

# CONTACT

The SKAO's Magazine

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## START OF ON-SITE CONSTRUCTION SPECIAL



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Dear Friends and Colleagues,

Welcome to this bumper issue of Contact! The SKAO Comms team have packed a lot into it. You'll be able to read in detail about what we in the project were calling the C3 – shorthand for the Construction Commencement Ceremonies – which took place on 5 December.



The two events that formed the core of the C3 were at the telescope sites in Australia and South Africa, but we also organised additional events in Cape Town and in Perth to allow more colleagues and partners to take part in the celebrations, as well as an event for our UK-based staff at the SKAO HQ. I was pleased to see that some of our partners institutes also celebrated, as they should!

I was honoured to take part in the C3 in Australia; Dr Catherine Cesarsky, Chair of the SKAO Council, represented the Observatory at the events in South Africa. As you can read, the care and attention, and organisation, that went into the events was highly professional and I give my heartfelt thanks to all the teams at SKAO, CSIRO, SARAO, DISER and DSI who made it happen. The grand conductor was SKAO Director of Communications William Garnier, who, I believe collapsed in a heap afterwards!

A major focus of the C3 was celebrating the work done by all of our partners across the world who have worked so very hard to get us to this place, but also we were acknowledging the local stakeholders, especially the indigenous people, who are graciously allowing us to build the SKA Observatory on their land. We are looking forward to the decades long relationships that will grow as we build and operate one of the world's largest science facilities.

Contact 12 also highlights some of the new science results emerging from the SKA precursor and pathfinder projects. It is great to see that science is not standing still and waiting for us. You can also read an in-depth interview with André van Es and Ben Lewis, who are the two Senior Project Managers responsible for overseeing the construction activities for SKA-Low and SKA-Mid respectively: they are two very busy people. There are several other interesting articles which I hope you'll enjoy reading.

The C3 was a great way to end 2022, but there was more. With deliberate timing we arranged the signature of several major construction contracts with different partners for, amongst others, the contracts to deliver the major infrastructure in Australia and South Africa, that to provide the SKA-Mid dishes and the contract to provide the SKA-Low antennas. In all, we have now signed construction contracts worth just under €500m. SKA is happening and 2023 should bring us a lot of exciting developments on various fronts. January was already quite eventful in this respect, with Canada announcing their intention to join the SKAO as a full member. What a great way to start the year!

**PROF. PHILIP DIAMOND,  
SKAO DIRECTOR-GENERAL**



# Reaching out to all ages in India

BY SKAO

Outreach is an important part of the SKA project, connecting with under-represented groups and inspiring people of all ages with the challenges and opportunities of astronomy and the STEM fields.

In September, Team SKA software specialist Snehal Valame joined a virtual science forum aimed at motivating women in STEM careers. Around 60 people attended, covering a wide age range from young girls to senior citizens, and including students at a women's engineering college.

The forum, *Sharada Shakti*, meaning "Women Power" in Hindi, is held in association with Siddhivinayak college in Pune. The city is a hub for the Indian software industry and is also home to India's National Centre for Radio Astrophysics (NCRA). *Sharada Shakti's* goal is to empower women with scientific knowledge and technology in the areas of health, science, environment and education.

"The organisers wanted me to convey not only the scale and goals of the SKA project but also to make it relatable, to talk

about what I do day-to-day and the kinds of career opportunities in the field. It was also important to give some motivational messages for the younger girls in the group," said Snehal.

There were plenty of questions, with people asking about India's participation in the SKA project, and what it takes for a person to get involved in a major international project like the SKAO.

"Outreach isn't just a one-way thing, it always feels motivating to me as well. People told me they were proud to see a woman leading in this area and some older people in the group said they now understand what radio telescopes are, and that astronomy is different to the popular astrology faiths in India," said Snehal.

"It's important for us as a community to see the value of these events, to understand the impact they can have and to take time to get involved."



ABOVE: Snehal Valame

# ICRAR to build SKA-Mid telescope's frequency distribution system

BY ICRAR

**A €7.5 million construction contract awarded by the SKAO will see ICRAR's Astrophotonics group (based at the University of Western Australia (UWA) build critical infrastructure for the SKA-Mid telescope in South Africa, keeping the dishes of the sprawling observatory perfectly synchronised over the hundreds of kilometres it will span once complete.**

"Having the UWA design selected for use on the SKA-Mid telescope was a great honour," said A/Prof. Sascha Schediwy, the team's lead. "It really validated the hard work the team put into the design and testing of the technology."

"With the frequency distribution system being such a specialised piece of hardware, winning the construction contract gives our team this fantastic opportunity to ensure the job is done how we'd envisioned."

The frequency distribution system will serve as the telescope's "beating heart", sending precise timing signals to each dish in the spiraling array, ensuring the timing signal does not degrade as it travels over the vast distances of fibre optic cable which will connect the dishes of the array together.

ICRAR's Astrophotonics group began developing the project in 2014 with the aim of maintaining phase-coherence on large radio antenna arrays. The scope of the project has evolved substantially over its development, scaling from an experimental system into a tried and tested technology. In November 2017 ICRAR's solution was formally selected for use on the SKA-Mid telescope, with the project awarded a AU\$1.5m (€964,000) grant by the Australian Government to develop a prototype for mass-manufacturing in 2019.

# Unique Wajarri planispheres share connection to sky and Country

BY SKAO, CSIRO & ICRAR

The charts feature the Aboriginal constellation of Yalibirri, the "emu in the sky", whose seasonal orientation is used by the Wajarri Yamaji to determine the most productive times of the year to search for emu eggs.

Yalibirri, overlaid on the southern stars, is seen with a lowered head as summer turns to winter, alerting the Wajarri Yamaji that nesting season is approaching and it's a productive time to hunt. The planispheres feature the artwork of Wajarri artist Judith Anaru.

The Wajarri Yamaji are the Traditional Owners and native title holders of Inyarrimanha Ilgari Bundara, the CSIRO Murchison Radio-astronomy Observatory, where the SKA-Low telescope will be built.

Judith Anaru said: "The emu in the sky will always be a part of my family for generations, and to be a part of this planisphere project is another way of preserving and sharing our Wajarri stories."

The planisphere's publication shares a small part of the rich Wajarri culture and their connection to sky and Country.

Profits from the sale of the planispheres will be reinvested to develop further Aboriginal Astronomy opportunities in Western Australia.

SKAO Director of Communications, Outreach and Education William Garnier said: "These charts were created in collaboration with the Wajarri community and key partners in Australia.

"Their production provides an opportunity for Wajarri culture to be shared globally, just one of the many ways such a rich heritage will be on the world stage now that the SKA-Low telescope is being constructed on Wajarri Country.

"As construction moves forward, we will be looking at forging even closer links with Indigenous communities in both Australia and South Africa, and exploring more opportunities for working together and helping preserve and promote their culture and heritage."

The Wajarri planisphere was developed through an International Centre for Radio Astronomy Research (ICRAR) initiative, funded by the Australian Government Department of Industry, Science and Resources, CSIRO – Australia's national science agency – and the SKAO. Development of the planisphere was managed by AstroTourism WA.

More of Anaru's paintings feature in the SKAO's *Shared Sky* exhibition – a travelling gallery of artworks created by artists from Indigenous communities around the SKA telescope sites.

BELOW: Wajarri artist Judith Anaru and the planisphere featuring her art and story at the on-Country planisphere launch in October. Credit: ICRAR







**ABOVE:** An architectural drawing of the proposed Deutsches Zentrum für Astrophysik. Credit: DESY

# New German astrophysics centre spells good news for SKA

**BY SKAO AND MAX PLANCK INSTITUTE FOR RADIO-ASTRONOMY**

In September, the German astronomy and astroparticle physics community was awarded funding in a competitive process to set up a new large-scale research centre dedicated to astrophysics in Lusatia, Saxony.

The [Deutsches Zentrum für Astrophysik](#) (DZA) will open new horizons for the country's scientists by enabling top-level astronomical research, the processing of gigantic data streams from next-generation telescopes such as the SKA, and the development of novel technology.

Germany's Federal Minister of Education and Research, Bettina Stark-Watzinger, and the Minister Presidents of Saxony, Michael Kretschmer, and Saxony-Anhalt, Dr Reiner Haseloff, [announced the decision](#) on 29 September 2022 at a media conference.

"I am thrilled by this fantastic news!" said Prof. Michael Kramer, director of the Max Planck Institute for Radio Astronomy and president of the German Astronomical Society, a proponent of the proposal.

"By fostering the development of new technologies, data processing, and high-performance computing techniques,

this new centre will provide a gateway for enhancing German participation in large-scale international astrophysics projects such as the SKA Observatory."

The SKAO's Director-General, Prof. Philip Diamond, congratulated his German colleagues on their successful proposal. "We regard the creation of a national centre for astrophysics in Germany as a promising milestone for the German community and our observatory.

"The compelling DZA proposal goes a long way towards strengthening SKA-relevant activities in the country and will undoubtedly boost Germany's participation in the SKA project. We look forward to exploring and understanding the mysteries of the cosmos together."

Germany is a prospective member country of the SKAO, having participated in planning and designing the SKA telescopes for several years.

# Spain exploring Open Science and green computing for sustainable SRCs

**BY DR JULIÁN GARRIDO (INSTITUTO DE ASTROFÍSICA DE ANDALUCÍA - CSIC)**

With the aim of creating a green and sustainable SKA Regional Centre (SRC) in Spain, the European Union funding scheme NextGenerationEU, via the Spanish National Agency of Research, has awarded a €460,000 grant to the Spanish SRC group.

The team will collaborate with the Portuguese SRC, the National Institute for Astrophysics (INAF) in Italy, the SKAO and the South African University of Cape Town in this two-year project. The project was ranked in the top 20 of 1,670 approved proposals.

Scientific data generated by the SKA telescopes will reach exa-scale levels, requiring an international network of SKA Regional Centres (SRCs) for their scientific analysis. In 2018, it was estimated that data centres worldwide consumed 1% of the global electricity demand, so the SRC developments constitute a unique testbed for transitioning to an ecological platform, in terms of energy and reproducibility.

The awarded project will address different aspects of sustainability of the SRCs and aims to contribute to a sustainable network. Its main goals are:

- a) minimisation of the environmental footprint of SRCs;
- b) incorporation of a green perspective in the platforms for SKA data storage, analysis and visualisation within the SRC Network prototypes; and
- c) development of Open Science technologies, supporting end-to-end research reproducibility.

"We are convinced that, as researchers, we have a responsibility to promote sustainability in scientific infrastructures and that the current science system is not sustainable unless reproducibility is improved and reinvention avoided," says Dr Lourdes Verdes-Montenegro, senior scientific researcher at the Institute of Astrophysics of Andalusia (IAA-CSIC) and co-lead of the proposal.

Via promoting green values within the community, the SKAO, and the SRC Network, this project emphasises actions that contribute to achieving the sustainable development goals of the United Nations. This includes showing how Open Science encourages a sustainable approach to science, how it accelerates the transfer of knowledge to society and promotes equity and inclusiveness.

*Grant details: "Grant TED2021-130231B-I00 funded by MCIN/AEI/ 10.13039/501100011033 and by the European Union NextGenerationEU/PRTR"*

**BELOW:** The study aims to make data centres more sustainable. Credit: IAA-CSIC







Australia



South Africa

# CONSTRUCTION COMMENCEMENT CEREMONIES

As SKA milestones go, they don't come much bigger than the start of construction at the telescope sites; the moment we can say to the world: now it begins. That moment arrived on 5 December 2022. Months of planning involving a large number of people separated by continents, oceans and time zones culminated in consecutive SKAO Construction Commencement Ceremonies (known as C3 for short) at the telescope sites in Australia and South Africa.

The effort behind these events – the biggest in the history of the SKA project – was led by the SKAO's Communications team, with significant support from across departments as well as from partners at CSIRO, SARAO and beyond. In the following pages, we hear from two members of Team SKA who were in the thick of the action at each site, SKA-Low Communications Manager Liz Williams, and SKAO Media Manager Anim van Wyk. Their stories give an insight into the hard work, excitement, and pressure surrounding preparations for the ceremonies, and a taste of how special it was to be part of this moment in SKA history.







## Culture, heritage and respect: SKA-Low celebrated on Wajarri Country

BY LIZ WILLIAMS (SKAO)

Inyarrimanha Ilgari Bundara, the CSIRO Murchison Radio-astronomy Observatory, is about 800km north of Perth – “outback” Western Australia – on Wajarri Country.

Our trip starts on Saturday 3 December, two days before the ceremony. We drive out to site on a hot and sunny day – the sky is a deep blue and the landscape covered in shrubs and low trees, with a few remaining wildflowers thanks to late season rain. I spy a small group of emus sheltering under a tree as we drive the four hours from Geraldton to Boolardy station, the accommodation facility that will serve as our base. Boolardy’s resident *bungarra* (goanna) Giuseppe greets us on our arrival.

It’s a significant exercise in planning to coordinate the movement of so many people to and around such a remote site, particularly when factoring in the need to

protect the on-site ASKAP and MWA radio telescopes from radio frequency interference (RFI) that activities of this nature bring. All equipment brought to site is vetted for RFI potential, including the media crews’ cameras and microphone equipment.

On Sunday we spend the day out on site setting up for the event, erecting marquees, and working with media who have arrived a day early to do their filming. This is our last chance to check and re-check the dozens of details on our planning spreadsheet to ensure everyone is briefed and prepared for the big day.

**ABOVE:** TV journalists began broadcasting before dawn at the AAVS2.0 prototype station on site, which was specially lit for the occasion. Among the interviewees, SKA-Low Site Construction Director Ant Schinckel spoke to Nate Byrne of ABC Breakfast News. Credit: SKAO

The forecast tells us we are in for a hot day on Monday – the day of the launch – reaching a high of 38 degrees Celsius. Those of us accompanying the media crews wake at 02:00 to drive out to site and set up in time for the breakfast news crosses to the east coast of Australia, three hours ahead.

It’s well worth the early start. When we get to site it is still dark; the Moon has set and the stars are brilliant. This is an opportunity that few people get to experience; it is a special occasion to be on site before sunrise. It’s peaceful and quiet and we enjoy the magical view while we prepare for the day ahead. As the media and CSIRO AV specialist Shaun Amy set up for the live crosses, we search for *Yalbirri* – the Wajarri emu in the sky – a well-known Aboriginal constellation that sits in the Milky Way, visible in the dark space between the dust and stars. The TV stations broadcast live as the Sun comes up, providing a magnificent backdrop. The *Yalbirri* is not the only bird we are watching for. A local nesting pair of wedgetailed eagles guard the skies, and could take a disliking to the media’s small buzzing drones.

Final preparations for the official launch are under way as we wrap up with the media. The team has worked across the weekend to get ready for the event, from setting up marquees and AV, to stocking up on water, food and icy poles (ice lollies) to keep people hydrated in the heat.

Guests start arriving on site at 08:00 as we welcome almost 100 people from local pastoral stations, the Wajarri community, official party, partner organisation representatives, media and a few members of staff.

We begin with a Welcome to Country – a ceremony in which Traditional Owners welcome attendees to their ancestral lands. The formalities include a Wajarri cultural dance, performed by Godfrey Simpson, Geoffrey Mongoo and Gerard Boddington.

