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# The South African Astronomical Observatory 200 Virtual Symposium

The South African Astronomical Observatory (SAAO), formerly The Royal Observatory Cape of Good Hope, celebrated 200 years of existence as an astronomical observatory on 20 October 2020 and is the oldest scientific institution in South Africa.

The Royal Observatory Cape of Good Hope was founded on 20 October 1820, and for much of its history, it was the major contributor to positional astronomy in the southern hemisphere. The SAAO is not only known for its rich history and various contributions to science, its buildings are also of special architectural significance. Consequently, on 21 December 2018, the South African Heritage Resources Agency (SAHRA) officially declared the SAAO a National Heritage Site and on 20 October 2020 it was formally unveiled.

## History of the Observatory

At the time of its foundation, the Royal Observatory was formally controlled by the British Admiralty and was initially intended for the improvement of navigation. Its main duty was to chart the southern skies and provide a time service for passing ships in Cape Town Harbour.

The work of the Observatory, however, soon moved into scientific inquiry and discovery. Indeed, only a few years after the completion of the Royal Observatory in 1832/1833, Thomas Henderson made the first measurements to find the distance to a star. The Royal Observatory found its forte in the late 19th century by leading the way in astronomical photography and the cataloguing of stars. For this, it gained a global reputation. The 20th century saw research move into the more fundamental physics of stellar dynamics and evolution, including the development of spectroscopy with the donation of the Victoria Telescope by Frank McClean. This led to further breakthroughs such as the discovery of oxygen, silicon, and europium in stars.

In 1951, the Observatory gained access to the 1.9-metre Radcliffe telescope in Pretoria which remained the largest telescope in South Africa until 2004. In 1971, a decision was taken to amalgamate the major facilities for optical astronomical research into one body, which became known as the South African Astronomical Observatory.

There was a new beginning in South African optical astronomy in 1972 with the foundation of the SAAO's Sutherland Observatory, situated far from the Cape Town city lights, wet winters and air pollution. The Sutherland site offered ideal conditions for astronomy being at high altitude with cold, clear air and a steady atmosphere. One of the primary telescopes at the new Sutherland site was the 1.9-metre telescope from the Radcliffe Observatory in Pretoria which was moved to Sutherland following the closure of the Radcliffe Observatory, and it became operational again in January 1976.

The South African astronomy community began considering the idea of acquiring a new telescope towards the late 1980s and had initially envisaged a rather modest 4-metre instrument. However, these dreams were far surpassed when, in 1998, South Africa became the leading partner in the Southern African Large Telescope (SALT), which was to become the largest optical and infrared telescope in the southern hemisphere. It is designed to provide maximum collecting area for minimum cost and is especially suited for spectroscopy of faint objects.

SALT comprises 91 hexagonal mirrors arranged to form a combined diameter of over 10 metres and was additionally backed by a consortium of international partners. The SALT consortium involved institutions from nearly a dozen countries in Europe, the USA, Britain and New Zealand, with South Africa constituting the largest partner. Based on the Hobby-Eberly Telescope in Texas, this facility has provided South African astronomers with outstanding capacity in the fields of optical photometry and high-speed spectroscopy with South African scientists having access to one-third of the observing time.

The South African National Research Foundation stated in 1999 that SALT's 'two primary missions' were (1) to provide a state-of-the-art facility for local and international astronomers and astrophysicists and (2) to overcome and redress past government policies that 'dislocated the majority of South Africans from science, engineering and technology education'.

From 2011, after a period of commissioning and performance verification, SALT started full science operations, coming into its own as Africa's 'giant eye' on the universe, with significant contributions to global astronomy.

One of the most notable and dramatic discoveries in recent years came in August 2017 when four telescopes at Sutherland contributed to a global effort to detect the first visible counterpart of a gravitational wave source. Gravitational waves were predicted by the theory of General Relativity but are extremely difficult to detect as they are ripples in the structure of space–time and are not like electromagnetic radiation. Gravitational waves were observed from a source in a known galaxy 130 million light years away on 17 August 2017. SAAO observed the aftermath of this neutron star merger with four telescopes: SALT, MASTER-SAAO, the 1.0-m and the Infrared Survey Facility, with SALT obtaining the first spectrum of the source.

Today Sutherland is home to more than 20 telescopes of various shapes and sizes with SALT remaining the flagship and the 1.9-m telescope still fully operational.

## SAAO 200 celebrations

To celebrate the bicentenary of the Observatory, various events were arranged including the unveiling of the SAAO as a National Heritage Site, the SAAO 200 Astronomy Symposium, and the SAAO 200 Virtual Astronomy Festival.

SAAO Managing Director Prof. Petri Vaisanen stated:

> *This occasion is an opportunity to recall some great scientific achievements. But more than that, it is an opportunity to celebrate our country's and continent's rich heritage in attempting to understand the universe and our place in it. In particular, we want to convey the pure excitement of exploring the amazing universe we are part of, and also highlight the many benefits that science brings to society. The theme of our event is 'Beyond 200 Years of Astronomy', and we see this future full of opportunity, inspiration, and pride in the excellence of decidedly African astronomy at the forefront of a cutting-edge global pursuit.*

## Unveiling of the SAAO as a National Heritage Site

The formal 'virtual' unveiling of the National Heritage Site was held on the 20 October 2020 and was attended by a limited number of dignitaries including Director-General of the Department of Science and Innovation (DSI), Dr Phil Mjwara, and CEO of SAHRA, Adv. Lungisa Malgas. The unveiling included pre-recorded addresses by the Minister of Sports, Arts and Culture, the Honourable Nkosinathi Mthethwa, and the Minister of Higher Education and Training, Science and Innovation, the Honourable Dr Blade Nzimande.

