LOFAR PIONEERS NEW WAY TO STUDY EXOPLANET ENVIRONMENTS

ALL SYSTEMS GO: SKA PASSES OVERALL DESIGN REVIEW

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Dear Friends and Colleagues,

The SKA ended 2019 with a major step forward: passing the System Critical Design Review. As in all such reviews, there are actions emerging from the meeting which are being addressed but what was immensely satisfying is that the panel identified nothing on the technical front that will stop us from proceeding to build the SKA. I congratulate all involved, from the Programme Directorate at SKAO to the SKA design teams around the world. I also extend my thanks to the extremely professional job done by the review panel, ably chaired by Adrian Russell from our sister organisation, ESO. You can read more about this in this edition.

As I’m sure our readers are aware, 2020 is shaping up to be a momentous year for the SKA. We have an ambitious and detailed plan on both the governance and technical side to establish the SKA Observatory and seek approval for the start of construction. I’m pleased to say that nine weeks into the year, we are on schedule. We have just emerged from a very positive extraordinary Board meeting, for which the traditional ‘Notes from the Chair’ will be available on our website shortly. We have seen Italy become the second of SKA’s Member countries to ratify the SKA Observatory treaty and we are working hard preparing the two key proposals (Construction and Operations) to be submitted to the first meeting of the SKA Observatory’s Council, planned in the June-July timeframe.

There are, naturally, issues that arise that cause challenges to any venture. The situation with Covid-19 is affecting people all over the world. At the time of writing we see significant impacts affecting our colleagues in China, Italy and South Korea, and it will very likely spread. We are monitoring the situation very carefully, using advice from the WHO, CDC and the UK’s Foreign and Commonwealth Office and its National Health Service. At the time of writing, we have implemented some restrictions on travel to and from SKA HQ, and are reviewing the situation constantly.

A second challenge arises from the advent of the so-called mega-constellations of satellites, such as the Starlink network from SpaceX, the OneWeb system and others. These have the potential to seriously disrupt both professional astronomy and the public’s right to enjoy the night sky. We have not yet commented publicly on the potential impact of such systems on the SKA since we are engaged in a detailed technical study, which is not yet complete. We are also engaging in the policy and political arena. However, when this work has reached a satisfactory stage, we will provide a statement.

I wish you all clear and radio-quiet skies and hope you enjoy Contact #3.

Prof. Philip Diamond, SKA Director-General
THE SKA IS NOW AVAILABLE IN AUGMENTED REALITY!

BY ICRAR

Experience both antenna designs of the SKA on their sites in South Africa and Western Australia brought to life in augmented reality. What’s more you can personalise them with your own choice of colours!

Draw your own shapes and colours in the real world on the new SKA colouring sheet, and using your mobile device see it pop into life in the digital world on the surface of the SKA’s dishes.

Once you’re in the app, you can explore the SKA antennas in both telescope host countries, and learn more about how a radio telescope like the SKA will collect information from the sky for astronomers around the globe.

You can see how the SKA-Low antennas will be laid out in stations in Australia, and even give them a colour of their own.

The augmented reality experience has been developed by the International Centre for Radio Astronomy Research (ICRAR) with New Zealand firm Quivervision, and funding from SKA Australia and the Australian Government.

See the augmented reality app in action, then download the colouring sheet and design your own! The Quivervision app behind the augmented reality experience is available for free on the Apple app store and the Google Play Store.

THE 4TH CHINESE SKA SCIENCE WORKSHOP TAKES PLACE IN SHANGHAI

BY SHAO & SKA CHINA OFFICE

This past January, Shanghai Astronomical Observatory (SHAO) hosted the 4th Chinese SKA Science Workshop in the presence of representatives from the Ministry of Science and Technology, Chinese Academy of Sciences and Shanghai Science and Technology Commission. Organisers also invited distinguished Prof. Jean-Paul Kneib, Chief Scientist of SKA Switzerland, to take part.

More than 100 Chinese astronomers attended the conference to discuss the performance of the SKA, rules of access and how to realise the SKA’s scientific goals.

Xiangping Wu, Chief Scientist of SKA China and eight other experts described key aspects of the SKA Observatory to the audience, including SKA1’s Baseline Design and Operations.