To launch telescope construction in Australia, we welcome SKAO Director-General Prof. Phil Diamond, Minister for Industry and Science The Hon Ed Husic MP, WA Government representative Ms Sabine Winton MLA, CSIRO Executive Director Prof. Elanor Huntington, SKA-Low Telescope Director Dr Sarah Pearce, along with local Murchison Shire President Rossco Foulkes-Taylor and Wajarri representatives Colin Hamlett and Dwayne Mallard.

Dwayne gives a moving speech about the Wajarri connection to land and culture, and the respectful and collaborative relationships between the Wajarri and SKA partners who will guide the project into the future. To mark the turning of the soil that will begin construction, Gail Simpson has crafted six traditional Wajarri digging sticks, which she presents to Minister Husic, Prof. Diamond and Ms Winton, together with Ivan Merry, Edward (Teddo) Ryan and Colin Hamlett from the Wajarri. In his speech, Dwayne references the digging sticks and turning of the soil as having a special connection and purpose for the Wajarri: “It has ceremony, it has dignity and



**ABOVE:** Gail Simpson from the Minangu Land Committee crafted traditional Wajarri digging sticks for the occasion, one of which was presented to SKAO Director-General Prof. Phillip Diamond. Credit: SKAO

reverence through reciprocity of love and respect.” Following the speeches, new and old friends have a chance to meet and chat.

The event finishes with a tour of AAVS2.0 – the test array of antennas that has been built on the observatory site by the Curtin node of the International Centre for Radio Astronomy Research (ICRAR), Italy’s National Institute for Astrophysics (INAF), and the SKAO, to prepare for the SKA-Low telescope. As journalists put the final touches to their stories to file them in time for the evening news, our staff start to pack up the site and we bid farewell to our guests as they fly and drive off site. Our official party hop on planes back to Perth for their next event – an evening reception for project partners, key stakeholders, ambassadors and consular representatives to coincide with the launch activities.

Minister Husic was surprised and delighted to receive an original Wajarri artwork on the day, commissioned and gifted by the SKAO, and presented to him by the artist Susan Merry. Susan’s painting shows SKA-Low antennas under the bright Murchison night sky – where one of the oldest living cultures and lands meet the newest technology in a joint quest to solve the mysteries of the Universe.



## Big sky country: SKA-Mid welcomed in the Karoo

BY ANIM VAN WYK (SKAO)

To grasp how tricky it is to build half of the world's largest scientific instrument in the Karoo, travelling to the site before dawn offers some perspective.

The drive from the nearest town – itself hundreds of kilometres away from bigger places – takes an hour. As we depart from Carnarvon on Monday 5 December, stars are still piercing the inky sky. Swiftly the darkness lifts to reveal the unending plains. Thanks to the rain that ended a murderous drought exactly one year ago, knee-high *bossies* (shrubs) blanket the veld. We're in big sky country.

Only once you descend a final long downhill do the dishes of the SKA precursor telescope MeerKAT come into sight. They have their backs turned towards us today, a criss-cross of curved white metal. Beyond lies Losberg. Translating to "loose mountain", it's part of the natural barrier that protects radio astronomy observations from human-made interference and the reason why we find ourselves in this spot of all spots.

One security gate, then a second. The guards "sniff" each vehicle with an instrument that detects WiFi or Bluetooth signals. A special switch in our SKAO vehicle turns these off. Additionally, all media equipment had been tested prior to coming to site to protect the MeerKAT dishes. Today science

takes a brief backseat to ceremony, though. The dishes cannot observe anything useful with so much "noise" in the vicinity.

We round Losberg to enter the terrain of the Karoo Array Processing Building. Inside the perimeter fence towers an industrial shed where MeerKAT's dishes were assembled back in the day, four at a time.

Today represents another intricate assembly line: receiving guests important to the project, protecting them from sunburn and dehydration, ensuring they're entertained and fed, and wrapping up history-in-the-making by the early afternoon.

We're hosting guests from close to home – such as the local mayor, representatives of Indigenous communities and provincial dignitaries – and others from much further afield, including the South African Minister of Science and Innovation Dr Blade Nzimande, SKAO Council Chair Dr Catherine Cesarksy and the Director-General of the Department of Science and Innovation, Dr Phil Mjwara.

**BELOW:** SKAO Deputy Director-General Dr Joe McMullin speaking at the site of the first foundation cast for an SKA dish. Credit: SARAO



**ABOVE:** A sunset performance of the riel dance took place the evening before the ceremony. Credit: SARAO

Round banquet tables await the guests in the first part of the shed, with a stage and big screen ready for the speeches. Behind the screen, a team from national radio station RSG are setting up for an hour-long live broadcast from 06:00, with another hour to follow at noon.

Other media members arrive to cover a moment 30 years in the making. One popular angle is the human capital development achieved by the South African Radio Astronomy Observatory (SARAO), the SKAO's local partner. Several technicians await their turn to tell how SARAO helped them pursue a trade.

As local guests trickle in and minibuses from the airstrip start depositing guests at the shed, the day kicks up a gear. After a quick welcome by Dr Cesarksy and the site induction, everyone departs on a tour to the core of MeerKAT and the future SKA-Mid telescope.

By now, the early morning coolness is but a memory. Guests quickly seek out the shade of a tent when we stop at a prototype SKA dish. SARAO System Engineer George Smit is on hand to offer lessons learned from a working specimen on site. Then we're off to the other side of the core.

At the first foundation cast for an SKA dish, SKAO Deputy Director-General Dr Joe McMullin explains just how advanced the relatively plain-looking cement circle is. "This isn't the foundation of your house!" he quips. To support a dish that weighs 60 tonnes, eight piles of almost a metre in diameter each reach more than 10m into the ground.

Then it is time for the day's show-stopper: a riel dance by a troupe of Carnarvon youngsters. The riel is an ancient dance form practised by the Nama and Khoi people who once roamed the Karoo. Kicking up dust with *velskoene* (a soft leather shoe) is a vital feature, and so over the weekend, a trusted handyman had to quickly deposit buckets of fine sand around the base for the required effect.

The Northern Cape province's Member of the Executive Council for Education Zolile Monakali, joins Minister Dr Nzimande and Dr Cesarksy in unveiling a commemorative plaque.

Back at the shed, Dr Cesarksy explains how emotional the day makes her feel. The mood is underlined when three SARAO bursary grantees describe how radio astronomy launched their futures skywards. In between, we hear from Dr Motheo Koitsiwe about indigenous astronomy, and from MEC Monakali.

Minister Nzimande caps off the proceedings. "I cannot help but be intrigued by the idea that significant discoveries on cosmological origins may well be made on African soil through the work of the SKA – the very place where we know through science the origin of all humanity is to be found," he muses.

Lunch, prepared by a Carnarvon caterer, consists of several mutton delicacies, including *skaapstertjies* (lamb tails). Before we depart, Drs Nzimande, Cesarksy, and McMullin each receive a beaded tin-and-wire replica of an SKA dish as a gift.

Admiring the handmade artworks, they strike me as an apt symbol of the SKA undertaking – the humble attempt of finite humans to tease apart the riddles of a near-infinite Universe.



**ABOVE:** Minister Dr Blade Nzimande speaking at the event. Credit: SARAO





**ABOVE:** Staff gathered in the Council Chamber at SKAO Global HQ to mark the start of construction at the telescope sites. Credit: SKAO

# Globe-spanning celebrations greet start of construction

BY SKAO

On-site construction commencement ceremonies were complemented by additional events in Australia, South Africa and at our SKAO Global Headquarters, reinforcing the one observatory spirit across SKAO sites.

At HQ, colleagues packed into the Council Chamber to celebrate this historic day. Senior Project Managers Andre van Es (SKA-Low) and Ben Lewis (SKA-Mid) delivered a joint potted history of the project to date. Head of Project Management Andrea Casson helped to recap the Observatory's journey while Communications and Outreach Manager Mathieu Isidro compèred proceedings.

Attendees were treated to a premiere screening of SKAO's new film, drawing together contributions from our member countries into an inspiring five-minute production showcasing construction efforts that have been taking place around the world over the past 18 months.

To connect UK-based staff with events taking place on the other side of the world, we set up a live feed, which allowed them to follow the evening proceedings in Australia. Following the official Australian launch at the SKA-Low site in the Murchison (read Liz Williams' reportage p.10 for more information), more than 180 people attended an evening reception at WA Museum Boola Bardip, including SKAO Member diplomatic mission representatives, senior government representatives, Wajarri community

representatives, industry partners and collaborating organisations. Under the Museum's iconic blue whale, people who have worked on the project from across its 30-year timespan and from across the nation came together to celebrate this milestone and reminisce on the project's successes with colleagues and friends.

To conclude the HQ event, members of staff were treated to some themed cuisine from our on-site cafe, where Braai-style barbeque meats and Vegemite-infused treats gave staff a taste of our host countries' delicacies.

In Australia, CSIRO hosted internal events at sites in Perth, Geraldton and Marsfield to thank staff for their hard work and contributions to the project, together with SKAO Director-General Professor Phil Diamond, SKA-Low Telescope Director Sarah Pearce and CSIRO Space & Astronomy Director Douglas Bock. Professor Diamond also met with Ambassadors and their representatives from China, France, Germany, India, Italy, South Korea, the Netherlands, South Africa, Spain and Switzerland at a special briefing at Mount Stromlo Observatory in Canberra, hosted by the Australian Government Department of Industry, Science and Resources.

Mirroring the construction commencement ceremony celebrations in Australia, on the other side of the Indian ocean in South Africa, two main events were organised: one at the SKA-Mid telescope site (read Anim van Wyk's reportage p.12 for more information); and a breakfast event the next day at the Cape Town International Convention Centre. This event coincided with the World Science Forum and incorporated a large number of VIP guests, including Ambassadors from across the SKAO partnership, representatives from partner institutions in the country, members of the scientific community, industry partners, and delegates of the Forum.

In the style of the 'Tour de Table', inspiring comments of support for the SKAO were given by a host of speakers. These included Mr Kevin Govender, Director of the International Astronomical Union (IAU) Office of Astronomy for Development, Ms Shamilla Nair-Bedouelle, Assistant Director General for the Natural Sciences from UNESCO, Mr Long Chen, Minister Counsellor at the Chinese embassy in South Africa, and Ms Marga Gual Soler, the Head of Science Diplomacy Capacity Building at the Geneva Science and Diplomacy Anticipator.

Palpable excitement of our telescopes' fruition was summed up by Dr Tana Joseph, who chaired a discussion on SKA precursor science and science prospects with the future SKA telescopes, and said: "We are lucky to be the generation that will get to play with the toy!"

The breakfast event celebrations culminated with a performance by The Drum Cafe ensemble, with each guest

gifted a 32cm drum to join in the spine-tingling celebration. It was a call for the SKAO to seek the Universe for all; symbolic of the diversity and togetherness necessary to produce telescopes on a global scale.

During the week, other joint SKAO-SARAO events were organised across the sites in Cape Town, Klerefontein, and Johannesburg, bringing together SKA-Mid and SARAO staff to thank everyone for their work in getting the SKA project in South Africa where it is today.

This diverse array of global events gave opportunity for all involved with the SKAO to celebrate our start of on-site construction milestone as one, reminding us that despite our differing locations and languages we are united as "one observatory".

## Cape Town Breakfast Event Highlights



**BELOW:** SKAO Scientist Dr Wendy Williams (centre), Dr Tana Joseph (left) and Prof. Sarah Blythe (right) speaking at the Cape Town breakfast event.





# Aboriginal astronomy centre stage for SKA-Low

BY RACHEL RAYNER (CSIRO)

In the beautiful, ancient landscape of Wajarri country, red dust is kicked up during a dance performance by Godfrey Simpson, Geoffrey Mongoo and Gerard Boddington, part of the SKAO's construction commencement ceremony in Australia.

Wajarri Country includes Inyarrimanha Ilgari Bundara, the CSIRO Murchison Radio-astronomy Observatory. Here, the SKA-Low telescope will be built: 131,072 metal antennas across 75km.

Godfrey, Geoffrey and Gerard's dance is part of the Welcome to Country that highlights the importance of land, community and culture to the region and its people. This region is now the centre of a global stage as we look to answer some of the biggest questions in the Universe with the SKA project.

But astronomy has always been a part of this place. The Wajarri Yamaji were the first astronomers here, and they are now *inyarrimanha ilgari bundara* – sharing the sky and stars – with the rest of the world.

Des Mongoo is Wajarri and part of the Minangu Land Council. He says: "The stars are a source of knowledge and guidance. Our people looked up at the stars every night and from that they knew where they had to be."

An Indigenous land use agreement, overwhelmingly endorsed by the Wajarri community, [has recently been signed](#) between the Wajarri Yamaji, CSIRO and Australian and Western

Australian governments to ensure that the building and operation of SKA-Low for the next 50 years will respect, protect and support the cultural and environmental needs of the community. The Wajarri celebrated the registration of the agreement at an event on Wajarri Country in November, attended by Wajarri community members as well as representatives from the Australian and Western Australian governments, CSIRO, and the SKA Observatory.

[Heritage surveys have been done across all SKA-Low sites at the observatory](#), with the SKA-Low telescope configured around heritage locations.

"The negotiation team worked for years with Wajarri to produce a meaningful cultural heritage management plan. It's at the core of everything we do, and it's vitally important," says Rebecca Wheadon, manager of the CSIRO observatory site.

The Wajarri Yamaji led the process with the Australian Government and CSIRO to develop this plan. The SKA project partners are listening, and it is important that Wajarri voices are the loudest ones in discussions on their cultural heritage protection. CSIRO

works closely with the Wajarri Yamaji Aboriginal Corporation on behalf of the organisations who use the observatory site, which includes the SKAO.

As Rebecca says: "We must, and will, do all we can to preserve and protect Wajarri culture. This is an enduring relationship between CSIRO and a people strongly connected to land and spirit. I feel incredibly privileged to be partnering with the Wajarri to protect their heritage."

Juliet Jones was the MC of the SKA-Low construction commencement ceremony held at the observatory, on Country on 5 December. She closed the event with words in the Wajarri language that translate to, "thank you for coming from near and far to our land here, and we'll see you later".

As dances welcome the international delegation to Country, Juliet dictates the ceremony's flow, and Des speaks to many participants, partners, and dignitaries gathered in Perth to celebrate the beginning of construction, we know that the nation's first astronomers will be guiding the next century's greatest astronomical discoveries.

# Building community relations in the Karoo

BY DR ANTON BINNEMAN (NRF/SARAO)

Since the early days of the SKA project, the importance of ensuring the broadest possible impact on society has been central to its mission. It is vital that the positive impact of the SKA is not only seen through ground-breaking advances in science and technology, but also is felt at a community level by the people who live close to the telescope sites.

Over the past decade, as part of the MeerKAT and SKA projects, SARAO (the SKAO's partner organisation in South Africa) has invested in a range of initiatives that have helped to support local people and improve facilities, including – among other initiatives – student bursaries for technical training and graduate study programmes, providing [teacher training in STEM](#) and funding three full-time STEM Educators at Carnarvon High School, supporting a [community computing centre](#) in Carnarvon, and [running an annual innovation challenge](#) for young people living close to the SKA-Mid site.