The programme included interviews with SAAO staff, and the premiere of a new animation of indigenous Khoesan starlore, 'Moons Message', which was very well received by dignitaries, the community, and the media. The livestream of the unveiling was viewed by over 1000 people.

## SAAO 200 Virtual Symposium

The SAAO 200 Symposium was planned as an in-person symposium due to take place from 20 to 22 October 2020. Owing to the COVID-19 pandemic, the decision was taken to shift from an in-person symposium to a virtual one. The symposium was then extended to become a 4-day event, starting with the unveiling of the SAAO as a National Heritage Site, followed by the SAAO 200 Symposium.

The original target was set at 300 attendees for an in-person symposium. Shifting to virtual allowed for more participants and complimentary registration fees. The symposium kicked off on 20 October with the number of registrations at 575. In total, 626 attendees registered and, at any given stage, an average of 127 viewers were engaged.

In terms of participants, 75.6% were from South Africa. The Western Cape represented 52.5%, Gauteng 12.8%, Eastern Cape 3.2%, KwaZulu-Natal 2.2%, Mpumalanga 1.5%, Free State 1.4%, North West 1.3%, and Limpopo 0.9%. Participants from other countries included those based in Britain, Mauritius, Nigeria, India, USA, Turkey, Japan, Uganda and Zimbabwe.

The virtual symposium provided an ideal opportunity to incorporate some leading international speakers without incurring exorbitant travel costs. This helped to develop a very strong programme.

## Astronomy for society

The SAAO 200 Virtual Symposium saw presentations covering a wide range of topics, including current and future science, the history of astronomy on the continent, as well as the cultural and sociological aspects of astronomy.

The opening session of the Symposium included keynote addresses focusing on a wide range of astronomy-related topics. The President of the International Astronomical Union (IAU), Prof. Ewine van Dishoeck, addressed the IAU's role in development, outreach and education including its Office Astronomy for Development (OAD) at SAAO in Cape Town. Prof. Vanessa McBride provided further details of the excellent work being done by the OAD to utilise astronomy to achieve the United Nation's Sustainable Development Goals.

One highlight of the Symposium was the address by the SAAO Manager of Collateral Benefits in Sutherland, Mr Anthony Mietas, who delivered a stirring account of the remarkable achievements of the programme over the past decade. Through this work, Sutherland has become an astro-tourism hub and has created 302 jobs directly and, indirectly, a number more. SAAO/SALT remains the single largest employer in the town of Sutherland, and SALT and SAAO continue to utilise the Sutherland-based local companies for various projects.

The SAAO and the National Research Foundation have refurbished both the primary and high schools' laboratories and SALT purchased school desks for the intermediate learners in the Roggeveld Primary School.

Additionally, the Sutherland Community Development Centre is an initiative from the SAAO, with support from SALT, the local community, and various partners, in particular the DSI as the main sponsor. The centre provides connectivity, childcare and several cultural, artistic, sports and social events throughout the year, enhancing the life of the community.

Various talks at the symposium addressed critical societal issues within astronomy such as transformation, human capital development and successful outreach initiatives across South Africa and the rest of Africa. Teams such as the SAAO Outreach department, the Astronomical Society of Southern African and the African Astronomical Society presented on their efforts to engage with the community.

## A rich history

The Symposium featured a variety of presentations on the diverse history of the Observatory and of astronomy in Africa, including presentations on indigenous knowledge and ethno-astronomy and efforts to better communicate this valuable knowledge and the efforts of astronomers at the Cape before 1820.

Dr Ian Glass delivered his keynote address on 'The Cape Observatory from 1820 to 1972', highlighting the myriad scientific achievements during those years and this was complemented by more detailed discussions of some of the key figures involved, such as Sir David Gill, as well as the role of the Royal Astronomical Society in South African astronomy.

More recent developments in African astronomy, such as the advent of SALT and the genesis of the Square Kilometre Array, were presented by Dr David Buckley and Dr Bernie Fanaroff, respectively, illustrating the tremendous advances in astronomy facilities on the continent in recent decades. The SKA Director-General, Prof. Phil Diamond, addressed some of the challenges and opportunities arising from one of the largest science experiments in his talk entitled 'SKA: Building an Observatory to Study the Dawn of Time and the Origins of Life'.

## A bright future

The bright future for African astronomy would not be possible without the development of African astronomers. Prof. Patricia Whitelock gave an overview of the hugely successful National Astrophysics and Space Science Programme (NASSP) founded in 2003. Hosted at the University of Cape Town, the University of KwaZulu-Natal and North-West University, the programme has seen over 300 students graduate with honours degrees and more than 140 with master's degrees.

In addition, since 2011, 87 students who were trained at SAAO and SALT have graduated – approximately 40% with honours, 30% with MSc and 25% with PhD degrees. Of these students, 63 (72%) were people of colour. Students at NASSP and SAAO represent the rich diversity and culture of our continent, coming from a range of countries including

Rwanda, Uganda, Ethiopia, Mauritius, Sudan, Burkina Faso, Lebanon and Madagascar.

Many of these students were represented in the Symposium schedule, both in oral and poster presentations, with talks covering observational and theoretical aspects of stellar and extragalactic astronomy, astronomical instrumentation, and computer modelling. Many projects involve combining and analysing data from different wavelengths, e.g. optical data from SAAO/SALT with radio data from MeerKAT and/or X-ray measurements from spacecraft.

Astronomy is expanding across the African continent, with the newly revitalised African Astronomical Society. On the horizon is the largest meeting in the astronomy calendar, the General Assembly of the International Astronomical Union. This meeting in Cape Town in 2024 will be the first General Assembly held on the African continent since the establishment of the Union over 100 years ago – securing the recognition of Africa's contribution to global science.

## Competing interests

There are no competing interests to declare.