Qi’an Wang, Director of the SKA China Office, called on Chinese scientists to participate fully in the SKA, in particular by contributing to SKAO’s work and by being actively involved in international academic activities. He also mentioned that the Chinese government will set up special funding to support China’s participation in the SKA.

The 4th Chinese SKA Science Workshop was held at Shanghai Astronomical Observatory. Credit: SHAO
ITALY RATIFIES SKA OBSERVATORY CONVENTION

BY SKAO

Italy has become the second country to ratify the SKA Observatory Convention, the treaty which establishes the intergovernmental organisation that will build and operate the SKA telescopes.

At the end of January, an Italian Senate vote passed the law that authorises the President to ratify the Convention. In the text, Italy announced a financial commitment of 120 million euros over 10 years for the project.

Italy led the multilateral negotiations on the text of the Convention, which was signed in Rome last year by seven countries: Australia, China, Italy, the Netherlands, Portugal, South Africa and the United Kingdom. The Convention will enter into force once five signatories, including the three hosts Australia, South Africa and the UK, have ratified the text. The Netherlands was the first country to do so last August.

Italy’s National Institute of Astrophysics (INAF) has been coordinating Italian participation in the SKA. Italian institutions and industry have been instrumental in the design phase of the SKA, particularly in prototyping work for the SKA’s low-frequency antennas.

“INAF has been part of the project from its foundation with an indisputable contribution in terms of science, technological development and industrial participation,” says INAF President Nichi D’Amico.

INAF HAS BEEN PART OF THE PROJECT FROM ITS FOUNDATION WITH AN INDISPUTABLE CONTRIBUTION IN TERMS OF SCIENCE, TECHNOLOGICAL DEVELOPMENT AND INDUSTRIAL PARTICIPATION.

Nichi D’Amico, INAF President

An official copy of the SKA Observatory Convention is proudly displayed at the SKA Global HQ.
NEW ZEALAND SUMMER SCHOOL BRINGS TOGETHER RADIO ASTRONOMERS

BY SERGEI GULYAEV (AUCKLAND UNIVERSITY OF TECHNOLOGY)

Auckland University of Technology (AUT) and the Institute for Radio Astronomy and Space Research (IRASR) successfully hosted a New Zealand Radio Astronomy Summer School this past February. The event was held at AUT’s Warkworth Radio Astronomical Observatory and its City Campus and featured talks by preeminent New Zealand and Australian radio astronomers.

A mixture of lectures and practical sessions, ranging from the fundamentals of signals (the Fourier transform, autocorrelation, convolution, etc.) and the astrophysical radio sky (masers, quasars, pulsars, etc.) to the configuration and operation of observatory instrumentation kept participants busy over the three-day event.

Radio astronomy in New Zealand has links stretching back to the pioneering work of Elizabeth Alexander on solar radio emission in the 1940s and John Bolton and Gordon Stanley’s mobile sea (cliff) interferometer, which they used in New Zealand to discover the associations between radio sources and optical objects (1948).

In 2008, AUT installed New Zealand’s first professional radio telescope (12-m) in Warkworth, 60km north of Auckland, and established the Warkworth Radio Astronomical Observatory. A few years later, Telecom New Zealand provided AUT with a decommissioned 30m satellite antenna, which was later converted to a radio telescope by specialists at AUT.

By this time, New Zealand was already involved in the SKA. Bearing in mind that the development and operation of the SKA would require specialists in astronomy and computer science, the Astronomy major (currently Astronomy and Space Science major) was established by the School of Computer and Mathematical Sciences to prepare specialists with strong computing, astronomical, and radio astronomical background.

Above: Warkworth Radio Astronomical Observatory.
Credit: Sergei Gulyaev
VISITORS FLOCK TO SHARED SKY EXHIBITION AT JODRELL BANK

BY JODRELL BANK DISCOVERY CENTRE

Over Christmas 2019, visitors to The University of Manchester’s Jodrell Bank Discovery Centre were treated to the SKA’s Shared Sky exhibition on loan from SKAO and displayed as part of the Centre’s winter celebration of science, stars and winter nights.

More than 2,100 people visited the iconic site over the holidays, leaving comments such as “Had a great time at Jodrell Bank today. The art installation and Shared Sky exhibition were fantastic” and “Really enjoyed my first visit to Jodrell Bank today, especially the Shared Sky exhibit.”