Importantly, such initiatives are not always related to the SKA's core business of science or astronomy; in some cases, they address a specific societal need. We spoke to SARAO's Dr Anton Binneman about some of these projects which have had a significant impact on those involved.

**Science infrastructure projects like MeerKAT and the SKAO are working hard to demonstrate how their surrounding communities can benefit from the investments being made – tell us about what SARAO has been doing.**

Many people will know we have a long history of supporting human capital development projects through things like education and training bursaries (read more in the case studies opposite and [on the SARAO website](#)). In addition,

over the past five years, SARAO has implemented grants for [socio-economic projects in the Karoo region](#), where SKA-Mid is being constructed, funding projects in collaboration with the Red Cross, hospices in the area, community members and other community development organisations.

**What kind of projects has SARAO supported in that space, which people might not have heard about?**

Two of the projects are particularly noteworthy. The first is the Verneukpan Soup Kitchen centre, which was built near the town of Brandvlei, in a small community called Swartkop that primarily consists of San descendants (one of the Indigenous communities in the Karoo). The centre houses a soup kitchen that feeds 90% of the Swartkop community, a pre-primary school, a consulting room for the district doctor, and a community library. This support was warmly welcomed by Hantam Municipality, where Swartkop is located. The second project is a feedlot, or livestock feeding station, in Williston.

**People might be surprised that SARAO is involved in these areas, in addition to the science-based support for communities.**

Yes, I think at first glance, it might seem strange; radio astronomy and feedlots or soup kitchens seem like they're from different planets, but they are a great example of leveraging investment from an infrastructure project like SKA, into some other area. [...]

**BELOW:** Swartkop Community Centre sponsored by SARAO. Credit: SARAO





*"It is with great joy that we can share that the SKA has constructed a multi-purpose centre in Swartkop. This will service the needs of the community. This centre is improving the quality of living for the people of Swartkop."*

LYNETTE OLYN, MAYOR OF HANTAM MUNICIPALITY



[cont. from p.17] The past 10 years saw the most severe drought in history hit the areas surrounding the SKA site. Among other things, this had a huge negative impact on the local sheep farming industry around Williston, prompting the farmers to ask for SARAO's assistance in setting up a feedlot to support the industry. This seemingly simple investment resulted in a huge impact, and at the peak of the drought the new feedlot had 6,000 sheep in it and it became a hub for drought relief support to the surrounding communities. These are just two examples of numerous projects initiated or requested by community members supported by SARAO and the SKA project.

**Why is it important to take this holistic approach to community relations, engaging in areas that are not the core focus of our organisations?**

It's really essential because they help contribute towards our broader "social licence to operate" in the area, something which is provided by communities; no legal licence to operate can be executed without it. SARAO – and, going forward, supported by the SKAO – has a full-time team in the Karoo working with local communities and delivering on our promise to be a good neighbour.



**Chanté Mathison**

"I'm a bursary student of SARAO, and started having my bursary since grade 11 and 12. Now I'm a first year student at Sol Plaatje University studying a BSc in Chemistry. I want to empower young people to use this opportunity – SARAO gives so many opportunities. They not only focus on telescopes, they invest in the kids of the town and I'm one of them."

**Virgillian Kasper**

"I received my first bursary opportunity in 2011 to become an electrical assistant. I was employed since 2012 with the project – from 2012 to 2014 I worked on site. After that I received another bursary opportunity to go and study and qualify in different trades, attending different courses where I trained to be an instrument mechanic. Now I am working for SARAO as a receiver technician. Being part of the project for 10 years, this is my story, but this is also a story for my community. Because in our community this is an opportunity to inspire; these stories do inspire when people hear them, and you mustn't limit, you must hope for the future. Such stories will inspire and motivate more young people to join the organisation and get these bursary opportunities that are offered."

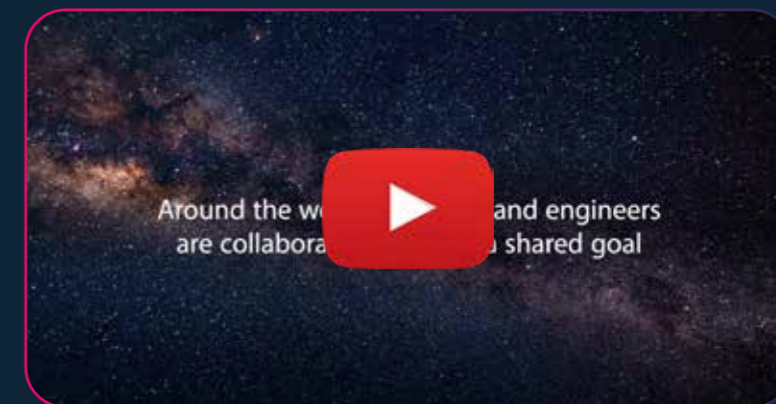
**Funding the next generation of STEM specialists**

SARAO provides bursary opportunities to support academic studies and artisan training, with more than 100 artisans trained to date. Below we hear from two SARAO bursary recipients who spoke at the SKAO's Construction Commencement Ceremony in South Africa (photo above), on the impact that such schemes can have.

**Marking the start of construction in video**

The construction commencement ceremonies provided a great opportunity to look back at the contributions from across our partner countries over the past few months and years. From design to prototyping, training and testing, this international effort over a decade laid the ground for the start of construction of the SKA telescopes.

This short film, produced by the SKAO with London-based production company Polar Media, celebrates this milestone in the multi-decade journey that is the SKA project. Partners from countries all over the world, including scientists and engineers in academia and industry working together, have been key in making the SKA a reality. As contracts are awarded to partner institutions and companies



in our member countries, construction can now start in earnest and telescopes can blossom with the support of local communities. Ministers and senior representatives from many partner countries also sent statements to mark the start of construction of the SKA telescopes. Watch them [here](#).

**Partners celebrate SKA construction milestone**

Alongside celebrations at the SKA telescope sites and the Observatory's HQ, partner institutions also held events to mark the construction milestone.



The SKA Switzerland (SKACH) consortium held an event at EPFL in Lausanne with talks from Swiss Scientific Delegate to the SKA Prof. Jean-Paul Kneib and representatives from industry, a demonstration of a radio telescope and a private tour of the Cosmos Archaeology exhibition, which features an [SKA-Mid site simulator](#).



At ASTRON in the Netherlands, the community spirit was very much alive as well during the construction commencement ceremonies. There was an abundance of themed cakes, along with a video screening of the Dutch science minister's remarks, and speeches from Director-General Dr Jessica Dempsey and Head of the Dutch SKA Office at ASTRON Michiel van Haarlem highlighting the significance of the moment.



Sweet treats were also central to the celebrations at Chalmers University in Sweden, where the traditional "fika" coffee break gathering featured a beautifully decorated SKAO cake, being enjoyed in the photos by Onsala Space Observatory Director John Conway.



# €300m investment front and centre at ceremonies

BY MATHIEU ISIDRO (SKAO)

The SKA construction commencement ceremonies provided a unique opportunity to announce the awarding of hundreds of millions of euros worth of construction contracts to companies in the SKAO's member countries, with a particular focus on local communities.

Major new construction contracts worth over €300m were announced at the construction commencement ceremonies, with Science Ministers Ed Husic from Australia and South Africa's Dr Blade Nzimande highlighting more than €200m for Australian and South African companies to deliver some of the extensive infrastructure required for the telescopes.

In their announcements, the science ministers elaborated on the contractual conditions that the SKAO placed on infrastructure providers to ensure local participation.

"We want to be good neighbours to all of the local stakeholders where our infrastructure is located," said SKAO Director-General Prof. Philip Diamond on the day. "It's important that we play our part in supporting the local economy as well as the national one, and we're doing our small part to ensure this is the case."

## Jobs for the local community in Australia

Australian infrastructure company Ventia was [awarded around €125m over three years to deliver power and fibre networks](#), and the design and commission of a central processing facility and remote processing facilities at the Australian SKA site. Ventia Group Executive for Telecommunications Mark Ralston specified that to support the delivery of the project, nearly 100 new roles would be created for the Wajarri community and locals in the Mid West region of Western Australia.

Mid West and Wajarri Yamaji businesses will play a big part in SKA construction," added Minister Husic. "Ventia will work with these businesses to deliver telescope infrastructure. A separate SKA contract to build the main road and airstrip is reserved for Mid West businesses."

"Beyond the scientific benefits, the SKA project will provide jobs for engineers, scientists and technicians around the world, including in Western Australia," added Western Australia's Deputy Premier and Minister for Science, Roger Cook MLA.

*"We also expect the SKA to attract an estimated AU\$1.8bn [€1.1bn] in foreign income flows to Australia over its first 30 years and create around 350 medium-term jobs"*

MINISTER ED HUSIC



The SKA Observatory will also have broader impacts over time for its host and member countries, in particular by highlighting exciting career opportunities in the science, technology, engineering and maths (STEM) fields.

"Australia's membership of the SKA Observatory is not only good for industry today but will inspire generations of Australians to dream big and follow a career in STEM," added Minister Husic. "We also expect the SKA to attract an estimated AU\$1.8bn [€1.1bn] in foreign income flows to Australia over its first 30 years and create around 350 medium-term jobs."

## Opportunities for SMMEs and skills transfer in South Africa

In South Africa, the Power Adenco Joint Venture was appointed to build the major civil infrastructure, including roll-out of power, fibre and roads. The €53m contract is the biggest contract awarded by the SKAO to a South African based company to date.

Power Adenco will be required to spend a proportionate amount of its contract locally on providing a range of sub-contract opportunities to local small, medium and micro enterprises (SMMEs), on employing, training and transferring skills locally and on other community development initiatives.

"This prestigious project is set to benefit not only our company, but more importantly, improve the lives of the surrounding communities as well as our understanding of the Universe," said Power Construction CEO Cobus Snyman.

In his speech on the day, Minister Nzimande highlighted that some 64 million euros had now been awarded by the SKAO to South African entities, with further contracts expected.

"The operations of the SKA Observatory for the next 50 years will deliver long term, sustainable foreign investment to South Africa with," he added.

*"The operations of the SKA Observatory for the next 50 years will deliver long term, sustainable foreign investment to South Africa with a large number of job opportunities to be created during the lifetime of the telescope."*

MINISTER DR BLADE NZIMANDE



Beyond infrastructure, the SKA project has also facilitated further training and development in the STEM fields in the country and highlighted its technological and scientific capabilities.

"This project is one of the major successes of South Africa broadly but in particular of science and technology in the country," added Pontsho Maruping, the Managing Director of the South African Radio Astronomy Observatory.

## Major antenna manufacturing starts

At the events, the SKAO also announced the major contracts – worth €100m – to manufacture the antennas for both telescopes, awarded to companies in Italy (with participation from UK companies) and China.

**Watch how South African company EMSS antennas developed the most sensitive RF receiver of its kind as part of the efforts to design receivers for the SKA dishes.**



In a high-level ceremony at the start of December, Chinese Minister of Science and Technology Wang Zhigang signed the agreement between SKAO and the Chinese government for state-owned telecommunications company CETC54 to manufacture the structure for the SKA dishes.

"The Chinese government, scientific and industrial communities have taken an active part in the design, research and development of the telescopes and the engineering construction and scientific research work," said Minister Wang on the occasion of the signing.

CETC SKA Office Vice Director Wang Feng added: "The high performance of the SKA dish is the result of many years of Chinese research and development combined with international cooperation and I'd like to thank everyone involved, from our technical team and cooperation partners from South Africa, Germany and Italy to the colleagues and

friends from SKAO and the Ministry of Science and Technology."

For SKAO member countries, the involvement of their industry in the SKA project with its cutting-edge technology and stringent requirements also creates opportunities to acquire new skills and open up new markets.

"This experience was extremely important for us to learn how to act with large and structured international organisations," said SIRIO Antenne CEO Stefania Grazioli, whose company won the tender to manufacture the SKA-Low antennas. "The company and the people involved in the project have had a very important opportunity to grow in experience and know-how."

## €500m invested so far

In the 18 months leading up to the construction commencement ceremonies and since the SKAO Council had approved the start of construction activities, over 40 contracts worth more than €150m had already been entered into by the Observatory, particularly for critical software development.

**Watch how the forest of SKA-Low antennas is born at SIRIO**



With the announcements of major infrastructure, antenna manufacturing and other contracts, the total amount of construction funds allocated so far by the Observatory to companies and partner institutes is now close to €500m.

"We've been on a multi-decade journey," said Prof. Diamond. "I'm so excited to see construction starting in earnest and telescopes blossoming in the Karoo in South Africa and in the Murchison in Western Australia."

Follow the SKA construction journey [on our website](#).



# South African president promotes SKAO at World Science Forum

BY LETEBELE JONES (SKAO)

The World Science Forum (WSF) held its conference, themed *Science for Social Justice*, in a very sunny and hot Cape Town in December.

The exhibition and conference sessions took place at the city's International Convention Centre and coincided with the SKAO's celebratory construction commencement ceremonies events.

The SKAO held an exhibition stand in collaboration with SARAQ, generating many engagements with visitors from around the world. This included educational outreach activities, with learners and conference attendees quizzed on their SKAO knowledge in exchange for some branded memorabilia.

The highlight was a visit to the stand by South African President Cyril Ramaphosa, who gave the keynote address at the official opening of the WSF. He took time to meet with SARAQ Managing Director Pontsho Maruping, SKA-Mid Telescope Director Dr Lindsay Magnus, the SKAO's Head of the Director-General's Office Dr Simon Berry, and Director of Communications, Outreach and Education William Garnier.

President Ramaphosa was presented with an SKAO lapel pin, which – much to the delight and surprise of the team – he immediately attached to his lapel underneath his South African national flag pin (pictured right). It was still there during the president's later keynote address, which was covered widely on Twitter and national television, providing a great endorsement for the Observatory.

There was even more SKAO content for the attendees at the WSF opening ceremony, including the president, with the showing of the Observatory's new film marking the start of construction (see page 20), and a speech from Chair of the SKAO Council Dr Catherine Cesarsky, who updated the audience on the recent construction milestones.

In a rousing address, Sudip Parikh, CEO of the American Association for the Advancement of Science, put a spotlight on the SKAO and its efforts to connect with the communities close to its facilities. "This is not about the elite, this is about the humility that it takes for scientists to be a part of their community and that is what I see in the SKAO. I think South Africa should be incredibly proud of this investment, and this model of partnership around the world."

Image credit: Letebele Jones/SKAO





# World's most radio-quiet power station to be built for SKA-Mid

BY MATTHEW TAYLOR (SKAO)

The unassuming collection of shipping containers and solar panels will be located where one of SKA-Mid's spiral arms will extend, and will house the prototype of the Observatory's power generation.

SKAO Power Engineer Adriaan Schutte has overseen eight years of hard work, with his team sometimes enduring dust storms, torrential downpours and searing heat in the South African Karoo while proving the science behind SKAO's ground-breaking, sustainable approach to powering the SKAO's telescopes.

