In July, the Chairperson of the Parliamentary Portfolio Committee on Science and Technology, Hon. Nompandolo Mkatswa, led a group of 100 Gauteng-based girls on a two-day visit to Sutherland. This programme exposed the girls to astronomy and engineering, dark skies, indigenous astronomy, and mental health benefits. Another visit by 50 girls from Gauteng, led by the Gauteng MEC for Education, Hon. Matome Chiloane, included presentations on astronomy research, mental health, and career opportunities.

Special Outreach Programmes

Collaborations with Dartmouth College and NASA-linked astronomers facilitated educational activities in Cape Town and Sutherland, involving over 500 learners. An art competition for primary schools attracted 4,392 entries, encouraging learners to express their perceptions of astronomy through art.

The SCBP also engaged in outreach with organisations such as Tomorrow Trust and Outreaching Angels, providing educational and support programmes for vulnerable and disadvantaged learners. Efforts to develop inclusive outreach continued with programmes for deaf learners and other special needs groups.

AstroQuiz

AstroQuiz, an initiative by SAASTA and administered by the South African Astronomical Observatory (NRF-SAAO), has captivated young learners since its inception by the SciBono Discovery Centre in 2005. Hosted on a user-friendly app developed by NRF-SAAO, the latest edition saw a remarkable increase in participation, with 570 schools and 1060 teams registering. The transition to a digital platform has transformed AstroQuiz, facilitating seamless participation and engaging students with interactive and immersive astronomical content. This digital evolution reflects NRF-SAAO's commitment to leveraging technology for broader science education outreach, inspiring a new generation of stargazers and fostering a lifelong passion for astronomy.



SCIENCE ENGAGEMENT AND OUTREACH

NATIONAL SCIENCE WEEK AND FESTIVALS

The SCBP participated in National Science Week celebrations in KwaZulu-Natal, Northern Cape, and Western Cape, reaching over 1,000 learners and members of the public. Festival participation included the Kirkwood Festival, Techno X in Sasolburg, and the Namaqua Flower Festival, engaging thousands of attendees in astronomy-related activities.

SCIENCE COMMUNICATION CAPACITY BUILDING

A series of meetings and workshops led to the delivery of an astronomy education and outreach programme for science centre staff, supporting the development of astronomy programmes and exhibits at science centres in South Africa. A new external newsletter on astronomy research and technological developments was established, featuring interviews with NRF-SAAO staff.

SALT AND NRF-SAAO IMPACT COMMUNICATION

Dr Daniel Cunnama and Mr Sivuyile Manxoyi addressed a special government group on the benefits of astronomy research infrastructure in Sutherland, highlighting community benefits through astro-tourism. Presentations to Rutgers University and at the STFC conference in Czech Republic underscored the economic, social, educational, and cultural impacts of SALT. A documentary highlighting SALT's achievements and impact is in development.

PUBLIC ENGAGEMENT AND AWARENESS

The Cape Town Observatory hosted 24 open nights in 2023, attracting 2,612 participants. The SCBP also participated in the Galileo Open Air Cinema event at Kirstenbosch Gardens, engaging 350 attendees with a talk by Dr Daniel Cunnama on the science behind "Interstellar."

ASTRONOMY FOR MENTAL HEALTH

A joint SCBP-IAU OAD programme at the Community Mental Health and Psychiatry Foundation in Cape Town used astronomy to improve mental health, with positive effects observed among participants.

THE PRESIDENTIAL IMBIZO

The SCBP, in collaboration with NRF facilities and DSI institutes, exhibited at the Presidential Imbizo addressed by President Cyril Ramaphosa in Paarl, engaging 107 visitors.

NEW SUTHERLAND MANAGER

Ms Anthea Oliphant was appointed as the new SCBP Sutherland Manager on 1 August 2023, succeeding Mr Anthony Mietas.

TOURS AND UNIVERSITY ENGAGEMENT

The Sutherland Observatory resumed normal tour operations post-COVID-19, attracting numerous visitors and generating income for the facility. University students from institutions such as the University of Venda and UCT visited the observatory for educational tours and stargazing sessions.

COMMUNITY DEVELOPMENT AND SOCIAL INTERVENTIONS

The Sutherland Community Development Centre received funding for new computers and improvements, enabling new training opportunities. Community support initiatives included cultural events, donation drives, and educational programmes for local schools and vulnerable groups.

INDIGENOUS ASTRONOMY

Collaborations with indigenous knowledge holders and the Centre for Astronomical Heritage have led to the development of indigenous astronomy tours and educational materials, enriching the NRF-SAAO visitor experience.

CONCLUSION

The year 2023 has been exceptional for science engagement and socio-economic development. The SCBP extends gratitude to the SALT Board, the NRF-SAAO Director, and management for their unwavering support. The commitment and dedication of SCBP staff in Cape Town and Sutherland have been instrumental in the success of the various educational and community programmes.



NOTABLE MEETINGS

EUROPEAN ASTRONOMICAL SOCIETY'S ANNUAL MEETING 2023

10-14 JULY - KRAKÓW, POLAND



The South African Astronomical Observatory (NRF-SAAO) and the Southern African Large Telescope (SALT) made significant contributions to the European Astronomical Society's Annual Meeting in Kraków, Poland. Their participation underscored the importance of Africa-Europe collaborations in astronomy and highlighted the pivotal role of African astronomy on the global stage.

A highlight of the conference was a Special Session dedicated to Africa-Europe collaboration, which focused on the anticipated impact of the 2024 International Astronomical Union General Assembly (IAU GA) on the development of astronomy. This session served as a platform for discussing future projects and initiatives, aiming to strengthen ties between the two continents and explore new opportunities for cooperation in astronomical research and education.

The session included a talk by Dr. Daniel Cunnama on "Advancing Science Engagement: The Impact of the South African Astronomical Observatory and SALT," providing insight into NRF-SAAO's efforts to enhance science communication and public engagement. Through initiatives involving SALT, NRF-SAAO has played a pivotal role in advancing astronomical

research and fostering a deeper appreciation of the universe among the general public.

NRF-SAAO and SALT's involvement in the EAS Meeting not only highlighted their achievements and ongoing projects but also extended an invitation to the international astronomical community to Africa for the upcoming IAU GA. This invitation reflects the growing significance of African astronomy and the continent's potential to contribute to our understanding of the universe.

Overall, the participation of NRF-SAAO and SALT in the EAS Meeting emphasized the importance of international collaboration in astronomy, the impact of public engagement in science, and the role of Africa as a rising star in the astronomical community.