As well as exploring the exhibition’s art work, visitors also took time to create their own pieces of astronomy-inspired art using the unique styles employed by the Shared Sky artists, all whilst learning about the stories behind the artworks from the Discovery Centre’s experienced engagement team.

The Discovery Centre runs both an extensive family programme of events and a successful schools education programme, helping to inspire the next generation of scientists and engineers. Each year it draws more than 160,000 visitors, a number set to grow after the site was awarded UNESCO World Heritage Site status in 2019.

Shared Sky was developed in collaboration with the Yamaji Art Centre, Geraldton, Western Australia and the First People Centre at the Bethesda Arts Centre, Nieu Bethesda, South Africa, bringing together Aboriginal Australian and indigenous South African artists to create a collaborative exhibition celebrating humanity’s ancient cultural wisdom.

Visitors exploring the Shared Sky exhibition. Credit: Jodrell Bank Discovery Centre
Why would a country be spending money on several (arguably costly) big science projects? In a period of austerity and healthy scrutiny on public finances, it’s an important question! India’s Vigyan Samagam exhibition (see our previous article here) brings together all seven international mega-science facilities the country is involved in, showcasing their relevance and complementarity. The name is spot on, meaning ‘confluence of scientific ideas’ in Hindi.

The exhibition, which has toured India, has now reached its final leg in Delhi. Its main aim is to bring science closer to society, and the many information panels, kiosks and models help break down the complexity of these facilities and explain how they contribute to the advancement of human knowledge.

Visitors can learn everything from how the process by which stars produce their own energy might one day power our houses with ITER, to how the study of elementary particles led to the creation of the internet with CERN, or how the observation of black holes by radio astronomers led to a patent fundamental for WiFi signals to work at CSIRO. The list goes on, demonstrating how blue-sky research has the potential to spin off into concrete applications embedded in our daily lives.

The contribution of academia and industries is also prominent, reflecting how investment in Big Science drives innovation, fuels job creation and contributes significantly to economic growth*.

Vigyan Samagam has attracted over half a million visitors and made the headlines in national and regional media outlets. This successful concept is easily exportable and has proven a great way to garner public support for Big Science. So which country will be next?

*Last year, a report issued by the European Physical Society (EPS) concluded that physics-based industries generate over 16 per cent of total turnover in Europe, exceeding contributions from the financial services and retail sectors.

Above: Dr Jitendra Singh, Minister for State at the Indian Prime Minister’s Office and other government officials visited the SKA booth at the Vigyan Samagam exhibition during its inauguration in Delhi. Credit: SKAO
OBLIVION@SKA SUPERCOMPUTER INAUGURATED IN PORTUGAL

BY SONIA ANTON (UNIVERSITY OF AVEIRO)

In February, the Portuguese ENGAGE SKA research consortium inaugurated the Oblivion@SKA supercomputer in Evora in the south of the country. With its 239 TeraFLOPS capacity and 1.5 PB of storage, the supercomputer is currently one of the best in the country.

“It is a powerful machine, with computing, management and storage nodes, and a performance equivalent to 1,200 personal computers working together,” said the astrophysicist and coordinator of Oblivion Miguel Avillez.

Oblivion@SKA represents a milestone in the development of digital applications for astronomy, data science and other applications with high socio-economic impact, being part of the National Network for Advanced Computing.

It was installed to support the ENGAGE SKA research infrastructure and the Portuguese scientific community, enabling the parallel processing of massive volumes of data resulting from the various research and innovation activities developed in Portugal and within the scope of design, prototyping and operation of the SKA and its precursors.

Fifty percent of its compute time will also be open to society and will contribute to Smartcities studies, simulations of fire monitoring and recovery, precision agriculture, smart factories or various infrastructures, design of new materials, medical drugs, or modelling of quantum communications and computing.