"The electronics in these power stations – the converters, inverters, battery chargers, maximum power point trackers, all of these things – produce radio frequency interference," Schutte said.

"Not a lot; most people wouldn't worry – since the emissions are way below the levels where people or equipment would be impacted. But we're not most people, and we have to shield this equipment to an incredibly high level to protect our telescopes and the receivers and ensure they can observe the faintest signals from the universe. For an example, take the emissions from a normal household inverter: we have to reduce those emissions by 80 decibels – which is a factor of 100 million. That is an awesome task."

**BELOW:** Nicky van der Merwe is pictured next to SARA0 RF Site Engineer Gerhard Botha, MESA's Dr Joely Andriambelolon, MESA's Casey Bryant and Prof. Howard Reader. Credit: Prof. Reader/MESA Solutions

Independent Power Producers (IPP) who would be invited to build the power stations the SKAO needs simply don't have the expertise to guarantee such unprecedented levels of shielding.

"Reducing electromagnetic interference to the level we need is such a specialist job, that there's only a handful of people in the world that can do it. If we went to the market and asked for someone to build us a radio-quiet power station, we wouldn't get any bids, or they would be far too expensive due to the perceived risk."

Therefore Schutte led a team including Director of Operations Lewis Ball, the SKAO Electromagnetic Compatibility (EMC) team of Braam Otto, Paul van der Merwe and Antheun Botha, Prof. Howard Reader and his team of EMC specialists at MESA Solutions, and design consultants Aurecon Australasia and Zutari, to develop the engineering principles to be used in the forthcoming prototype power station – which will be built starting around April 2023.

"We decided after deliberation and stakeholder engagement that the SKAO are the only ones who can address this electromagnetic interference (EMI) risk and for the past two years we've been investing heavily to designing these power stations and the EMI mitigation measures," he said.

The investment pales in comparison to the capital cost savings SKAO experts have identified.

"We've done fundamental research – things that have never been done before. We've found an entirely new way to dissipate radio noise from the container via cable and soil attenuation without using EMC filters, which saved us over 800 filters at a cost saving of over €2m.

"We're designing fully shielded generator enclosures that have never existed before and this required going to the site, digging trenches, setting up measurement equipment, getting rained on, blown away by wind.

"All of this has culminated to the point where we've got reference designs that are more or less complete.

"It will be the world's most radio-quiet power station by far."

### Thinking green

Throughout his involvement, Schutte has stressed the primacy of ensuring the SKAO's telescopes are as green as possible, with the maximum input possible coming from renewable energy.

"Emissions are an existential consideration for us. With the world really waking up to the climate crisis, public opinion would rightly turn against a research infrastructure that wasn't thinking green.

"People are very happy for science projects to discover amazing things, but not if it comes at the expense of the planet. And as we like to say: the best way to reduce CO2 emissions is to not use the power in the first place."

This work has already included reducing the Observatory's anticipated power consumption by a factor of three.

"It was about making everyone aware of the need to save power and select low-power equipment, even if that equipment meant paying a bit more for capital costs.

"We're going to extraordinary lengths to be as green as possible and we're going all-in for this at significant additional shielding cost and effort.

"It's very important that we can illustrate to people that we're doing everything in our power to be green and the rewards will be seen in the long term sustainability of the project."

### Future developments

The prototype power station will utilise photovoltaic (PV) solar panels and batteries, with a back-up diesel generator solution for times of low solar irradiation.

Early this year, Adriaan will examine replacing the battery/generator model with a hydrogen energy storage system: a



**ABOVE:** Casey Bryant from MESA Solutions uses an antenna to record emissions from buried cables – part of the team's unique solution to use soil attenuation to absorb Electromagnetic Interference (EMI). Credit: Prof. Reader/MESA Solutions

cutting-edge solution that uses micro electrolyzers to split water into its component hydrogen and oxygen elements. The oxygen is vented to the atmosphere, but the hydrogen is stored in large medium-pressure cylinders.

At times of low solar input, this system can recombine atmospheric oxygen and the stored hydrogen through a fuel cell. Crucially, one of the main hurdles for the system in an radio-quiet environment has already been overcome: the large amounts of excess heat generated.

"The generator heat dissipation system has already been designed as part of the prototype PV, battery, diesel generator design," he said.

"We now know how to design a fully-shielded container with an attenuation factor of 100 million that can get rid of huge amounts of heat, without chasing our tails with air conditioning. The world has got a finite amount of lithium to mine for batteries and is not something that you can cheaply recycle.

"I'm really keen to see if we can make hydrogen work as it's just water and the remaining components are 97% recyclable."

The SKAO's prototype power station will be constructed on a spiral arm of the SKA-Mid array from April 2023. Ultimately there will be 21 remote power stations for Mid.

There will be at least one Central Power Station (CPS) for Low, and potentially also a CPS for Mid, with a capacity of around 3.5MW each. The smaller power stations will power the outer seven dishes on Mid and have a capacity of about 15kW each.

A further power station will partially power the Science Processing Centre (SPC) in Cape Town.





## WALLABY builds an intergalactic map in the outback

BY ICRAR AND CSIRO

A survey conducted using CSIRO's ASKAP radio telescope in Western Australia is helping to build a 3D map of the night sky, mapping galaxies up to a billion light years away.

The WALLABY (Widefield ASKAP L-band Legacy All-sky Blind survey) Pilot Survey will be sharing its first data release with the scientific community, helping us to better understand nearby galaxies and galactic clusters. Hundreds of galaxies have been surveyed in Phase 1 of WALLABY, covering 180 square degrees of the observable sky. A second phase of the survey is already under way.

Over the course of the survey 250,000 galaxies are expected to be catalogued – almost an order of magnitude more than the current state-of-the-art ALFALFA survey on the Arecibo telescope – helping researchers to measure dark matter distribution and how galaxies evolve and interact.

Lead author Dr Tobias Westmeier (ICRAR/UWA) said the data WALLABY collects will help us investigate the Universe at a scale we never could with just optical telescopes.

"If the plane of the Milky Way is between us and the galaxy we're trying to observe, the sheer number of stars and dust makes it incredibly hard to see anything else," Dr Westmeier said. "WALLABY isn't affected by these limitations. It's one of the great strengths of radio surveys; they can simply peer through all the stars and dust in our own Milky Way."

It's the first full 3D survey of this scale, with over 30 terabytes of data collected each day from eight hours of ASKAP observations. This is an ingest rate of around 4TB per hour, which is like streaming 4,000 standard definition movies at the same time.

Co-author Dr Karen Lee-Waddell (ICRAR/UWA & CSIRO), WALLABY Project Scientist and Director of the Australian SKA Regional Centre, said the project will show us where these galaxies really are in relation to one another, splitting up galaxies which appear clustered together but are millions of light years apart.

"WALLABY will enable us to directly map and detect the fuel for star-formation: hydrogen gas," Dr Lee-Waddell said.

WALLABY is one of nine pilot surveys being undertaken with ASKAP before it becomes fully operational later this year.

CSIRO's Australia Telescope National Facility Science Program Director Dr George Heald said these projects have been made possible through ASKAP's ability to collect data at a scale never seen before.

"Inyarrimanha Ilgari Bundara, CSIRO's Murchison Radio-astronomy Observatory is one of the most radio-quiet locations in the world, allowing projects like WALLABY to find narrow and faint astronomical signals without being swamped by radio interference," said Dr Heald.

**ABOVE:** A dish from CSIRO's ASKAP radio telescope.  
Credit: Alex Cherney/CSIRO

## India's GMRT discovers the oldest known remnant radio bubbles

BY DR SURAJIT PAUL (SAVITRIBAI PHULE PUNE UNIVERSITY, PUNE AND RAMEN RESEARCH INSTITUTE, BANGALORE)

A team of Indian astronomers has discovered the oldest ever remnant radio "lobes" of a galaxy residing inside the cluster Abell 980.

The discovery was made mainly using data from India's GMRT, with additional data from fellow SKA pathfinder telescopes LOFAR and the VLA, as well as the Chandra X-Ray Observatory.

Galaxies are the assembly of billions of stars, often residing in clusters containing hundreds of them, all held together by their mutual gravity. Among them, the largest galaxies host supermassive black holes at their centre, and in their active phase (when they're known as active galactic nuclei or AGN) usually they spew relativistic electrons in the form of two oppositely expanding collimated jets. These expand into balloon-like clouds, or "lobes", of magnetised relativistic plasma radiating in radio waves, and become visible to sensitive radio telescopes.

Like living beings, these radio lobes also have a lifespan which depends on how they are fed with the plasma by the AGN of their parent galaxy. Once the feeding stops, these lobes start losing their energy rapidly by radiation and fade away beyond detection.

Usually, they remain visible for only a few tens of millions of years. However, the team [led by the author of this piece] has serendipitously spotted an extremely old but surviving pair of radio lobes with an estimated record age of about 260 million years, trapped inside the intra-cluster medium of Abell 980.

While highly aged radio bubbles of around 100 million years are not something completely unknown, they are usually the fossil remains of once active radio jets, and only detected in massive merging clusters; their electrons revived by the shock of the merger. This discovery is unique and puzzling as these lobes are not revived fossils and are surprisingly found inside a non-merging, low-mass cluster, as confirmed by an analysis of Chandra X-ray data, thus indicating that they have been continuously emitting detectable radio signals for 260 million years after the cessation of jet activity, which is next to impossible in usual cases.

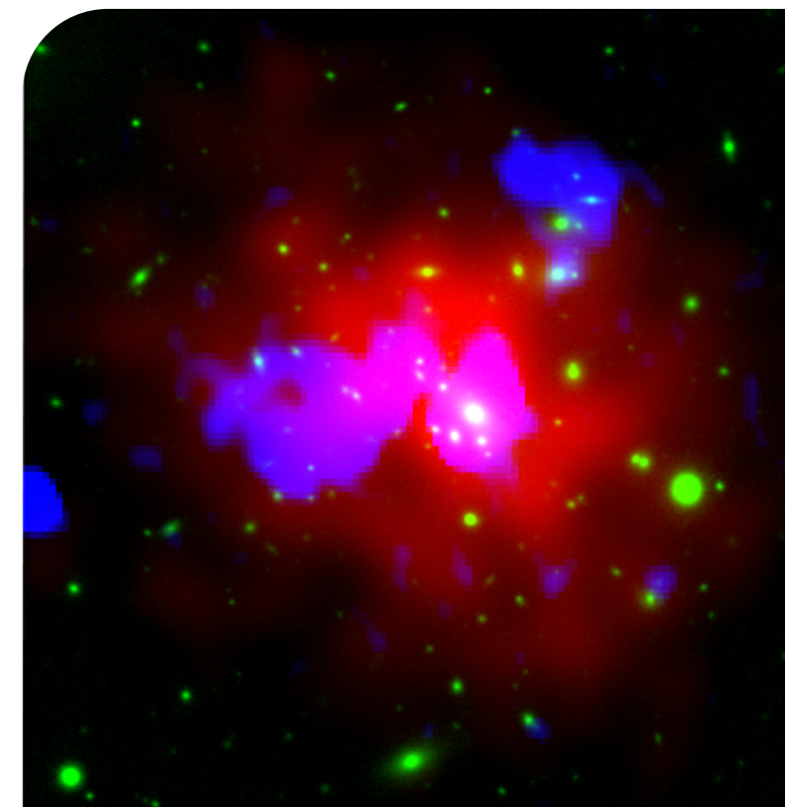
The team thinks this is an atypical example where confinement of radio lobes inside the hot but relaxed cluster medium has prolonged the life of the lobes to such an extent. The fact that the cluster is comparatively a low-mass one may also have provided a rare favourable

environment. This discovery has therefore opened up a unique opportunity for scientists to study radio jet evolution over the longest period of time.

This technically challenging detection of these extremely faint sources was possible due to the high sensitivity of the GMRT and LOFAR telescopes. While this is the first one found, it may not be the only one in the sky. In fact, the Universe is likely to be infested with faded relics of radio lobes of various ages blown up by billions of large galaxies during their multiple active phases over the cosmic time scale. The SKA telescopes will therefore be the game changer to unravel the radio sky with many such extreme events.

The entire research has been recently published in two research articles in [Astronomy & Astrophysics](#) (A&A) and in [Publications of the Astronomical Society of Australia](#) (PASA).

**BELOW:** Optical photograph of the cluster of galaxies, whose central giant elliptical galaxy (white elliptical patch) is the parent of the radio lobes shown in blue. The red-shaded region displays the halo of X-ray emission due to the hot intra-cluster medium.





# Extraterrestrial signal search gets under way using MeerKAT

BY SARAO AND BREAKTHROUGH INITIATIVES

[Breakthrough Listen](#) – the initiative to find signs of intelligent life in the Universe – has started observations of a million nearby stars with the MeerKAT radio telescope in South Africa.

The new search for technosignatures – indicators of technology developed by extraterrestrial intelligence – expands the number of targets searched by a factor of 1,000, and uses a powerful new instrument deployed to MeerKAT.

The astronomers and engineers on the Breakthrough Listen team have spent the last three years developing and installing the most powerful digital instrumentation ever deployed in the search for technosignatures, and integrating the equipment with the MeerKAT control and monitoring systems in cooperation with SARAO engineers.

The new hardware complements Listen's ongoing searches using the Green Bank Telescope (GBT) in the USA, the Parkes Telescope in Australia – another SKA pathfinder – and other telescopes around the world. But while Listen's programmes at the GBT and Parkes involve moving these thousand-ton-plus dishes to point at targets all over the sky, the programme on MeerKAT usually won't mechanically move the antennas.

"MeerKAT consists of 64 dishes, which can see an area of the sky 50 times bigger than the GBT can view at once," explained Breakthrough Listen Principal Investigator Dr Andrew Siemion. "Such a large field of view typically contains many stars that are interesting technosignature targets. Our new supercomputer enables us to combine signals from the 64 dishes to get high resolution scans of these targets with excellent sensitivity, all without impacting the research of other astronomers who are using the array."

By operating in this "commensal" mode, Breakthrough Listen gains access to one of the world's most capable and sensitive radio telescopes almost 24 hours a day, seven days a week. The ability to scan 64 targets at a time within the main field of view also improves Listen's ability to reject interfering signals from human technology such as Earth-orbiting satellites.

The Listen team had to develop sophisticated targeting and scheduling software to ensure the survey goals could be met in the desired timeframe. They have also developed an automated data processing pipeline that scans through the data in near-real-time to search for interesting signals.

Breakthrough Listen is also working with SARAO to develop research opportunities for astronomers and data processing experts in Africa on this cutting-edge programme.

"MeerKAT has a remarkable combination of sensitivity and survey speed, which makes it a wonderful telescope for Search for Extraterrestrial Intelligence (SETI)," said Dr Fernando Camilo, Chief Scientist for SARAO.

"The telescope was planned and developed here in South Africa, and it's very exciting that young South Africans will have the chance to be involved at the forefront of the search for life beyond Earth."

Related paper: [The Breakthrough Listen Search for Intelligent Life: MeerKAT Target Selection](#)

## LOFAR unveils giant glow of radio emission spanning galaxy cluster

BY INAF AND THE UNIVERSITY OF BOLOGNA

Researchers have observed a huge expanse of radio emission embedding an entire cluster of galaxies, one of the largest structures in the Universe seen at radio wavelengths.