ASTRONOMY TOWN MEETING

21-23 SEPTEMBER 2023

The South African astronomy community recently convened for the Astronomy Town Meeting on September 21st and 22nd, 2023. This significant gathering, held in a hybrid format and hosted by the South African Astronomical Observatory (NRF-SAAO) and the South African Radio Astronomy Observatory (SARAO), represented a crucial moment in shaping the future of astronomy in the nation. The meeting brought together esteemed scientists, researchers, and stakeholders to discuss the evolving landscape of astronomy in South Africa.

Critical discussions and resolutions emerged from the meeting, outlining the roadmap for the next decade of South African astronomy. These outcomes are expected to bring transformative changes, further propelling the country to the forefront of astronomical research and discovery.

AFRICAN REGIONAL SHAW-IAU WORKSHOP ON ASTRONOMY FOR EDUCATION

3-5 OCTOBER 2023



The African Regional SHAW-IAU Workshop on Astronomy for Education was held from 3-5 October 2023 at the South African Astronomical Observatory (NRF-SAAO) in Cape Town. This collaborative event, funded by the SHAW Prize Foundation and involving the IAU Office of Astronomy for Education (OAE) and AfAS, aimed to promote astronomy in African education. Participants included teachers, National Astronomy Education Coordinators (NAECs), and science centre personnel.

The workshop focused on integrating astronomy into school curriculums, enhancing astronomy education in science centres, and promoting extracurricular activities to spark interest in astronomy. Key discussions covered strategies for developing astronomy education, evaluating astro-tourism training, and assessing learner performance in science. The event also featured cultural exchanges, highlighting Africa's rich heritage and its connection to astronomy. The workshop fostered collaborations and initiatives, such as expanding the Astro Quiz across Africa, marking a significant step towards advancing astronomy education on the continent.

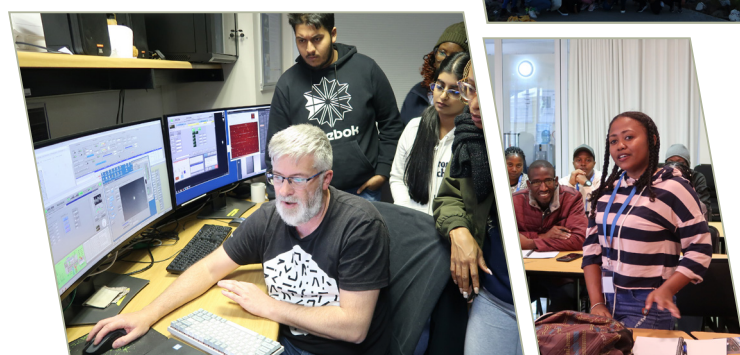


44TH INTERNATIONAL SCHOOL FOR YOUNG ASTRONOMERS (ISYA)

19 NOV – 9 DEC 2023

The 44th International School for Young Astronomers (ISYA) took place at the South African Astronomical Observatory (NRF-SAAO) from 19 November to 9 December 2023. This three-week program targeted postgraduate students from regions with limited exposure to current astrophysics theory and observations. The curriculum included lectures and practical sessions covering various fields of astronomy, delivered by expert lecturers from around the world. A significant part of the program was held at the Sutherland Observatory, providing students with hands-on training in observational techniques. Despite logistical challenges, the students gained valuable experience using telescopes like SALT, the 1.9m, Lesedi, and the 1m, and attended lectures by renowned astronomers.

Upon returning to Cape Town, students continued with intensive lectures and group projects, where they worked with SALT spectroscopic data to derive redshifts and chemical compositions of stars and galaxies. The program also included practical sessions on career development, CV writing, and ethics in astronomy, along with leisure activities like visits to Cape Point, Boulders Beach, and Kirstenbosch Gardens. The event culminated in a closing dinner and dance party, celebrating the students' achievements and the successful completion of the school. The ISYA at NRF-SAAO fostered new collaborations and inspired a future generation of astronomers, demonstrating the legacy and impact of the ISYA program.



AMERICAN ASTRONOMICAL SOCIETY (AAS) ANNUAL MEETING IN NEW ORLEANS

7-11 JANUARY 2024

The South African Astronomical Observatory (NRF-SAAO) and the Southern African Large Telescope (SALT) had a prominent presence at the American Astronomical Society (AAS) Annual Meeting in New Orleans from January 7th to 11th, 2024. This participation highlighted NRF-SAAO and SALT's commitment to fostering international collaboration and enhancing the role of Africa in the global astronomy community.

The week began with a presentation to the AAS Strategic Assembly on Sunday, setting the stage for NRF-SAAO and SALT's involvement. The following day, Session 123 focused on "Exploring New Frontiers: Strengthening Africa-US Collaborations in the Golden Age of Astronomy in Africa Towards IAU-GA2024 and Beyond," underscoring the importance of partnerships between Africa and the United States in advancing astronomical research. Session 144 on the same day discussed "Astronomy for a Better World,"

emphasizing the societal impacts of astronomical sciences.

Tuesday featured a brief presentation by Dr. Khotso Mokhele during the morning plenary session, further emphasizing NRF-SAAO and SALT's contributions to global astronomy. The day concluded with the Black in Astro networking dinner, promoting diversity and inclusion within the astronomical community.

Wednesday offered an engaging "In Conversation with Khotso" session at the exhibition theatre space, providing insights into the achievements and future aspirations of NRF-SAAO and SALT.

Overall, NRF-SAAO and SALT's involvement at the AAS Annual Meeting showcased their pivotal roles in advancing astronomical research and education, fostering international collaborations, and promoting diversity and inclusion within the field.

NASSP 20TH ANNIVERSARY SYMPOSIUM

25-26 JANUARY 2024

The NRF-SAAO community recently organized and participated in the NASSP@20 symposium, held at UCT on 25-26 January 2024. This event celebrated two decades of the National Astrophysics and Space Science Programme (NASSP), bringing together alumni, staff, leadership, lecturers, supervisors, and supporters who have contributed to its success in human capacity development.

The symposium was a remarkable event, showcasing inspiring stories from NASSP alumni who have excelled in diverse fields. These individuals have become leaders in major science projects, excelled in research, developed graduate programs across Africa, and made significant impacts in education, finance, and health. A standout talk was given by former NRF-SAAO student Mellony Spark, who shared her journey from astronomy to the financial sector, where she now focuses on impactful investments in Africa. The event highlighted the broad and successful careers of NASSP alumni and the program's profound impact over the past 20 years.