“We are empowering the country and the industry, through a consortium with four million euros,” underlines Domingos Barbosa, ENGAGE SKA consortium coordinator. The consortium is composed of the Telecommunications Institute, University of Aveiro, University of Porto, University of Coimbra, University of Évora, Polytechnic Institute of Beja and Associação RAEGE Açores.
LET’S TALK ABOUT...
FAST RADIO BURSTS

BY CASSANDRA CAVALLARO (SKAO)

SKA pathfinders and precursors have been at the forefront of Fast Radio Burst discoveries in recent years, but these strange flashes are still among the biggest mysteries in the Universe.

If there’s a rock star of the radio astronomy world, it’s the Fast Radio Burst (FRB). Flashy, energetic, often in the headlines, and very, very trendy.

The new year kicked off with some big FRB news from two SKA pathfinder telescopes. The European VLBI Network (EVN) determined the location of a burst first detected by the Canadian Hydrogen Intensity Mapping Experiment (CHIME) – only the second repeating FRB to be localised. It originated in a spiral galaxy similar to our own Milky Way, completely different to the environments of previously studied FRBs.

“It’s consistent with our current thinking that FRBs can be found in a wide variety of galaxy hosts, and that it doesn’t take a very specific environment to produce them,” says Prof. Vicky Kaspi of McGill University, who studies FRBs using CHIME and was part of the team behind the EVN result.

FRBs don’t give up their secrets easily though and astronomers still don’t know what they are more than a decade since the first discovery in 2007. So to understand the significance of recent progress we first need to rewind a little.

For years astronomers had spotted only a handful of these mysterious and intense millisecond bursts of radio waves coming from deep space, and yet, they seem to be very common.

“One of the most astounding things about FRBs is that we think there’s one happening about once every 10 seconds somewhere in the sky,” says Dr Jason Hessels of the University of Amsterdam, also part of the EVN team. “So if we had a very sensitive radio telescope that could monitor the whole sky at once, it would be like watching a fireworks show.”

The reason we can’t do that is, put simply, the sky is really big and most telescopes see just a small fraction of it at once. To put things into perspective, the full Moon covers 0.2 square degrees in the night sky – you can cover it with your thumbnail if you extend your arm. CHIME’s field of view is 1,000 times greater than this at 200 square degrees – but the full sky is 41,000 square degrees, so that’s where the trouble lies.

To make it even harder, most FRBs that have been discovered so far seem to be one-offs never to be seen again, while others repeat. It might well be the case that a large majority (if not all) of them do actually repeat though, but signals are so weak that they are much harder to detect.

Because of that, for many years FRBs were mostly found in archives of data, not observed live. Recent advances in data processing have changed that, and a new generation of telescopes is advancing the field at an amazing rate.

In the decade after FRBs were first discovered, using data from CSIRO’s Parkes telescope, a few dozen more were spotted. Since 2018 that has grown to around 100 published FRB sources, a figure expected to be closer to 1,000 by the end of this year.

Until recently however, working out where the signals were coming from seemed impossible. Such fleeting events demand not only telescopes with a wide field of view to see enough of the sky, but also exceptional sensitivity to home in on their origin. That means a large array of small diameter dishes, like ASKAP, MeerKAT, the Very Large Array (VLA) in the United States and eventually the SKA.

In 2017, the VLA localised what was at that time the only known repeating FRB, pinpointing it to its home galaxy.

Above: CHIME is part of a new generation of telescopes changing the FRB landscape, alongside other SKA pathfinder facilities like China’s FAST, Australia’s ASKAP and Parkes telescopes and the Expanded VLA in the United States.

DID YOU KNOW?

• FRBs have only ever been detected by radio telescopes. It’s unclear if this is because they only emit at radio wavelengths or because we haven’t looked enough at other wavelengths
• A millisecond duration FRB can emit as much energy as the Sun does in a whole day
• Despite being immensely energetic for radio objects, they are not very energetic in a broad astronomical sense and are for instance dwarfed by Gamma Ray Bursts – the most violent events in the Universe – which release as much energy as the Sun does in its lifetime.
From there the floodgates opened. Late 2018 brought news that the Australian SKA Pathfinder ASKAP had found 20 new FRBs in just one year, nearly doubling the number detected in the previous decade. CHIME kicked things up another gear in 2019, finding only the second repeater ever detected and continued spotting more of them as the year went on.

ASKAP achieved a first in 2019 when it pinpointed a one-off FRB to an extraordinary degree of accuracy. How precise are we talking? Imagine narrowing down a location on Earth to a city block...while standing on the Moon!