The source is invisible in optical light and is associated with the huge Abell 2255 galaxy cluster, located at a distance of about a billion light-years from Earth.

The discovery was made possible by combining 18 nights of observations with the Low-Frequency Array (LOFAR) radio telescope – a network of thousands of antennas across Europe. The scientists, based in the Netherlands, Italy, and Germany, worked for more than two years analysing and interpreting the observations to achieve the results [published in the journal \*Science Advances\*](#).

Galaxy clusters are fascinating objects residing in the densest regions of the Universe, containing hundreds to thousands of galaxies. The volume between galaxies is permeated by an extremely rarefied gas of high-energy particles mixed with magnetic fields. Very little is known about the origin of the most energetic particles in this gas and their interaction with cluster magnetic fields.

"We discovered that Abell 2255 is enveloped by a faint glow of radio emission that embeds thousands of cluster member galaxies and extends on unprecedented large scales of at least 16 million light-years," says Dr Andrea Botteon of Leiden University and the University of Bologna (and INAF associate), lead author of the study and a member of the SKAO's Extragalactic Continuum Working Group. "This emission is generated by high-energy particles moving at speeds close to the speed of light in feeble magnetic fields – one million times weaker than the Earth's field – that fill the entire volume of the cluster, even in its most peripheral regions.

"For the first time, we have detailed information about the distribution and properties of these components over such vast extents. We can also study the physical processes occurring at large distances from the cluster centre in the most rarefied regions of the Universe that we can currently probe. Furthermore, we believe that the origin of the radio emission in Abell 2255 is connected with the enormous energy released during the formation process of the cluster."

The research is based on a set of very deep radio observations, which have never been done before.

"To process these data, we had to develop some new techniques to create very sensitive images. In particular, the image that we produced at 50MHz is the deepest ever obtained at such low frequency," says Prof. Reinout van Weeren from Leiden University, co-author of the paper.

The study shows that current radio telescopes have the power to unveil the properties of unexplored regions of the large-scale structures in our Universe, and the SKA telescopes will build on this.

One of the scientific goals behind the SKA telescopes is to understand if the radio emission from clusters – such as that discovered in Abell 2255 – extends beyond clusters themselves, tracing the network of filaments connecting clusters of galaxies in the Universe known as cosmic web.

SKA-Low – the SKAO's telescope in Australia – will be able to search for radio emission from the Universe's largest structures in an efficient way, thanks to its low-frequency operational range (where these kind of radio sources appear brighter) and high survey speed. In fact, the new techniques developed by the researchers to process LOFAR data will be adapted to produce high-sensitive images with SKA-Low too.

Moreover, studies on the Faraday rotation [a phenomenon where radio waves are "twisted" by the magnetic fields of objects they encounter, enabling us to study the magnetic environment] of background sources with SKA-Mid – the SKAO's telescope in South Africa – are expected to revolutionise this field, allowing researchers to investigate the poorly understood properties of magnetic fields in galaxy clusters and cosmic filaments.

**ABOVE:** Composite image of galaxy cluster Abell 2255, showing an area of about 18 million light years across. X-ray data (blue) from ROSAT shows hot gas between the galaxies; radio data (orange and purple) from LOFAR shows fast-moving particles in the cluster's magnetic fields; the purple glow is the radio emission surrounding the entire cluster. Background optical image taken with the SDSS. Credit: ROSAT/LOFAR/SDSS/Botteon et al., 2022, *Science Advances*/Frits Sweijen.



**BREAKTHROUGH LISTEN** on MeerKAT



# Championing reproducible science

BY THE SKAO SCIENCE TEAM

The SKAO Science team has announced the results of the Science Data Challenge 2 (SDC2) reproducibility awards. The SKAO Science Data Challenges are designed to prepare the astronomical community - and the SKAO - for the novel, yet challenging, nature of SKA data.

SDC2 saw over 100 worldwide participants tackle a 1 TB dataset to find and measure galaxies in a simulation of a deep SKA-Mid neutral hydrogen survey. The challenge demonstrated the value of complementary methods and diverse collaborations, and full findings from the challenge will be published in a paper soon.

The SDC2 [reproducibility awards](#) sat alongside the main challenge, [the results](#) of which were announced in October 2021. Developed with the help of the [Software Sustainability Institute](#) (SSI), awards were made to all teams whose pipelines demonstrated best practice in the provision of reproducible results and reusable methods.

“Reproducibility leads to better, more efficient science,” says Dr Philippa Hartley, SKAO Scientist and co-lead of SDC2. “When we talk about reusable methods, we mean creating software that can be adapted by others, allowing previous work to be built upon for the future: that’s a key feature of Open Science.”

Six teams took part in the reproducibility part of the challenge, each submitting their analysis pipeline to an expert panel for evaluation against a set of [pre-defined criteria](#).

The team HI-FRIENDS, comprising members across eight institutions in six countries, received the top award for providing an excellent gold-standard solution containing many examples of best practice.

“Reproducibility is a fundamental principle of the scientific method and the best practices defined by Open Science, such as having precise documentation and metadata, are our ally to enable our results to be reproduced,” says Dr Lourdes Verdes-Montenegro, researcher at the Instituto de Astrofísica de Andalucía (IAA) and co-leader of the HI-FRIENDS team.

“Pipelines designed with reusability and reproducibility in their core can be used and improved by the community so we can all benefit from prior work and be better equipped to do great science with the SKAO,” says Javier Moldon, Operations Scientist of the SKA Regional Centre (SRC) Spanish prototype and HI-FRIENDS co-leader.

“We appreciate that preparing analysis software for sharing publicly can take time, and we very much appreciate the involvement of the teams in this aspect of the challenge,” says Dr Hartley. “The challenge results highlight the value of community-built software and underscore the need for that software to receive the funding to be well-maintained.”

The reproducibility awards will be included and discussed in the upcoming SDC2 results paper, and the SKAO Science team welcomes feedback on how best to support collaborative science through reproducibility best practice.

The SKAO is now gearing up for the start of [SDC3](#), which focuses on peering into the so-called [Epoch of Reionisation](#): a time in the very early Universe when the very first stars were forming. Registration has now closed, with more than 230 participants worldwide having signed up.

Stay tuned for updates when the challenge begins.

*Interested in reproducibility? Check out [this guide](#).*


The results



**HI-FRIENDS**  
Gold-level



**FORSKA Sweden**  
Silver-level



**Team SoFiA**  
Silver-level



**NAOC-Tianlai**  
Bronze-level



**SHAO**  
Bronze-level



**EPFL**  
Bronze-level



ABOVE: SKAO Council #7 took place in October 2022 in Cape Town, South Africa

## South Africa hosts SKAO Council

BY LETEBELE JONES (SKAO)

In October, the quarterly SKAO Council meeting was held in South Africa, the first time it has been held at a site other than SKAO Global Headquarters.

The meeting kicked off with an exciting and insightful visit to the SKA site and the town of Carnarvon in the Karoo region of the Northern Cape. Visiting the site and surrounding communities enabled Council members to see and understand what has been accomplished so far by SARAO colleagues, not only from a scientific and technological point of view with regards to the MeerKAT telescope and its future expansion, but also in terms of local investment in support of the local communities.

The visit also allowed Council members to witness first-hand the SKA-MPG dish prototype erected on site, as well as

emerging activities in preparation for the SKA-Mid telescope, including the ground work related to the future construction camp where contractors will be accommodated.

The trip to the Karoo was carefully planned and well executed by the joint SKAO and SARAO team, which bodes well for the future of the collaboration between the SKAO and the host country.

The October 2023 SKAO Council meeting will be held in Australia, allowing Council members to see the progress at the SKA-Low site, 10 months after the official start of on-site construction that took place on 5 December 2022.

BELOW: The SKAO Council visiting the MeerKAT/SKA site to witness progress and on-going activities ahead of the start of construction of SKA-Mid.







2 minutes with...  
Hélder Ribeiro,  
CEO at ATLAR Innovation

Building the SKA isn't only about constructing the telescopes on site; construction contracts for hardware components, software development and computing infrastructure have been awarded globally. In Portugal, software company ATLAR was founded to support SKA construction. We caught up with CEO Hélder Ribeiro, who visited the SKAO's Global Headquarters in December.

**Welcome to the HQ, Hélder! Tell us about ATLAR and its role in construction.**

We are a small company with five people working on SKA software in three teams: one installing and configuring the computing clusters, one assigning resources from the clusters for other teams to develop software on, and one that is developing monitoring and control software. This is a web-based software suite, like an online dashboard, where you can see all the telescopes and what they're doing, check whether they're working well or if there are any problems. You can even test movement, send, receive or process a signal, and other teams – for example those building the central signal processor, or the pulsar search system – can use it to simulate and test their software.

**ATLAR is a spin-off company of the SKA, is that right?**

Yes exactly, some of us were involved in the SKA design process, employed by academia through the [EngageSKA](#) infrastructure during the SKA software bridging period. We decided to establish the company to bid for an SKA construction contract, which fortunately we won – in fact it's the biggest one in Portugal. We now have 15 staff in total, and contracts with the Portuguese Ministry of Defence and others operating space infrastructure (radars and telescopes) for the European Space Surveillance and Tracking programme. It's quite simple: the company would not exist without the SKA – it was born from big science. It gave us the stability to continue and our people have learned so much that now we are able to gain more projects.

**Where does the challenge lie in developing software for the SKA?**

Developing software in general is challenging as there's no one correct way to do it, so every day people have different ideas and we need to agree on the best approach. It's also on a scale that other projects aren't, so every time you develop something for one telescope, you have to make sure it will scale for thousands of telescopes, thousands of different controllers and processors retrieving data. That's very challenging, and we can only do it with the help of all the teams and their expertise, all of us pitch in with ideas. The SKAO always welcomes new thinking and new ways to do stuff.

**What does it mean to you to be involved in SKA construction, professionally but also personally?**

It's a dream for us to contribute to this extraordinary project. In the future when the SKA telescopes make important discoveries, we will feel we've been a small part of making it possible. For me personally the most exciting part is the search for life out there – if we can contribute in some way to that, it would be amazing.

# Making the world better with a sweater

BY CASSANDRA CAVALLARO (SKAO)

**Since 2018, staff at the SKAO's Global Headquarters in the UK have taken part in an annual fundraising event called Christmas Jumper Day in aid of the charity Save the Children, whose 30 national member organisations work in more than 100 countries worldwide providing food, medicine, education and emergency humanitarian support.**

Christmas Jumper Day is marked in workplaces, schools and community groups in the UK, and more than three million people signed up nationwide in 2022. As well as raising money, it's a great way to build team spirit and a welcome excuse to wear cosy, novelty knitwear to the HQ when the temperature outside falls below zero.

This year saw a great turnout and SKAO staff got involved with festive jumpers and accessories. The HQ cafe, The Hub, also prepared special treats to mark the occasion and help with the fundraising effort.

The day's slogan is "Make the world better with a sweater", and through staff donations and the support of the Recreation Committee [we raised over £600](#) (around €700) this round. You can read about how the donations will be used to support [the charity's lifesaving work here](#).

A big thank you to all who joined in and donated!

**BELOW:** Staff at SKAO Global HQ wore festive knitwear for the annual charity event Christmas Jumper Day.



# SKAO releases its first Equality, Diversity and Inclusion plan

BY MATHIEU ISIDRO (SKAO)

In December, the SKAO released a set of documents to take its equality, diversity and inclusion (EDI) vision forward.

**Two years of work culminating in nine actions**

The publication of these documents is the result of over two years of work by a large group of staff, following a call from the director-general to review practices and develop an EDI plan for the nascent observatory.

After several months of work including climate surveys, training sessions and workshops with experts, a set of recommendations focusing on areas such as recruitment, culture, accessibility, and data, were produced and endorsed by the SKAO leadership. A small taskforce chaired by the director of operations and including members from the leadership, HR and staff was set up to prioritise recommendations and develop an implementation plan.

Nine actions were identified, which strongly align with the SKAO's core values. These actions were developed to address three themes that represent the highest priority EDI ambitions for the observatory:

- Gender balance;
- Diversity that reflects the SKAO's member countries; and
- Equity of access to SKA activities, including science.

Additionally, three areas were identified in which to focus immediate action: recruitment; the development of the observatory's tools, systems, and culture; and communications and reporting.

The plan, now approved by the SKAO director-general and released to staff and partners, will be implemented across the SKA Observatory and its activities. A review is expected in 12 months' time to check where the observatory is in its implementation.

**A new code of conduct**

The taskforce also produced a new [code of conduct for meetings and events](#) that now applies to all SKAO-organised meetings and can be used for any SKA-related meeting organised by third parties, as well as guidelines for external facilitators and trainers the observatory uses.

**Policies that apply to all members of the SKA community**

Several policies of the Observatory apply not just to its staff but to members of the SKA community, including partners, contractors, meeting attendees and others the Observatory works with. These include an EDI policy, code of ethics, and standards of conduct and behaviour. You can find more information [on our website](#).

"EDI are core values of the SKA Observatory," said Prof. Philip Diamond, Director-General of the SKAO, upon publication of the documents. "It is incumbent on all of us – senior leaders, line managers, staff, but also members of the SKA community – to uphold these values and help take these actions forward. I look forward to seeing these actions implemented across the SKAO and for our work to promote and respect EDI continue."

## SKAO's nine EDI actions

- 1 - SKAO's core EDI policy documents must be approved, signed, made available and promoted to all relevant stakeholders.
- 2 - SKAO's commitment to EDI and the content and response to this Implementation Plan, should be clearly communicated to all Observatory and collaboration staff, including the flow through from the EDI Working Group Action Plan and the staff Climate Survey, and demonstrated through concrete actions including those in this plan.
- 3 - Work already underway to update the recruitment process for SKAO employees and collaboration staff should continue, with the urgent deliverable being to incorporate measures specifically targeting gender and other diversity outcomes.
- 4 - SKAO should take specific account of the EDI-related challenges of having staff working and living at remote sites/communities, and implement safety and training measures that follow best practice in this area.
- 5 - SKAO should adopt an EDI Calendar of Events and appropriately mark those events across the Observatory as a means of communicating and celebrating its commitment to EDI and helping to embed SKAO's EDI values across its activities.
- 6 - SKAO should make a clear statement on its commitment to accessibility, including ensuring appropriate building codes are adhered to as a minimum, seeking to adopt best practice where feasible, and committing to fair and equitable access to SKA activities, including science and supporting tools.
- 7 - SKAO-hosted meetings open to a wide community must incorporate the Code of Conduct for SKA Meetings and Events which provides guidance for facilitators, presenters and participants, and external facilitators and trainers working with SKAO must be provided with EDI guidelines explaining the SKAO's values and expectations. There must be a clearly identified mechanism for the reporting of concerns or breaches, with defined paths for escalation and response.
- 8 - SKAO should commit to reporting publicly on diversity KPIs on an annual timescale, including relevant baseline/population data regarding protected characteristics, in order to assess performance and drive change over time.
- 9 - SKAO should implement an appropriate mechanism to oversee and advise on EDI issues and performance, and consistency with best practice.