NRF-SAAO STAFF



NRF-SAAO EXECUTIVE

IN THE REPORTING PERIOD OF APRIL 2023 TO MARCH 2024,
THE NRF-SAAO EXECUTIVE COMPRISED THE FOLLOWING:

PROF. PETRI VÄISÄNEN

Managing Director: NRF-SAAO

MR KEVINDRAN GOVENDER

Director: IAU OAD

MR EUGENE LAKEY

Manager: Finance and Operations

PROF. STEPHEN POTTER

Head: Astronomy

DR RAMOTHOLO SEFAKO

Head: Telescope Operations

DR ENCARNI ROMERO COLMENERO

Head: SALT Astronomy Operations

MR PAUL RABE

Head: SALT Technical Operations

MR HITESH GAJJAR

Head: Instrumentation

MR SIVUYILE MANXOYI

Manager: SALT Collateral Benefits Programme

MRS LINDA TOBIN

Manager: Human Resources

MR IRIWAAN SIMON

Manager: Information Technology

**ASSOC / PROF. VANESSA MCBRIDE/
DR ROSALIND SKELTON**

Head: Research

STAFF HIGHLIGHTS

RECOGNITION FOR MUNIRA HOOSAIN: DSI-NDONI MCUNU FELLOWSHIP AWARD

Congratulations to SAAO/UCT PhD student Munira Hoosain, who was recently awarded the DSI-Ndoni Mcunu Fellowship in the Doctoral Awards category at the Department of Science and Innovation: Women in Science awards.

She is currently working with Dr. Rosalind Skelton, Associate Professor Sarah Blyth, and the LADUMA survey collaboration to determine how the amount of cool gas in galaxies, from which stars form, evolves over time. The fellowship, named in honour of the late Ndoni Mcunu, founder of "Black Women in Science," recognises the awardees' outstanding ability and potential in research. It aims to enhance their research experience and output, encouraging more young women to complete research degrees.



Munira Hoosain

STAFF HIGHLIGHT: DR. VANESSA MCBRIDE'S PRESTIGIOUS APPOINTMENT



Dr. Vanessa McBride

Dr. Vanessa McBride has been appointed Science Director at the International Science Council (ISC) in Paris. This prestigious role recognises her significant contributions to the scientific community, particularly through her work with the Office of Astronomy for Development (OAD), a collaborative initiative of the International Astronomical Union (IAU) and the National Research Foundation (NRF) of South Africa. Dr. McBride's appointment underscores her dedication to advancing scientific research and policy on a global scale.

Her efforts at the OAD, supported by the Department of Science and Innovation (DSI), have been pivotal in promoting astronomy for sustainable global development. As she transitions to her new role at the ISC, Dr. McBride's journey from her early education in Cradock to her significant achievements in astronomy highlights the importance of robust support structures in nurturing scientific talent and fostering international collaboration.

FAREWELL TO DIRECTOR PETRI VÄISÄNEN

On Friday, 8 March, the South African Astronomical Observatory (SAAO) community gathered to bid farewell to Director Petri Väisänen at a Star Wars-themed event, a tribute to Petri's love for the franchise. The gathering included SAAO and SALT staff, retired personnel, colleagues from various NRF facilities, and representatives from UCT and other institutions. The event began with Daniel Cunnamo serving as emcee, who humorously engaged the audience in fluent Shyriiwook. The opening tribute was delivered by Dr Angus Paterson, NRF's Acting DCEO of National Research Infrastructure Platforms, via Zoom. Subsequent speakers included SARAO's MD, Ms Pontsho Maruping, Prof. Patrick Woudt from UCT's astronomy department, and Dr Zara Randriamanakoto, a former student of Petri. Each speaker shared heartfelt tributes, with Zara's emotional address particularly touching the audience.

Petri, clearly moved by the tributes, maintained his composure by adhering to his prepared script and presentation. He reflected on his and his family's time at SAAO, expressing admiration for the staff and profound gratitude for their support. Minna, Petri's wife, echoed his sentiments, barely holding back tears. The farewell event was a heartfelt celebration of Petri's tenure, marked by his open-door policy, resilience, and dedication, leaving a lasting impact on the SAAO community.



On Friday, 8 March, the South African Astronomical Observatory (SAAO) community gathered to bid farewell to Director Petri Väisänen at a Star Wars-themed event, a tribute to Petri's love for the franchise.

STAFF LIST

THIS LIST INCLUDES CASUAL STAFF, HONORARY FELLOWS AND STUDENTS WORKING AT NRF-SAAO BETWEEN APRIL 2023 AND MARCH 2024. STAFF ARE LISTED IN ALPHABETICAL ORDER, ACCORDING TO SURNAME.

SURNAME, NAME	TITLE	GENDER	POSITION	MUNICIPALITY
Abrahams Florine	Ms	Female	Casual	Cape Town
Adams, Shamiel	Mr	Male	Software Engineer	Cape Town
Adonis, Stephano	Mr	Male	CNC Machinist	Cape Town
Appolis, Wade	Mr	Male	CNC Machinist	Cape Town
April, Koos	Mr	Male	Driver Maintenance	Sutherland
Baadjies, Dawid	Mr	Male	Driver Maintenance	Sutherland
Baadjies, Elizabeth	Mrs	Female	Receptionist	Sutherland
Banda, Richard	Mr	Male	Mechatronics Engineer	Sutherland
Banda, Thabo	Mr	Male	Maths and Science Educator	Sutherland
Bernardo, Jean	Mr	Male	IT Support Technician	Sutherland
Bershady, Matthew	Dr	Male	SARChi Chair	Cape Town
Bichanga, Brian	Mr	Male	MSc Student	Cape Town
Bonokwane, Kelebogile	Ms	Female	PhD Student	Cape Town
Booyesen, Paul	Mr	Male	IT Systems Administrator	Sutherland
Botha, Lucian	Mr	Male	Senior Systems Engineer	Cape Town
Breytenbach, Hannes	Mr	Male	PhD Student	Cape Town
Brink, Jaco	Mr	Male	MSc Student	Cape Town
Brink, Janus	Mr	Male	Software Engineer	Cape Town
Buckley, David	Dr	Male	Astronomer	Cape Town
Chattopadhyay, Sabyasachi	Dr	Male	Post-Doctoral Fellow	Cape Town
Chandra, Sunil	Dr	Male	Post-Doctoral Fellow	Cape Town
Chingozha, Tawanda	Mr	Male	OAD Intern	Cape Town
Chipembe, Bryne	Mr	Male	SALT Software Engineer	Sutherland
Christian, Brendt	Mr	Male	Mechanical Technician	Sutherland
Christians, Alrin	Mr	Male	Mechanical Design Draughtsman	Sutherland
Claassen, Siphosethu	Mrs	Female	Human Resources Officer	Cape Town
Cloete, Valencia	Mrs	Female	Office and Grant Manager	Cape Town
Crause, Lisa	Dr	Female	Scientist	Cape Town
Cunnamá, Daniel	Dr	Male	Science Engagement Astronomer	Cape Town
DeBeer, Gideon	Mr	Male	MSc Student	Cape Town
De Bruin Juan	Mr	Male	Casual	Sutherland
De Bruyn Jeremeen	Ms	Female	Casual	Cape Town
De Villiers, Mikhail	Mr	Male	MSc Student	Cape Town
De Water, Katriena	Ms	Female	Housekeeper and Mirror Cleaner	Sutherland
De Wet, Simon	Mr	Male	PhD Student	Cape Town
De Young, Theresa	Ms	Female	Librarian	Cape Town
Doman, Shamin	Mr	Male	Science Engagement Intern	Cape Town
Egbo, Daniel	Mr	Male	PhD Student	Cape Town
Erasmus, Nicolas	Dr	Male	Instrumentation Scientist	Cape Town
Featherstone, Lara	Ms	Female	MSc Student	Cape Town
Firth, Andrew	Mr	Male	MSc Student	Cape Town
Fischer, Dalene	Mrs	Female	Financial Controller	Cape Town
Fransman, Timothy	Mr	Male	Mechanical Technician	Sutherland
Gajjar, Hitesh	Mr	Male	Head of Instrumentation	Cape Town
Geduld Franklin	Mr	Male	Casual	Cape Town
Geen, Ulrich	Mr	Male	MSc Student	Cape Town
Genade, Anja	Ms	Female	PhD Student	Cape Town
Gibbons, Denville	Mr	Male	Mechanical Assistant	Sutherland