# Cornerstone agreements signed for telescope operations

BY MATTHEW TAYLOR (SKAO)

Hot on the heels of on-site construction ceremonies, 2023 has already seen another crucial SKAO milestone reached.

The signing of an Agreement of Bilateral Collaboration (ABC) with the SARAO on 17 January signalled the end of a two-year process to legally define the SKAO's working relationships with our key collaborators in the telescope host countries.

Together with the ABC finalised with CSIRO in December, this completes the two foundational documents that underpin the staffing arrangements to deliver the SKA in Australia and South Africa.

They are legal contracts that capture the specifics of how those close relationships work and they have been written to stand for the 50-year lifespan of the Observatory.

The ABCs are central to establishing how the SKAO will source the team of roughly 150 people in each host country who will



operate our telescopes, highlighting shared strategic goals that each party is working toward for the benefit of the SKA project.

The negotiations to finalise the ABCs were led by Director of Operations Dr Lewis Ball (photo above), alongside Legal Manager Decker and SKA-Low and SKA-Mid Telescope Directors Dr Sarah Pearce and Dr Lindsay Magnus, respectively.

Dr Ball said: "These are the contracts that will underpin almost two thirds of the staff who will work to deliver the SKA in the long term.

"They are significant agreements and, frankly, it's terrific to be able to put a tick next to them on the to-do list".

**ABOVE:** SKAO Director of Operations Dr Lewis Ball with the signed ABCs. Credit: SKAO

# SKAO holds inaugural annual programme review

BY SKAO

Earlier this month, forty people plus remote attendees convened in the SKAO Council Chamber for the first ever annual programme review meeting, which took a comprehensive look at how the construction execution on the SKA-Low and SKA-Mid facilities was progressing.

It provided an opportunity for an independent panel of experts to assess whether the SKAO is on-course to deliver an operating observatory.

Ahead of the full report being finalised, Dr Adrian Russell, Chair of the Review Panel and Director of Programmes for the European Southern Observatory, pointed to a rosy future with a very positive verbal summary.

He said: "It's absolutely clear, as we expected, that it has been extremely well organised. The willingness of people to be totally open and discuss issues has been absolutely fantastic.

"I think every single person that was involved should be extremely proud of what they're achieving."

Deputy SKAO Director-General Dr Joe McMullin said: "It was an extremely helpful meeting for us. The panel is deeply experienced in deploying large research infrastructures and they were able to efficiently review both the documentation and the summary presentations to highlight areas that are going well, and need to be maintained, as well as areas to focus improvements as we continue forward. We will integrate their recommendations into our planning to continue to improve our execution.

"These reviews will continue to be vital as the SKAO progresses through construction."

# 2021 SKAO Annual Report is out

BY SKAO

Hot off the press, the very first SKAO Annual Report covering the period from the legal constitution of the Observatory in January 2021 until the end of that year [has just been published](#), providing information on the background of the SKA project as well as the progress, achievements and financial performance of the organisation during 2021.

"I am proud of what our organisation has achieved, individually and collectively around the world, in what was an extremely challenging year," says Prof. Philip Diamond, SKAO D-G. "The foundation of our success is our people, who have demonstrated integrity and dedication dealing with challenging circumstances and maintaining high standards of professional excellence to serve our members and communities."



# New test antennas arrive at SKA-Low site

BY MATTHEW TAYLOR (SKAO)

Antennas for the latest prototype station arrived in Australia this month, the first of many exciting milestones due for SKA-Low this year.

The Aperture Array Verification System 3.0 (AAVS 3.0) represents a significant evolution from previous versions.

Its primary objective is to ensure continuity for the product development teams and to reduce risk for the delivery of the construction phase, increasing the probability that performance, cost, and schedule are maintained.

The shipment of antennas arrived at Fremantle port in Western Australia on 15 January. The first container was cleared on 17 January, and the second container the day after that.

The 260 antennas, without the low-noise amplifiers, arrived and were unpacked on 20 January at Inyarrimanha Ilgari Bundara, the CSIRO Murchison Radio-astronomy Observatory, following the 750km drive.

Although AAVS 3.0 will be built and operated on Curtin University's Murchison Widefield Array (MWA) site, it will be the first instrument owned, operated and maintained by SKAO staff in Australia.

**RIGHT:** The 260 antennas arrived at Inyarrimanha Ilgari Bundara, the CSIRO Murchison Radio-astronomy Observatory on 20 January.







# André van Es and Ben Lewis – SKAO Senior Project Managers

The formal start of construction at the SKA telescope sites in Australia and South Africa was also celebrated at the SKAO's Global Headquarters in the UK, which is where the Observatory's Project Management team is based.

SKA-Low Senior Project Manager André van Es from the Netherlands, and SKA-Mid Senior Project Manager Ben Lewis from Australia, lead the two telescope delivery teams, overseeing development and manufacturing activities in SKAO partner countries and ensuring the SKAO maintains an ambitious construction schedule. We caught up with them to hear about the challenges of their roles, how they work together, and their very different childhood aspirations.

**How did you both feel on Monday 5 December when we celebrated the SKAO's Construction Commencement Ceremonies?**

**André:** The event was a momentous occasion for everyone involved in the project. The project teams with the procurement department (and many others across departments) have worked hard to make this happen. And for me it was great to see the project now really kick off with construction work on site in 2023, it was a long journey but I'm so happy to start!

**Ben:** Happy, proud, and a little terrified. It's a bit of a step-change in the project, and will require us to continue to refine and adapt our working practices to ensure a successful delivery. To paraphrase Abraham Lincoln, we've sharpened the axe and now it's time to cut down the tree!!

**Tell us about your roles as senior project managers for each of the telescopes, what does it mean day to day?**

**Ben:** It's primarily a coordination role, with teams across the HQ and

internationally; we've got collaborators in nearly every member country. On any given day, it could be a meeting with the strategy group for membership discussions, or a detailed discussion about a contract clause, but it's mostly about communication and leadership.

**What did you do before this?**

**André:** I've been involved with the SKA project for a long time, since around 2004, including in design studies. I was project manager of the Low Frequency Aperture Array consortium, started in 2011, which was responsible

for designing the array of the Low telescope. In 2015 I joined the SKA Organisation [precursor to the Observatory] as engineering manager of the Signal and Data Transport Consortium, responsible for designing the networks and clocks for the telescopes.

**Ben:** I knew about the SKA since university but came fresh to the project after working for a broadcast telecommunications infrastructure company in Australia, as an engineer and then a project manager.

**Let's cast our minds back to your childhoods. Were you into science and engineering as kids?**

**Ben:** Yeah, I always loved pulling stuff apart. I never put it back together.

**André:** I did a lot of reading and was a bit of a quiet child. I grew up in a small village and always dreamed of becoming a fighter pilot or maybe even an astronaut. That ambition died at the moment I got glasses, so I decided to study aerospace engineering at Delft University of Technology in the Netherlands. It's only then that I got more interested in science. There are two types of aerospace engineering students: the ones that always wanted to build planes, and the ones that always wanted to fly. I was in the second category, but when I started working on engineering I enjoyed it a lot more than I expected to.

*"I got involved in the project because I saw an advert for building the biggest telescope array in the world and ever since then, I have not let go of that focus"*

ANDRÉ VAN ES

**Did you have an ambition like that Ben?**

**Ben:** No, I was the opposite, I was just interested in doing stuff that was fun. I play guitar and sing, and when I was younger I was all about being a rock star. I haven't got there yet but I'm only 38, there's still time. I went to the University of Tasmania which had a strong astronomy department so I studied astronomy. Actually my mum takes credit for me being at the SKAO because when I was a toddler, she would take me out in the backyard - I grew up in Tasmania which has got great dark skies - and she'd hold my hand and point it up at the stars.

**Other than your mum, were there role models who inspired you?**

**Ben:** For me it was people like Neil Young, Billy Bragg, activist musicians with a social conscience, they were my idols.

**André:** I was very Catholic growing up so I had a lot of saints that were examples for me, but the person I always admire is Primo Levi, who was both a scientist and a writer, and who had been in Auschwitz.



I read a lot of his books and he made a big impression on me; how could he combine these lives and continue living after that experience.

**So you had quite different backgrounds and goals - at what point did you decide on project management?**

**André:** My career started in industry where I was test manager for an aperture array radar. At ASTRON I started as head of the project support group and combined this with project management because we were successful in gaining European funding for an SKA design. I have always enjoyed working on the edge of management and technology. The project controls management role increased when the LOFAR telescope project started, but it was definitely not a conscious choice in my career to become a project manager.

**Ben:** In my case I got to a point in my career where my engineering skills were somewhat exhausted; I found out my stakeholder management and leadership skills were much better than my technical skills, so I could do

**BELOW:** André (below) and Ben (right) with their younger sisters







**ABOVE:** André (left) with colleagues at the SKA-Low site in Western Australia.

way more interesting stuff as a project manager than I could have done as an engineer. I started doing more leadership of projects, running teams of tens of people and I thought “there’s got to be a better way to do this - I need to go and actually learn how to become a project manager”.

**What drew you to the SKAO?**

**André:** I wanted to finish what I started with the LFAA Consortium. I got involved in the project because I saw an advert for building the biggest telescope array in the world and ever since then, I have not let go of that focus. I came to the SKAO with the intention of building the Low telescope, so that’s what I want to achieve.

**Ben:** It’s a hugely ambitious project, so when the vacancy came up I saw it as a chance to work with people who do things that I couldn’t do, but I could coordinate them and make a tangible impact. My next job might not even be in project management; I’m here because I feel I can make a big difference in this project, I wouldn’t want to do project management just anywhere.

**André:** I feel the same, but for me this is most likely the last job of my career. Retirement after this.

**Do you have shared issues between the two telescopes that you can work on together?**

**Ben:** Yeah, quite a few. They’re both technically challenging in different areas, but there are a lot of similar

challenges regarding RFI [radio frequency interference] and electronics digital processing in particular that we need to solve. Then of course the global environment, the financial environment, COVID and all of those project-perturbing issues that we’ve had recently are all shared. The answers aren’t always the same, but the problems are the same, so there is a benefit to being able to work together on it.

**André:** Having a counterpart in that way is helpful. Sometimes you can discuss problems that are similar and try to find the best solution, but often I find these obstacles are in the organisation itself that we both encounter, and in that case we can make sure processes are improved making sure the project runs smoothly. That can be very useful.

**What’s the biggest challenge in your roles?**

**André:** For me it’s the next big milestone AA0.5\*, where everything, the entire design is coming together as a telescope. That is a very big challenge. The other major challenge is because the project takes a long time, on a human level, making sure that everybody stays engaged and enthusiastic about the project.

**Ben:** Yeah, I’d agree. Our strengths are also our biggest challenges in that regard. We have got lots of people with different experiences and successes in delivering different sizes of projects and they bring so much to the table,

but it’s also a huge challenge making sure that you set the right direction that everyone’s coordinated. You have to constantly reevaluate the level of your involvement because André and I can’t do the project ourselves, so we need to instil the right level of trust in our teams and our contractors and our sub teams – hundreds of people – so that the person with the shovel on the ground feels empowered to make the right decisions, and we trust them to do that.

**Is there a method that you’ve used to try and keep people engaged and enthusiastic?**

**André:** The best approach is to show that you’re engaged yourself, and committed to the project, and try to get that across to the people that are working on the project. Leading by example.

**How do you oversee building telescopes so far away from where you’re based day to day, from a logistical perspective?**

**Ben:** It’s taken a fair bit of adaptation. We have site management teams, collaboration staff and lots of people on site, but I think André and I would both be more comfortable standing there with our safety hats on, directing people on the ground. Instead we focus on instilling the right level of responsibility, delegation, communication and setting the direction, referring back to our value statements. This is the way SKAO works, and this is how we want to execute the telescope.

**André:** It’s also about making sure that you have the right people that are closely involved with the project on the other side of the world. The communications remain challenging; through Zoom you can communicate a lot, but not everything you want, so being there in person every now and then is very important.

**How does it feel when you go to the telescope sites?**

**André:** At the moment in Australia it is still very empty, but when I saw the AAVS [prototype] station, I thought “yeah, we are really getting there”. Then again, we have to build 512 of these stations so we’ve got a long way to go! I can’t wait to go when we get construction access on 1 February -I’m looking forward to that moment.

**Ben:** The scale of the SKA-Mid site is overwhelming. It’s four hours’ drive between the furthest dish location and the core, so if you’ve forgotten a set of bolts or a piece of test equipment then you’ve got a full day’s round trip to get back. When you consider our schedules, which are quite aggressive, there isn’t a lot of slack. So being on site drives home that we need to make sure that we put the right frameworks in place.

Seeing what the MeerKAT team were able to do with relatively limited resources, to come up with an instrument like that, it’s inspiring to be there. On a human level, seeing the

**BELOW:** Ben arriving at the SKA-Mid site in the Karoo.



*“It’s the whole package of international collaboration, social empowerment, and the raising up of the host countries that make the job worthwhile”*

**BEN LEWIS**



SKA-Mid team working together on site, feeling the sense of community, and knowing that from afar I helped to foster that, it’s rewarding as well.

**What do you enjoy most about your roles?**

**André:** For me it’s working with the international teams and building on a site which is the size of my home country, the Netherlands. And of course it’s not a standard telescope; SKA-Low consists of over 130,000 antennas.

**Ben:** The most rewarding part of my job is when I see a room of people from all around the world, junior staff members learning things, senior staff members talking, arguments here and there but at the end of it you come out with something; when you see a successful collaboration like that. I’m proud of the social impacts that we’re able to have, too. Being in South Africa and seeing the impact both at the academic level, but also with the outreach programmes that our partners SARA0 are engaged in around the SKA -and that we as the SKAO will be complementing. So it’s the whole package of international

collaboration, social empowerment, and the raising up of the host countries that make the job worthwhile. We don’t have any science to do at the moment, but we’ve got these real tangible impacts. That’s why I come to work in the morning.

**André:** I recently visited Australia and even just to have a chat with a scientist who was doing simulations for the stations and seeing how involved and engaged they are, that’s very rewarding. I’ve also learned a lot about the respect there is also for the Aboriginal communities, around our use of the site and how they are involved in the project as well. I find that very special and inspiring.

**As well as the social impacts we often talk about spin-offs that will come from the SKA - do you see that happening?**

**André:** Yes, in fact with the Low antennas we’ve already seen [technology spin-offs](#), so that’s been exciting to see. No doubt we will see more.

\* AA0.5 will be the completion of a six-station array for SKA-Low (each station comprising 256 antennas), and a four-dish array for SKA-Mid.



**Ben:** The project really is driving technological innovation. We tell suppliers: "We want to be able to do X with your device", and they say: "Why on Earth would you want to do that with it?" When we tell them it's because we're building a radio telescope with it, they're really interested and engaged. They never imagined someone would use their technology for this. Working with experts in their own field and adapting technology for use in radio astronomy, that's a cool part of it too.

**Now that construction is starting, do your roles get even more intense?**

**Ben:** It's going to shift a bit. We've made a lot of long term strategic decisions and now we need to adapt as an organisation to make decisions a lot quicker because things are happening in the field. So it will be a step change, and that's going to be led by André and I having to make big, difficult decisions about things in a prompt manner without the extensive consultation that we've been able to do in the past.

**André:** For as long as I've been at the SKAO I've always thought "soon I will get a quieter life". It never did get quieter; we've only worked harder and harder and now I know for sure that it will not get quieter. With the start of construction, the time we will have for

decisions and the speed of the project will be challenging for us, but for the organisation as a whole as well.

**This does feel like the start of a new era, and often we are so busy we don't pause to acknowledge these moments. What would you say to the wider teams that you oversee at this stage?**

**Ben:** We know it's going to be very hard to make the SKA project a success in the coming years, but I'm confident we've got the best teams, with the best people from all around the world, so if anyone's going to be able to make this a success, it's the people we've got in place. We've hired them, we've taught them how to do what they need to be able to do, and now it's their opportunity to shine and go forth and execute the project. We're both extremely happy with our teams and confident that they're going to deliver.

**André:** And all I can say is please keep on doing what you've been doing. My team is working on an AAVS3 station, an update to the AAVS2 prototype. We are leading the work ourselves for the first time, as earlier prototypes were led by our partners, so that is giving us a good insight into what these teams all this time have needed to do to make the SKA a success.



**ABOVE:** Ben is a keen biker when he's not snowboarding, surfing or playing team sports.

**We've talked a lot about work but there is more to your lives of course. How do you like to spend your free time?**

**André:** If I have spare time I spend it walking with my dog, Quist and my wife Marit. I like a long walk in the Peak District, which is near SKAO HQ, or to take our little camper van somewhere. We have explored the UK a bit but we're also lucky that we have a lot of beautiful nature here at our feet.

**Ben:** I manage to fit in a lot of sports like surfing, motorbike riding, I play basketball with a few guys from the office a couple of times a week. I'm learning to snowboard now, so that's taken up my last couple of winters. And I still play the guitar. I've got a YouTube channel - 12 subscribers but maybe I'll get another one or two after this.

All photos courtesy of Ben Lewis and André van Es

### TEAM SKA

In each issue of *Contact*, we'll get to know one of the many talented people contributing to the SKA project, hearing about their work, how they got here and their advice for the next generation.

**LEFT:** André and his dog Quist during a hike in the North Pennines near the River Tees in the UK.

# Astrofest: an astronomy festival of epic proportions

BY ICRAR

Perth's annual astronomy festival, Astrofest, went ahead on 29 October drawing a crowd of nearly 2,500 people despite the overcast weather. Lucky visitors were treated to glimpses of the Moon, Saturn, and Jupiter through the clouds, as well as a variety of talks, stalls, and shows throughout the night.

For the first time, there were three separate talk zones with more than 30 speakers across the night with topics ranging from SKAO science to judging astrophotography. This culminated in an hour-long panel discussion around SKAO science – *Big Telescopes, Big Data* – featuring scientists from the SKAO, Pawsey Supercomputing Research Centre, CSIRO, Australian SKA Regional Centre, MWA, and ICRAR.

Scattered around the inside of the stadium were more than 20 stalls, each one inspiring people about the wonders of astronomy and what is happening in the sector here in Western Australia.

ICRAR's ever-popular stall was joined by a combined SKAO-CSIRO booth, giving the Australian SKA project partners great visibility at the event.

The ICRAR stand was a hit with both the young and young-at-heart, with hundreds of people building and taking home their own Lego radio telescope, looking at WALLABY survey data in virtual reality, and talking to researchers about their work.

Members of the SKA-Low telescope team presented on a range of SKA-themed science, and the SKAO-CSIRO stand drew many youngsters with the opportunity to help "build" an SKA-Low antenna using plastic construction tools.

More than 100 people had the opportunity to experience the immersive virtual reality documentary developed by White Spark Pictures, *Beyond the Milky Way*, showcasing SKA precursor telescopes and the beautiful site where the SKA-Low telescope will be built.

**BELOW:** Astrofest has something for all ages. Credits: ICRAR (left); SKAO (right)





# A stargazing celebration of the SKA

BY CAROL REDFORD (ASTROTOURISM WA FOUNDER AND CEO)

Starry nights across Western Australia's Mid-West region came alive during the last half of 2022 with six astronomy events focused on celebrating the SKA.

Six astronomy and stargazing outreach events were held throughout the Mid-West region between July and October 2022 in small towns around the Australian SKA site\*. The events celebrated Australia as the host of the SKA-Low telescope now under construction at Inyarrimanha Ilgari Bundara, CSIRO's Murchison Radio-astronomy Observatory on Wajarri country.

The International Centre for Radio Astronomy Research (ICRAR) secured funding from the Australian Government Department of Industry, Science and Resources (DISR) to deliver public engagement stargazing events in the region with the aim to promote the SKA, astronomy, Indigenous astronomy, astrotourism and the dark skies of regional Western Australia.

Several of the events featured a special "Welcome to Country" by a local Traditional Land Owner. This was followed by a formal presentation covering introductory astronomy and information about the SKA project. SKAO and CSIRO scientists gave special presentations on the SKA. Visitors were then invited outside to view through large telescopes and see a green laser pointer tour that showed the amazing constellations of the southern hemisphere night sky. One lucky person took home a telescope prize at each event.

The last two events launched the newly released Wajarri planisphere (mentioned elsewhere in this edition) which features the story of the Aboriginal constellation and story of *Yalibirri*, the Wajarri "Emu in the Sky".

The events attracted an average of 45 people each time, and up to 70 in the town of Mullewa. Visitors returning feedback surveys described the events as interesting, exciting, informative and fun. Most people attending had not been to an astronomy/stargazing night before, showing how such outreach events can reach beyond traditionally engaged audiences, while two-thirds of the audience planned to tell others about the SKA after the fun and educational night out they enjoyed.

*\*The nights were held in the towns of Cue, Meekatharra, Mingenew, Morawa, Mullewa and the Murchison Settlement. Each event was delivered jointly by ICRAR and Astrotourism WA, with support from DISR. Also contributing were CSIRO, the SKA Observatory, the Shires of Cue, Meekatharra, Mingenew, Morawa, Murchison and the City of Greater Geraldton.*

**BELOW:** Astrotourism WA founder and CEO Carol Redford introducing the Wajarri planisphere to audiences at one of the stargazing events in the Mid West. Credit: ICRAR



**ABOVE:** SKAO Communications and Outreach Officer Joe Diamond presenting with NCRA's Tirth Choudury. Credit: Samir Dhurde

## SKA project takes centre stage at IAU outreach conference

In September, representatives of many SKAO partner institutions took part in the International Astronomical Union's Communicating Astronomy with the Public (CAP) conference at Macquarie University in Sydney, which brought together astronomy communications and outreach professionals from 43 countries.

The conference theme was *Communicating Astronomy for a Better World* and included a special focus on Indigenous astronomy, with illuminating talks highlighting the importance of diversity and inclusion in astronomy and its communication.

Members of the SKAO's Communications & Outreach team from Australia, South Africa and the Global Headquarters shared their experiences with fellow attendees, giving several talks, running a workshop on graphic design, and taking part in a panel discussion on science communication careers. The talks delivered by the SKAO team were aimed at sharing knowledge and lessons learned with the community, and covered topics including website development, making videos, magazine production (about this very publication,

*Contact*), and a plenary talk in collaboration with India's National Centre for Radio Astrophysics (NCRA) on the *Vigyan Samagam* mega science travelling exhibition.

Alongside the SKAO's own contributions, communications and outreach colleagues from CSIRO (Australia), SARAO (South Africa), INAF (Italy), IAA (Spain), and NCRA (India) presented on SKA-related activities.

Taking pride of place in the conference venue foyer was a replica SKA-Low antenna, garnering plenty of interest from attendees.

The next CAP conference [will take place in 2024](#) and applications for hosting it are currently open.





# Observatories join forces for Big Science forum

BY MATTHEW TAYLOR (SKAO)

SKAO colleagues met international peers during the Big Science Business Forum (BSBF) 2022 in Granada, Spain.

The congress brought together around 1,500 delegates from the main European-based Intergovernmental Organisations (IGO) and government representatives between 4-7 October to share best practice in procurement and meet suppliers.

Following the inaugural BSBF in Copenhagen in 2018, it represented the first face-to-face meetings between organisations sharing common challenges and Big Science objectives.

SKAO D-G Prof. Philip Diamond gave a plenary speech to delegates and Head of Procurement Services Ian Hastings participated in a round table discussion.

Ian said: "We and other IGOs share a lot of the same challenges in common in terms of procurement, such as inflation and scarcity of raw materials. It was interesting to see the agility and creativity with which they're meeting those challenges, and to share our own experiences with them."

Head of the D-G's Office, Dr Simon Berry, was part of the SKAO delegation attending BSBF.

He said: "On the policy side, it was really good to talk to our compatriots in these other organisations about the fact that we all have the same kind of issues: pressures on budgets; the impact of the global economic situation."

On the sidelines of the Forum, the Instituto de Astrofísica de Andalucía (IAA) hosted a [roundtable involving the SKAO, the Cherenkov Telescope Array Observatory \(CTAO\), and the European Southern Observatory \(ESO\)](#), moderated by the IAA's Deputy Science Director, Isabel Márquez.

D-G Prof. Philip Diamond joined ESO Director-General Xavier Barcons and CTAO Project Manager Wolfgang Wild to elaborate on their respective observatories' scientific goals, technology, impact, and governance. The three organisations are all major international collaborations, with numerous member states involved, with Spain being involved in all three organisations.

"Working with nations as diverse as China to Canada, or India to Spain and SKAO's three host countries -to name just a few- is a joy", said Prof Diamond. "All of them have the same goal through their involvement in large-scale astronomy infrastructures, and that is: build the telescopes, do the science we've laid out, get a social and economic return for their taxpayers' money, and do so in a sustainable manner. It is on us, representing all our members, to deliver on this ambition and get the job done."

**BELOW:** SKAO Director-General Prof. Philip Diamond, sixth from the right, alongside delegates at BSBF. Credit: IAA"



**ABOVE:** ESCAPE attendees posing for a group photo after a successful event. Credit: ESCAPE

## ESCAPE project looks to the future

BY CASSANDRA CAVALLARO (SKAO)

Late October 2022 saw the final in-person gathering of the ESCAPE project, bringing together data experts including members of the SKAO's Operations team.

ESCAPE, funded under the European Union's Horizon 2020 programme, facilitated collaboration between major science infrastructures which share a need to deal with massive data rates, including the SKAO, CERN, the European Southern Observatory (ESO) and Cherenkov Telescope Array Observatory (CTAO).

Hosted at the impressive Royal Belgium Museum of Natural Sciences in Brussels, the *ESCAPE to the Future* event was an opportunity for members to talk about the results that have been collectively achieved with a range of technologies for Big Data management and processing.

Operations Data Scientist Dr James Collinson presented SKAO results from the science platform prototyping – the software that will allow users to generate science results from their data – and talked about the benefits of being part of the ESCAPE project, many of which have fed into the SKA Regional Centre Network development started earlier in 2022.

"ESCAPE has enabled us to pool knowledge with engineers and technical leaders from all organisations involved," said Dr Collinson. "We face similar challenges around how to efficiently process and store our data so it's invaluable to be able to hear each others' experiences and how different organisations are approaching these issues."

SKAO Deputy Director of Operations Antonio Chrysostomou represented the SKAO on a panel to discuss the legacy of ESCAPE and the broader impact of such collaborations for the SKAO and other groups.

The collaboration doesn't end here: following the meeting, nine of the core ESCAPE research infrastructure partners, including the SKAO, signed a [new Open Collaboration Agreement](#). This is intended to cement their long-term cooperation into the future.

Materials from the meeting including recordings of the presentations are now available on the [meeting website](#).





# New Eyes on the Universe: SKA and ngVLA 1-5 May 2023 - Vancouver, Canada

BY DR ERIC MURPHY (NRAO) AND DR TYLER BOURKE (SKAO)

The SKAO and the US National Radio Astronomy Observatory (NRAO) are pleased to announce that registration is now open for a landmark radio astronomy science meeting designed to highlight the complementarity and synergies between two of the premier radio telescopes of the 21st century: the SKA telescopes (SKA-Low and SKA-Mid) and the Next Generation Very Large Array (ngVLA).

To be held at the Pan Pacific Hotel in Vancouver, Canada, from 1-5 May 2023, the meeting will review, discuss, and extend the cutting-edge science opportunities enabled by the unprecedented SKA-ngVLA coverage across a wide range of radio frequencies of radio frequency (50 MHz to 116 GHz).

Plenary talks will feature the highest-priority science for these observatories, striving to determine where new scientific understandings are most likely to result from access to both observatories. Contributed talks and posters will focus on topics that highlight each facility's strengths.

We particularly encourage the participation of early career scientists, who will be the major users of these

observatories. The meeting will primarily be in person with online participation available. All talks will be recorded and made widely available during and after the meeting. It will be structured to stimulate dynamic, real-time interactions, for discussion of and planning for the science synergies that will be possible with the telescopes. Opportunities to request financial support to attend the meeting will be available, with registration fees reduced for students and postdocs.

In-person registration deadline: **7 April**

Abstract submission deadline: **10 February**

Find more information on the [meeting website](#).

## SKA Open Science School 8-10 May 2023

Are you interested in Open Science and the effect it will have on your research and tools? The first SKAO Open Science School will take place in Granada, Spain, from 8-10 May 2023 and registration is now open!

The school is organised under the IAA-CSIC Severo Ochoa programme and is endorsed by the SKA Regional Centre partner training programme.