SURNAME, NAME	TITLE	GENDER	JOB TITLE	MUNICIPALITY
Gobeni Lusanda	Ms	Female	Intern	Cape Town
Govender, Kevindran	Mr	Male	Director: IAU OAD	Cape Town
Govender, Pranesthan	Mr	Male	Public Outreach Officer	Cape Town
Groenewald, Daniël	Dr	Female	SALT Astronomer	Cape Town
Hatamkhani, Narges	Dr	Female	Research Fellow	Cape Town
Haupt, Jamie-Lee	Ms	Female	Procurement Assistant	Cape Town
Hannie, Louis	Mr	Male	Facility Manager	Sutherland
Hendricks, Johan	Mr	Male	Driver Maintenance	Sutherland
Hendricks, Malcolm	Mr	Male	CNC Operator	Cape Town
Hercules, Nazli	Mrs	Female	Personal Assistant	Cape Town
Hettlage, Christian	Dr	Male	SALT Software Engineer	Cape Town
Higgo, Liam	Mr	Male	MSc Student	Cape Town
Hlakola Moloko	Mr	Male	Software Developer	Cape Town
Hoosain, Munira	Ms	Female	OAD Intern	Cape Town
Jacobs, Amelde	Ms	Female	Casual Worker	Cape Town
Jacobs, Cedric	Mr	Male	Education Officer Assistant	Cape Town
Jacobs, Nicolaas	Mr	Male	Mechanical Trainee Assistant	Sutherland
Januarie Karel	Mr	Male	Casual	Sutherland
Jones, Natalie	Mrs	Female	Communication and Resource Officer	Cape Town
Jonker Anita	Ms	Female	SALT Software Developer	Cape Town
Kabini, Sunnyboy	Mr	Male	SALT Software Engineer	Cape Town
Kamfer, Hilton	Mr	Male	Mechanical Technician	Sutherland
Kayyunnaparayil Thomas, Jessymol	Ms	Female	Post-Doctoral Researcher	Cape Town
Kgengwe, Mpho	Mr	Male	Purchasing Officer	Cape Town
Khangale, Zwido	Dr	Male	PhD Student	Cape Town
Khumalo, Buzani	Miss	Female	Education Officer	Cape Town
Klaasen, Dillon	Mr	Male	SALT Software Engineer	Cape Town
Klaaste, Petrus	Mr	Male	Driver/ Maintenance	Sutherland
Klein , Annalize	Ms	Female	Casual	Cape Town
Klein, Francois	Mr	Male	Tour Guide	Sutherland
Klein Meagan	Ms	Female	Casual	Cape Town
Klein, Sina	Mrs	Female	Hostel Assistant	Sutherland
Knaizev, Alexei	Dr	Male	Astronomer	Cape Town
Koen, Thea	Miss	Female	Telescope Operator	Sutherland
Koeslag, Anthony	Mr	Male	Software Engineer	Cape Town
Koorts, Willem	Mr	Male	Electronics Technician	Cape Town
Kortje, Sofia	Mrs	Female	Housekeeper	Sutherland
Kotze, Enrico	Dr	Male	Astronomer	Cape Town
Kubheka, Duduzile	Ms	Female	Project Coordinator	Cape Town
Kuhn, Rudolf	Dr	Male	SALT Astronomer	Cape Town
Lakey, Eugene	Mr	Male	Manager: Finance and Operations	Cape Town
Lancaster, Tamara	Ms	Female	MSc Student	Cape Town
Lande, Cornelius	Mr	Male	Casual Worker	Cape Town
Ledimo, Mampho	Ms	Female	OAD Intern	Cape Town
Ledwada, Gontse	Ms	Female	Honours Student	Cape Town
Lekoloane, Moleboge	Mr	Male	BRICS Astronomy Intern	Cape Town
Lethetsa, Katileho	Mr	Male	Intern	Cape Town
Lewis, Sanchia	Ms	Female	Safety and Site Officer	Cape Town
Loubser, Egan	Mr	Male	Mechanical Technician	Cape Town
Louw, Rianelda	Ms	Female	Machine Operator	Cape Town
Love, Jonathan	Mr	Male	Mechanical Technician	Sutherland

STAFF LIST

SURNAME, NAME	TITLE	GENDER	JOB TITLE	MUNICIPALITY
Luningo, Nomtha	Ms	Female	Hostel Assistant	Sutherland
Maartens, Deneys	Mr	Male	Software Engineer	Cape Town
Makda, Nazir	Mr	Male	PhD Student	Cape Town
Makungo, Fhumulani	Mr	Male	Science Engagement Intern	Cape Town
Macebele, Nhlavutelo	Mr	Male	SALT Software Developer	Cape Town
Macfarlane, Sally Ann	Dr	Female	Post-Doctoral Research Fellow	Cape Town
Madhanpall, Nikhita	Ms	Female	OAD Big Data Fellow	Cape Town
Maerman, Nkululeko	Mr	Male	Machine Operator	Cape Town
Maharana, Siddharth	Mr	Male	Post-Doctoral Researcher	Cape Town
Mahoro, Antoine	Dr	Male	Post-Doctoral Researcher	Cape Town
Makananise, Thabelo	Mr	Male	Instrumentation Technician	Sutherland
Makoloane, Lehlohonolo	Mr	Male	IT Systems administrator	Cape Town
Makolomakwe, Kgomotso	Ms	Female	Electronics Engineer	Cape Town
Mamo, Alemiye	Mr	Male	PhD Student	Cape Town
Mantungwa, Thembela	Ms	Female	Communications Officer	Cape Town
Manxoyi, Sivuyile	Mr	Male	Head of Salt Collateral	Cape Town
Mashego, Tshepo	Mr	Male	Mechanical Technician	Sutherland
Maqam, Malibongwe	Mr	Male	Systems Administrator	Cape Town
Mashile, Tokelo	Mr	Male	Honours Student	Cape Town
Matlala, Kgothatso	Mr	Male	Electronics Engineer	Cape Town
Matthys, Jan	Mr	Male	Casual Worker	Cape Town
Mbengashe Sibabalo	Ms	Female	Procurement Officer	Cape Town
Mcbride, Vanessa	Dr	Female	Astronomer	Cape Town
Mahluli, Joyful	Ms	Female	OAD Fellow	Cape Town
Mehandiratta, Nidhi	Ms	Female	PHD Student	Cape Town
Meswatu, Jandre	Mr	Male	Casual	Cape Town
Meswatu, Julie	Mr	Male	Manager: Sutherland Site	Sutherland
Mgwatyu, Ayanda	Mr	Male	Site Supervisor	Cape Town
Mgwatyu, Sithembele	Mr	Male	Groundsman	Cape Town
Mkhize, Dumazile	Ms	Female	Intern	Cape Town
Mnisi, Mandle	Mr	Male	Honours Student	Cape Town
Mofokeng, Chaka	Mr	Male	SALT Astronomy Software Developer	Cape Town
Mogotsi, Moses	Dr	Male	Astronomer	Cape Town
Moosa, Surayda	Mrs	Female	Accounts Clerk	Cape Town
Msezeni, Sandiswa	Ms	Female	Intern	Cape Town
Mulaudzi, Avhapfani	Mr	Male	Electronics Technician	Sutherland
Mutobvu, Todani	Ms	Female	SCM Manager	Cape Town
Mvakade, Zuthobeke	Miss	Female	Librarian	Cape Town
Naicker, Tasheen	Mr	Male	Senior Mechanical Engineering	Cape Town
Naluminsa, Elizabeth	Dr	Female	Post-Doctoral Fellow	Cape Town
Ndaba, Bongekile	Mrs	Female	Mechanical Technician	Sutherland
Ndaliso, Xola	Mr	Male	SALT Operator	Cape Town
Nel, Sherelene	Ms	Female	Housekeeper	Sutherland
Ntame, Masixole	Mr	Male	Electronics Assistant	Sutherland
Oliphant, Anthea	Mrs	Female	SCBP Manager	Sutherland
Paul, Bynish	Dr	Male	PhD Student	Cape Town
Pieterse, Jonathan	Mr	Male	SALT Supply Chain & Administration Officer	Sutherland
Potter, Stephen	Dr	Male	Head of Astronomy	Cape Town
Pretorius, Magaretha	Dr	Female	Instrumentation Scientist	Cape Town
Prins, Adneciah	Ms	Female	Casual	Cape Town
Prins, Willem	Mr	Male	Lead Maintenance Assistant	Sutherland
Qodji, Nombali	Ms	Female	Education officer Afas	Cape Town
Rabe, Paul	Mr	Male	SALT Technical Operations Manager	Sutherland
Ramalatswa, Katlego	Mr	Male	MSc Student	Cape Town

SURNAME, NAME	TITLE	GENDER	JOB TITLE	MUNICIPALITY
Randriamampandry, Solohery	Dr	Male	SALT Astronomer	Cape Town
Randriamanakoto, Zara	Dr	Female	Astronomer	Cape Town
Rarivoarinoro, Tombo	Ms	Female	MSc Student	Cape Town
Romero Colmenero, Encarnacion	Dr	Female	Head of SALT Astronomy Operations	Cape Town
Roode, Susan	Ms	Female	Hostel Assistant	Sutherland
Rosie, Kathryn	Ms	Female	Mechanical Engineer	Cape Town
Ryk, Selome	Ms	Female	Hostel Assistant	Sutherland
Saayman, Melanie	Miss	Female	Optical Engineer	Cape Town
Sanker, Sriram	Mr	Male	MSc Student	Cape Town
Sass, Craig	Mr	Male	Head of Mechanical Workshop	Cape Town
Scarrott, Malcolm	Mr	Male	SALT Software Developer	Cape Town
Scheepers, Garthvine	Mr	Male	Casual Worker	Cape Town
Seconna, Lisa	Ms	Female	MSc Student	Cape Town
Sefako, Ramotholo	Dr	Male	Head of Small Telescope Operations	Cape Town
September, Juliana	Miss	Female	Receptionist	Sutherland
Simon, Etienne	Mr	Male	Electronics Technician	Sutherland
Simon, Iriwaan	Mr	Male	Head of IT	Cape Town
Skelton, Rosalind	Dr	Female	SALT Astronomer	Cape Town
Skermant, Russel	Mr	Male	Lead Maintenance Assistant	Sutherland
Snowball, Glenda	Mrs	Female	Financial Officer	Cape Town
Solomon, Nuhaah	Mrs	Female	Office Manager : IAU OAD	Cape Town
Solomons, Kyle	Mr	Male	MSc Student	Cape Town
Stuurman, Jeremy	Mr	Male	Tour Guide	Sutherland
Swanevelder, Pieter	Mr	Male	Electronics Engineer	Cape Town
Taaibos, Sinethemba	Mr	Male	All Sky Monitor Operator	Sutherland
Thambiran, Abigail	Ms	Female	Science Engagement Intern	Cape Town
Thavhana, Pfunzo	Ms	Female	Software Intern	
Tiki, Zodwa	Ms	Female	Afas/OAD Intern	Cape Town
Titus, Keegan	Mr	Male	Electronics Technician	Cape Town
Tobin, Linda	Mrs	Female	Manager: Human Resources	Cape Town
Townsend, Lee	Dr	Male	SALT Astronomer	Cape Town
Väisänen, Petri	Dr	Male	Director: NRF-SAAO	Cape Town
Van de Merwe, Christian	Mr	Male	PhD Student	Cape Town
Van Der Merwe, Nicolaas	Mr	Male	SALT Mechanical Engineer	Cape Town
Van Der Westhuizen, Willem	Mr	Male	SALT Electronics Engineer	Sutherland
Van Dyk, Anke	Ms	Female	PhD Student	Cape Town
Van Gend, Carel	Dr	Male	Software Developer	Cape Town
Van Rensburg, Petro Janse	Ms	Female	PhD Student	Cape Town
Van Wyk, Magdalena	Mrs	Female	Hostel Supervisor	Sutherland
Van Wyk, Patrick	Mr	Male	Tour Guide	Sutherland
Van Wyk, Veronica	Miss	Female	Telescope Operator	Sutherland
Venugopal, Ram	Mr	Male	OAD Project Manager	Cape Town
Vernooi, Claudine	Ms	Female	Tour Guide	Sutherland
Vertue, Dominic	Mr	Male	OAD Intern	Cape Town
Viljoen, Johanna	Ms	Female	MSc Student	Cape Town
Visser, Martin	Mr	Male	CNC Operator	Cape Town
White, Sarah	Ms	Female	Astronomer	Cape Town
Whitlock, Patricia	Prof	Female	Astronomer	Cape Town
Wiid, Eben	Mr	Male	Mechanical Technician	Sutherland
Worters, Hannah	Dr	Female	Astronomer	Cape Town
Xipu, Athule	Ms	Female	Intern	Cape Town
Zibaya, Nomandla	Ms	Female	Procurement Officer	Cape Town