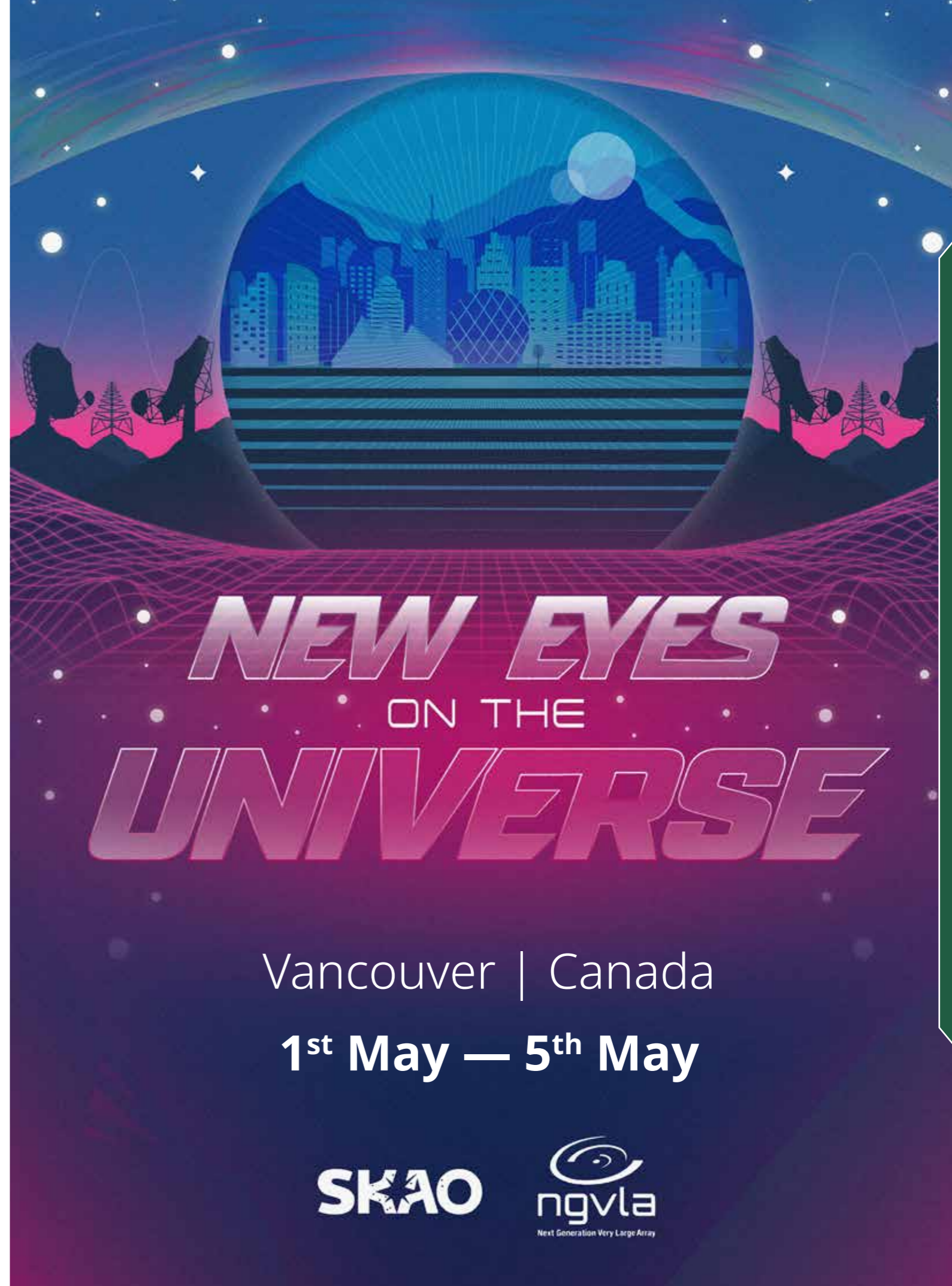
Offering both in-person and remote participation, the school aims to answer questions such as:

- What is Open Science and how can we expect it to change and benefit science and society?
- How will the SKAO and the SKA Regional Centres enable best practices in Open Science?
- As a senior researcher/PhD student/engineer, how do Open Science practices and policies benefit and change my research/collaborations/services and tools?
- What tools can I use to follow Open Science principles?
- Will Open Science be acknowledged in the research assessment system? How can I capture Open Science merits in my CV?

By making data and methods more accessible, understandable and reusable, Open Science practices facilitate reproducibility of scientific studies. In alignment with several United Nations sustainable development goals, the concept of Open Science contributes to democratising information and reducing inequalities in accessing scientific infrastructures. Open Science is rooted in the SKAO's foundational principles and the SKA Regional Centre Network (SRCNet) will play a key role in providing the framework for implementing SKA Open Science policies.

This school brings an opportunity to anyone from the astronomy and SRCNet communities to gain a detailed view of Open Science policies and tools, as well as ongoing activities related to Open Science at the SKAO and the SRCNet.

Read more and register [via the website](#).





## SKAO in the news

The SKAO's ceremonies in December to commemorate the start of construction of the SKA telescopes attracted media coverage galore! At least 640 articles about the event were published online, generating an estimated 1.9 billion page impressions.

Find a comprehensive list [on our website](#). Below are some of the most prominent pieces:

### Nature

['Great scientific step forward': Construction of world's largest radio observatory is finally under way](#)

### Cosmic Savannah

[Listen] [Construction of the SKA commences!](#)

### BBC

[SKA: Construction to begin on world's biggest telescope](#)

### ABC

[Square Kilometre Array Telescope construction begins in West Australian outback](#)

### China TV

[Watch in Mandarin] [Square Kilometre Array officially started construction in South Africa](#)

### Space.com

[Construction begins on world's largest radio telescope after decades of preparations](#)

### Daily Maverick

[Blue-SKA thinking – construction begins on Square Kilometre Array](#)

### NOS

[In Dutch] [Afgelegen plek in Zuid-Afrika draagt bij aan baanbrekende heelal-wetenschap](#)

### Le Figaro

[In French] [Le chantier du plus grand télescope de la planète est lancé](#)

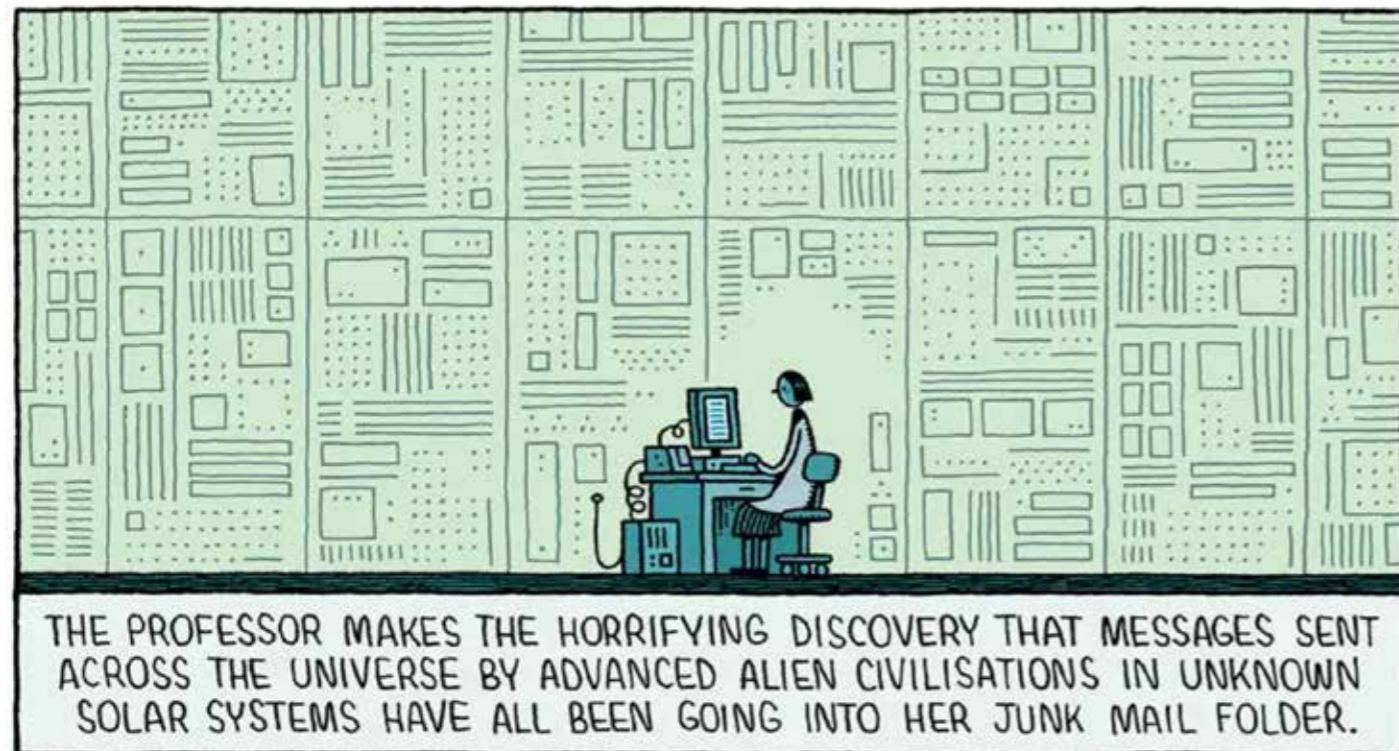
### RAI

[Watch In Italian] [Ska, inizia l'avventura del più grande radiotelescopio di sempre](#)

## Cartoon Corner

As the Search for Extraterrestrial Intelligence (SETI) picks up (see our article on the Breakthrough Listen partnership with the South African SKA precursor telescope MeerKAT in this edition), here's a reminder to check your junk mail folders every now and then...

Credit: [Tom Gauld for New Scientist](#)



## SKAO jobs

With the start of construction of the SKA telescopes, we continue to recruit staff across a number of areas at our 3 locations in the UK, Australia and South Africa. Some of the South Africa and Australia-based roles are employed through our partners [CSIRO](#) and [SARAO](#). Make sure to register on [our recruitment website](#) to receive alerts.

### Project Manager, Networks & Computing

The Project Manager, Networks & Computing will manage the procurement and delivery of the following networks and computing contracts for both the SKA-Mid and SKA-Low telescopes being built in South Africa and Australia respectively.

Deadline: **06/02/2023**

[APPLY HERE](#)

### Verification Systems Engineer

The Verification System Engineer will be responsible for the verification of the SKA-Mid telescope and will provide engineering support and leadership both in their specific discipline and across the entire SKA-Mid telescope.

Deadline: **03/02/2023**

[APPLY HERE](#)

### Electronic Engineer

The Electronic Engineer will work in collaboration with the PDT Project Manager and the Systems Engineer. In that respect the Electronic Engineer will act as design authority for the SKAO, working with contractors to guarantee the required performance of the subsystem following the SKAO standards and best practices.

Deadline: **03/02/2023**

[APPLY HERE](#)

## Partner institute jobs

### Research Associate in Astrophysics and Cosmology (UoM)

The post-holder will work with Prof. Keith Grainge, Dr Laura Wolz and Prof. Clive Dickinson, primarily on HI Intensity Mapping with data from MeerKAT. Applying the techniques developed in this project to data from other telescopes and preparing for future surveys with the SKA will also be important aspects of this role.

Deadline: **08/02/2023**

[APPLY HERE](#)



# Celebrating our community: awards and honours

In this section we celebrate success and recognise colleagues, partners and members of the community who have received prestigious grants, awards and honours in recent months.



**Prof. Françoise Combes**, co-chair of the SKA Extragalactic Spectral Line Science Working Group, [has been elected vice-president](#) of the French Academy of Sciences for 2023-2024.



**Prof. Yashwant Gupta**, director of India's National Centre for Radio Astrophysics (NCRA), was [elected as a fellow](#) of the Indian National Science Academy and the Indian National Academy of Engineering, as well as being awarded the Indian Physics Association's Shri Murli M. Chugani Memorial Award for Excellence in Applied Physics.

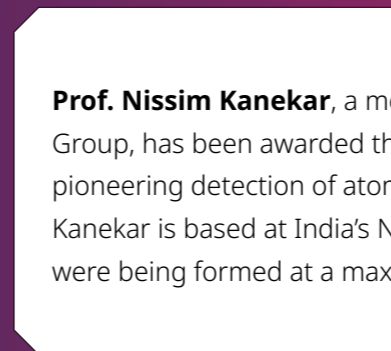
**The MeerKAT telescope team** has been awarded the [Royal Astronomical Society's 2023 Group Achievement Award](#) in recognition of its "spectacular advances in radio astronomy". The citation reads: "As well as the extensive scientific output, MeerKAT has supported an intensive programme of human capital development in Africa, stress-tested the technology for the Square Kilometre Array and helped train the next generation of radio astronomers."



**Dr Zafiirah Hosenie** has been [awarded first prize in the 2022 Institute of Physics CPG Thesis Prize](#) for her work applying machine learning techniques to the large datasets produced by the new generation of telescopes such as the SKA. Zafiirah's PhD research was carried out at The University of Manchester as part of the DARA (Development in Africa with Radio Astronomy) Big Data project, and her algorithms have been deployed on both MeerKAT and the MeerLICHT optical telescope.



**The CHIME telescope team**, was awarded the [Brockhouse Canada Prize for Interdisciplinary Research in Science and Engineering](#) in recognition of CHIME's science impact, particularly in fast radio burst detections. The award citation notes the team "proudly includes members of underrepresented groups in physics" and has "a progressive training environment for students, post-doctoral fellows and research associates".



**Prof. Nissim Kanekar**, a member of the SKAO's HI Galaxy Science Working Group, has been awarded the [2022 Infosys Prize in Physical Sciences](#) for his pioneering detection of atomic hydrogen at cosmological distances. Prof. Kanekar is based at India's NCRA and studies galaxies in an era in which stars were being formed at a maximum rate.



**Ugur Yilmaz**, DevOps Engineer in the SKAO Software team, has been appointed as a [Software Sustainability Institute Fellow for 2023](#). The SSI is dedicated to cultivating better, more sustainable software to enable world-class research.



**Prof. Yin-Zhe Ma**, a member of the SKAO's Epoch of Reionisation, Cosmology and HI Science Working Groups, [was elected as a member of the Academy of Science of South Africa](#) for his distinguished contribution to the science and education of cosmology and radio astronomy.



## CONTACT – THE SKAO'S MAGAZINE

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We welcome your contributions to Contact!

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All images in Contact are courtesy of SKAO unless otherwise indicated.

## ABOUT THE SKAO

The SKAO, formally known as the SKA Observatory, is an intergovernmental organisation composed of Member States from five continents and headquartered in the UK. Its mission is to build and operate cutting-edge radio telescopes to transform our understanding of the Universe, and deliver benefits to society through global collaboration and innovation. Its two telescopes, each composed of hundreds of dishes and thousands of antennas, will be constructed in South Africa and Australia and be the two most advanced radio telescopes on Earth. A later expansion is envisioned in both countries and other African partner countries.

Together with other state-of-the-art research facilities, the SKAO's telescopes will explore the unknown frontiers of science and deepen our understanding of key processes, including the formation and evolution of galaxies, fundamental physics in extreme environments and the origins of life. Through the development of innovative technologies and its contribution to addressing societal challenges, the SKAO will play its part to address the United Nations' Sustainable Development Goals and deliver significant benefits across its membership and beyond.

The SKAO recognise and acknowledge the Indigenous peoples and cultures that have traditionally lived on the lands on which our facilities are located. We acknowledge the Wajarri Yamaji as the Traditional Owners and native title holders of Inyarrimanha Ilgari Bundara, the CSIRO Murchison Radio-astronomy Observatory, the site where the SKA-Low telescope will be built. Inyarrimanha ilgari bundara means 'sharing sky and stars' in the Wajarri language.

**FRONT COVER:** *Local communities and their traditions played a key part in the SKAO construction commencement ceremonies that took place on 5 December 2022. In South Africa (top) SKAO representatives and partners were welcomed to the SKA site at sunset to mark the start of on-site construction of the SKA-Mid telescope with a traditional riel dance performed by the Kareeberg Cultural Association, based in the Northern Cape. The dance symbolises land and environment, and is traditionally performed during happy occasions such as births and weddings, as well as during harvest. The dancers' movements are intended to mimic local animals including meerkats and ostriches. SARAQ's MeerKAT telescope provided a stunning backdrop to the performance. Picture courtesy SARAQ. In Australia (bottom), A Wajarri cultural dance performed by Godfrey Simpson, Geoffrey Mongoo and Gerard Boddington welcomed SKAO representatives and partners to Inyarrimanha Ilgari Bundara (the CSIRO Murchison Radio-astronomy Observatory), to mark the start of on-site construction of the SKA-Low telescope.*

Credit: SKAO



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# SKAO