NRF-SAAO STUDENTS



The South African Astronomical Observatory (NRF-SAAO) is proud to host a diverse and culturally rich student body, with participants from around the globe and particularly from other African countries.

During the reporting period, 24 students were supervised by NRF-SAAO staff, resulting in the graduation of 2 PhD and 4 MSc students. Currently, 9 students are pursuing their PhD (5 male and 4 female), 10 students are working towards their MSc (8 male and 2 female), and 1 female student is enrolled in an Honours programme.

STUDENT SUPPORT INITIATIVES:

Enhanced Administrative Support: NRF-SAAO has taken on the administration of NRF bursaries to ensure students receive their stipends monthly without delays. This initiative aims to streamline financial support and minimize administrative burdens on students.

Top-Up Funding: Additional financial support is provided through top-up funding from our research and publication incentives grant. This ensures that all NRF-SAAO-supervised students receive a respectable level of financial support.

Service Work Requirement: In return for the financial support, students are required to contribute 40 hours per year to service work at the observatory. This includes activities such as service observing, assisting with open nights, and participating in school tutoring programmes. These responsibilities help develop essential skills and support NRF-SAAO's activities.

Postgraduate Advisory Committees (PAC): Each PhD student is assigned a PAC, which meets annually with the student and supervisor to evaluate progress. The PAC reviews the research proposal in the first year and identifies potential issues and support needs in subsequent years. While currently optional for MSc students, PAC involvement may become mandatory to ensure progress evaluation for all students.

Office Space and Facilities: NRF-SAAO ensures that adequate and well-equipped office space is dedicated to all students based at the main building. Students also have access to an on-site health clinic and therapist provided by the NRF for staff members.

Skills Development: Regular skills sessions are organized for students, facilitated by NRF-SAAO astronomers, to enhance their knowledge and capabilities.

Weekly Shuttle Service: A weekly shuttle service is provided to transport students to the University of Cape Town (UCT), enabling them to participate in the Astronomy Department's writing circle, journal club, and astro lunch.

Social Interaction Budget: A modest budget for social functions allows students to organize their own opportunities for social interaction, in accordance with NRF finance regulations

These initiatives reflect NRF-SAAO's commitment to providing comprehensive support to our students, ensuring their academic success and professional development within the field of astronomy.

GRADUATED STUDENTS (PHD)

**BYNISH PAUL**

Research Title: Narrow-Line Seyfert Galaxies and their role in the general model of Active Galactic Nuclei

Supervisors: Prof. Hartmut Winkler (UJ) and Prof. Stephen Potter (NRF-SAAO/UJ)

We analyse medium resolution optical spectra of 14 narrow-line Seyfert 1 galaxies with average to strong iron emission. The targets were observed several times over a 2-yr period to probe the nature of spectral variations. Parameters determined from fitting the line profiles include relative strength, width, and asymmetry.

We explore the applicability of various profile combinations to $H\beta$. We achieve satisfactory fits using three components: the narrow and broad components characteristic of all Seyfert 1 galaxies and that are reasonably represented by Gaussian profiles, and an intermediate component with width similar to that of the Fe II lines. This intermediate component accounted for the largest fraction of the $H\beta$ flux in most of our sample, especially when fitted with a Lorentzian instead of a Gaussian profile. This Lorentzian component improves the overall $H\beta$ fits in most cases. In contrast to many other types of active galactic nucleus, no dramatic spectral changes were detected in our sample over the 2-yr period spanning this study, even though some of our targets are known for large and rapid X-ray variability. In particular, we find the variability of the Fe II lines relative to the $H\beta$ intermediate component to be minimal. For the [O III] lines, we identified asymmetries in almost all our targets well represented by two Gaussians: a primary central and a second blueshifted component. These may signify different gas dynamics connected with nuclear outflow. As in several previous studies, we identify a clear correlation between [O III] asymmetry and its core component width.

GRADUATED STUDENTS (MSC)



JACO BRINK (UCT/SAAO)

Research Title: Spectroscopic and Photometric Observations and Analysis of Compact Binaries

Supervisors: Prof David Buckley (NRF-SAAO/UCT/UFS), Prof Paul Groot (NRF-SAAO/UCT/Radboud U)

I present the results of time resolved optical spectroscopic and photometric observations of three recently discovered transient compact binary systems which comprise all three types of accretors, namely a white dwarf, neutron star and black hole. One system is a Cataclysmic Variable (CV), with an accreting white dwarf, namely 2SXPS J062339.9-265751, while two are Low-Mass X-Ray Binaries (LMXBs). One of these, Swift J1357.2-0933 is thought to contain an accreting black hole, while the other, CXOU J1109-6502, contains a neutron star and is also a Transitional Millisecond Pulsar (tMSP) candidate. All of these sources were observed as part of the Southern African Large Telescope (SALT) transient follow-up program.

The CV, 2SXPS J062339.9-265751, was recently found in the eROSITA all-sky survey and was shown to be a Novalike CV system, although its true nature is not well established and photometry I present here supports a possible Intermediate Polar classification. Swift J1357.2-0933 was observed by SALT since it was discovered to be in outburst in 2019 and CXOU J1109-6502 was observed as part of a follow-up campaign, also utilizing SALT, on tMSP candidates.

One major aim of this thesis is to study the time varying

nature of the optical spectra of the three objects and particularly to measure the emission lines parameters and to determine the radial velocities of the systems. For 2SXPS J062339.9-265751, spectroscopy was undertaken using the NRF-SAAO 1.9 metre telescope. In addition, time series high speed photometry, over many epochs, was also obtained and analyzed for 2SXPS J062339.9-265751, using the two NRF-SAAO 1 metre telescopes of the South African Astronomical Observatory (SAAO).

The aim of the spectroscopic and photometric observations of 2SXPS J062339.9-265751 was to help understand the physical nature of the system, and determine whether it is a magnetic CV (i.e. an intermediate polar) or an over-luminous non-magnetic novalike CV. The derived Lomb-Scargle radial velocity periodograms of 2SXPS J062339.9-265751 were used to determine the orbital period of the system, which is 3.164 ± 0.036 h. This is significantly different to the photometric period determined by TESS of 3.941 ± 0.010 h which may indicate the presence of a superhump period.

2SXPS J062339.9-265751 displays some similarities to other novalike systems, such as V341 Ara and ASAS J071404+7004.3, some of which also show similar shallow broad absorption lines with strong central emission peaks. From my analysis of multiple epochs (from 1 November 2020 to 2 March 2021) of high speed photometry of 2SXPS J062339.9-265751, comprising 56.5 hours of data, I show evidence for periodicity at $P = 24.905 \pm 0.003$ min, which I interpret as evidence that the system is a member of the intermediate polar class of magnetic CVs.

For the LMXB black hole system, Swift J1357.2-0933, the observed transient blue-shifted absorption lines were analyzed to determine the radial velocity changes of the out-flowing material, previously attributed to a hot wind outflow. Persistent weak double-peaked emission lines, centred near the rest velocity, were also detected at times, most likely being produced by the accretion disk. These emission lines do not show any modulation throughout an observation, although the separation between the peaks do vary slightly from epoch to epoch. The H α emission line is also seen to change from a broad line to showing a P Cygni profile at certain epochs.

Time resolved spectra of the tMSP candidate, CXOU J1109-6502, were analysed and radial velocity measurements were determined for the H α emission line. This emission line displayed a multi-component nature and showed dramatic changes from epoch to epoch, and even throughout a single night, from broad emission to narrow emission lines at the rest wavelength.



SRIRAM SANKER
(UCT/NRF-SAAO)

Research Title: Linking the evolution of galaxies, groups and the baryon cycle using MeerKAT and SALT

Supervisors: Dr Moses Mogotsi (NRF-SAAO/SALT), Prof. Matthew A. Bershad (NRF-SAAO/UCT/UW Madison)

This study presents a kinematic analysis of neutral hydrogen (HI) in two galaxy groups from the Choirs sample, observed with MeerKAT. Using 3D tilted ring modeling, Gaussian decomposition, and kinematic tagging, we identified and characterized anomalous gas resulting from galaxy interactions.

Galaxies are influenced by their environments, with HI 21 cm serving as an ideal tracer due to its susceptibility to environmental effects. HI distributions often show warps, lopsidedness, and anomalous gas (AG) such as Extraplanar Gas (EPG). However, distinguishing AG from the disc is challenging due to instrumental and projection effects.

We developed a method to separate anomalous gas from the disc and applied it to two low-mass, gas-rich, late-type galaxy groups: HIPASS J1250-20 and HIPASS J1403-06. Both groups contain interacting pairs with unique HI morphologies, influenced by ongoing minor and major mergers. Our techniques allowed us to extract the kinematics of the extended, warped, and lopsided discs and detect significant amounts of anomalous gas, including leading gas, lagging gas, extended envelopes, tails, and bridges. We linked this gas to star formation in the discs and interactions, observing gas exchange and enhanced star formation in inflowing galaxies.

Notably, we report the farthest characterized EPG in HIPASS J1403-06 at 40 Mpc, among the most massive EPG reservoirs studied. HIPASS J1250-20's 150 kpc long envelope, with a total HI mass of $\log M_{\text{HI}} \sim 10.72 M_{\odot}$, is one of the most HI-rich galaxies recorded. We propose formation scenarios for these features, suggesting misaligned gas accretion and a combination of collisional and tidal origins. This study enhances our understanding of the baryon cycle, galaxy interactions, and environmental impacts on galaxy evolution.

CURRENT STUDENTS

PHD STUDENTS



ANJA GENADE
(NRF-SAAO/UCT)

Research Title: Observational studies of centaur characteristics

Supervisors: Prof. Paul Groot (UCT/NRF-SAAO/Radboud University (NL), Dr. Amanda Bosh (MIT/Lowell Observatory)



ANKE VAN DYKE
(NRF-SAAO/UCT)

Research Title: Transient follow-up and characterisation in the LSST era

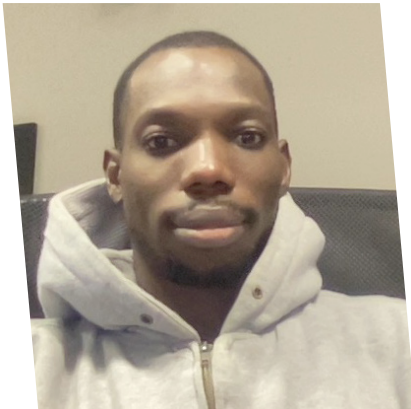
Supervisors: Emeritus Prof David Buckley (NRF-SAAO), Vanessa McBride (NRF-SAAO/UCT)



CHRISTIAN VAN DER MERWE
(NRF-SAAO/UCT)

Title: Explosive transients from stellar collisions

Supervisors: Prof. Shazrene Mohamed (NRF-SAAO/UCT/University of miami (UM)



OKWUDILI DANIEL EGBO
(NRF-SAAO/UCT)

Research Title: Multi-wavelength study of MeerKAT Galactic Plane Point Sources

Supervisors: David Buckley (NRF-SAAO/UCT)



HANNES BREYTENBACH
(NRF-SAAO/UCT)

Research Title: A Study of Quasi-Periodic Oscillations in magnetic Cataclysmic Variable Stars

Supervisors: Dr David Buckley (NRF-SAAO), Prof Patrick Woudt (UCT)



KELEBOGILE GASEALAHWE

Research Title: The Affiliation study of Stellar Mass Black Hole and Neutron Star X-ray Binaries

Supervisors: Dr Itumeleng Monageng (UCT & NRF-SAAO), Prof. Rob Fender (University of Oxford & UCT), Prof. Patrick Woudt (UCT)



PETRO JANSE VAN RENSBURG (NRF-SAAO/UCT)

Title: Studying gas flows in the SUNBIRD starburst galaxies and LIRGs

Supervisors: Dr Moses Mogotsi (NRF-SAAO/SALT), Prof. Petri Väisänen (NRF-SAAO/SALT) & Prof. Matthew Bershadly (NRF-SAAO/UCT/UW-Madison)



NAZIR MAKDA (NRF-SAAO/UCT)

Title: Ultra-Diffuse Galaxies: A Multiwavelength Study

Supervisors: Dr Rosalind Skelton (NRF-SAAO), Assoc Prof Sarah Blyth (UCT)



SIMON DE WET (UCT)

Title: Gamma-Ray Bursts with MeerLICHT

Supervisors: Prof. Paul Groot (UCT/NRF-SAAO/Radboud University)



MUNIRA HOOSAIN (UCT/NRF-SAAO)

Title: Measuring the cosmic neutral hydrogen density in LADUMA

Supervisors: Assoc Prof Sarah Blyth (UCT) & Dr Ros Skelton (NRF-SAAO)

CURRENT STUDENTS

MSC STUDENTS



ANDREW FIRTH
(UCT/NRF-SAAO)

Research Title: Resolving Atomic Hydrogen in Galaxies in Next-Generation Radio Surveys Using High-Resolution Optical-Near- infrared Imaging

Supervisors: Prof Matthew A. Bershad (NRF-SAAO / UCT / UW Madison)



GIDEON DE BEER
(UCT/NRF-SAAO)

Research Title: Extended radio sources in the Small Magellanic Cloud

Supervisors: Prof Vanessa McBride(NRF-SAAO/UCT)



JC VILJOEN
(NWU/NRF-SAAO)

Research Title: Determining the properties of galaxies in Meer-Choirs groups

Supervisors: Dr Moses Mogotsi (NRF-SAAO), Prof Ilani Loubser (NWU)



KYLE SOLOMONS
(UCT/NRF-SAAO)

Research Title: A spectral and timing study of the low-mass X-ray binary MAXI J1820+070 during its outburst

Supervisors: Dr. Sunil Chandra(NRF-SAAO), Dr. Itumaleng Monageng(UCT)



LIAM HIGGO
(NRF-SAAO/UCT)

Research Title: Conceptual design of a distributed spectroscopic telescope array

Supervisors: Prof Paul Groot (UCT/NRF-SAAO), Dr Retha Pretorius (NRF-SAAO)



LISA SECONNA
(UCT/NRF-SAAO)

Research Title: Investigating the blue stellar clumps of the Penguin galaxy

Supervisors: Dr Zara Randriamanakoto (NRF-SAAO), Dr Jacinta Delhaize(UCT)



**MIKHAIL DE VILLIERS
(UCT/NRF-SAAO)**

Research Title: Probing for radio and optical diffuse gas in MHONGOOSE galaxy UGCA 250

Supervisors: Dr Moses Mogotsi(NRF-SAAO/SALT) and Prof DJ Pisano(UCT)



**ULRICH GEEN
(NWU/NRF-SAAO)**

Research Title: A new spectrograph: Characterisation and early transient science

Supervisors: Dr Retha Pretorius(NRF-SAAO), Dr Nicolas Erasmus(NRF-SAAO), Prof Paul Groot(UCT/NRF-SAAO/Radboud U)



**LARA FEATHERSTONES
(UCT/NRF-SAAO)**

Research Title: The gas depletion timescale of star-forming galaxies at intermediate redshift

Supervisors: Assoc. Prof Sarah Blyth(UCT), Dr Rosalind Skelton(NRF-SAAO)



**TOMBO RARIVOARINORO
(UCT/NRF-SAAO)**

Research Title: Nuclear activity and polarisation properties of restarted radio galaxies

Supervisors: Russ Taylor (UCT/IDIA), Zara Randriamanakoto (NRF-SAAO), Dharam Lal (NCRA-TIFR)



**THOBEKILE NGWANE
(UCT/ NRF-SAAO)**

Research Title: Developing Instrumentation and Software for Rapid Follow-up and Characterisation of near-Earth Asteroids

Supervisors: Dr Nicolas Erasmus(NRF-SAAO), Prof Paul Groot(UCT/NRF-SAAO/Radboud U)



**MANDLENKOSI MNISI
(UCT/NRF-SAAO)**

Research Title: Detecting Surface Composition Inhomogeneity of Asteroids

Supervisors: Dr Nicolas Erasmus(NRF-SAAO), Dr Itumeleng Monageng (UCT/NRF-SAAO)



NRF-SAAO PUBLICATIONS

REFEREED PUBLICATIONS

Breakdown of Refereed Publications using NRF-SAAO & Hosted Facilities

NRF-SAAO affiliated papers	79
Non-NRF-SAAO affiliated papers	103
Papers using NRF-SAAO data	119
Papers using SALT data	56

Maitra, C., Kaltenbrunner, et al.: "Broadband study and the discovery of pulsations from the Be/X-ray binary eRASSU J052914.9-662446 in the Large Magellanic Cloud", 2023, *Astronomy and Astrophysics*, vol. 669, id.30.

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Baran, A. S., Van Grootel, et al.: "Short-period pulsating hot-subdwarf stars observed by TESS. I. Southern ecliptic hemisphere", 2023, *Astronomy and Astrophysics*, vol. 669, id.48.

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Kollatschny, W., Grupe, et al.: "The outburst of the changing-look AGN IRAS 23226-3843 in 2019", 2023, *Astronomy and Astrophysics*, vol. 670, id.103.

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Appleby, Sarah, Davé, et al.: "The physical nature of circumgalactic medium absorbers in SIMBA", 2023, *Monthly Notices of the Royal Astronomical Society*, vol. 519, id.5514.

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Haberl, F., Maitra, et al.: "SRG/eROSITA-triggered XMM-Newton observations of three Be/X-ray binaries in the LMC: Discovery of X-ray pulsations", 2023, *Astronomy and Astrophysics*, vol. 671, id.90.

Gasealahwe, K. V. S., Monageng, et al.: "The 2019 outburst of AMXP SAX J1808.4-3658 and radio follow up of MAXI J0911-655 and XTE J1701-462", 2023, *Monthly Notices of the Royal Astronomical Society*, vol. tmp, id.622.

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French, Richard G.; McGhee-French, Colleen A.; Gordon, et al.: "Uranus ring occultation observations: 1977-2006", 2023, *ICARUS*, vol. tmp, id.39515474.

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IMPRESSUM



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