What no facility has managed to do yet is to establish what they actually are.

“FRBs vary enormously in brightness,” Jason explains. “Their short duration tells us they must be coming from something very small, but with a lot of energy packed into a small region, very much like a neutron star.” What’s not clear is where all that energy comes from.

“One currently preferred model particularly for the repeaters is that they are young neutron stars that are highly magnetized – similar to a pulsar but with an even stronger magnetic field” Vicky adds. “But we really don’t know yet, and indeed there could be multiple classes of FRBs. SKA will be very helpful both for finding more events, and for doing very sensitive, detailed studies of known sources.”

Its massive collecting area will mean SKA can detect even fainter FRBs, which are much more numerous, giving us a better chance of detecting trends that suggest multiple different origins and eventually cracking the FRB mystery!
Behold the most detailed view ever of the Sun’s surface. This stunning shot was captured a few weeks ago by the Daniel K. Inouye Solar Telescope (DKIST) in Hawaii to celebrate its entrance into the world – and what an entrance! The image shows convection cells on the surface of our star. Each is about the size of a country like Spain. The smallest details visible are just 30km across, on an object located 150 million kilometres away!

SKAO Director of Programme Dr Joe McMullin was Project Manager and Deputy Director of DKIST before joining SKAO. We asked him to comment. “People might not realise this but getting that First Light with such spectacular resolution and without burning anything was no small feat. There’s a heatstop at the focus that removes more than 95% of the heat from the system. It’s cooled using a high flow of a special coolant called dynalene, which allows it to absorb most of the 12 kilowatts of energy focused by the 4m primary mirror.”

Looking at the image and what it means, Joe says: “It’s the years of effort and planning. I’m so proud of everyone involved and proud to have been a part of it all.”

The SKA will also study our star, so we asked NCRA’s Divya Oberoi, co-chair of the SKA’s Solar, Heliospheric & Ionospheric Physics Science Working Group how this new telescope fits in. “Understanding solar magnetic fields is key to understanding the Sun,” he told us. “The excellent imaging quality of DKIST will provide an unprecedented ability to study magnetic fields not only in the corona – the Sun’s outer atmosphere, but also in the chromosphere – the layer immediately underneath it. “Even though they operate in very different parts of the spectrum, together SKA & DKIST will explore very complementary aspects of the Sun, allowing us to understand long-standing problems, such as the physics behind solar flares and how the corona can reach temperatures of 2 million degrees Celsius.”

Located atop the 3,000m Mount Haleakala – meaning ‘House of the Sun’ in native Hawaiian – the newly inaugurated DKIST is now the most powerful solar telescope in the world. Like the photo?

Watch the mesmerising video here!
An international team of astronomers including one of SKAO’s Project Scientists and using SKA pathfinders has for the first time detected the dragging of space-time in a distant binary star system, something previously only measured around Earth with satellite experiments.

According to Einstein’s general relativity, the rotation of a massive object drags the space-time in its vicinity. Using a pulsar orbiting a white dwarf and two SKA pathfinders – CSIRO’s Parkes Telescope and the Molonglo Observatory Synthesis Telescope – the team were able to detect for the first time this swirling of space-time around the fast-rotating object.

New and upcoming radio telescopes such as MeerKAT and the SKA will play a central role in understanding how Einstein’s theory is at play in such natural laboratories. “With the SKA expected to detect more exotic binary systems like this one, we’ll be able to investigate many more effects predicted by general relativity” concluded Dr Evan Keane, co-author and scientist at the SKA Organisation in the UK.

Commenting on Evan’s work, SKAO Science Director Prof. Robert Braun added “The SKA is still some years away, but our team of astronomers at SKAO are continuing their research and contributing to groundbreaking work with international teams.”
EVN DISCOVERY DEEPENS MYSTERY OVER FAST RADIO BURSTS

SOURCE: JIVE

Telescopes in the European VLBI Network (EVN), one of the SKA pathfinder facilities, have observed a repeating Fast Radio Burst (FRB) in a spiral galaxy similar to our own.

This FRB is the closest to Earth ever localised and was found in a radically different environment to previous studies. The discovery, once again, changes researchers’ assumptions on the origins of these mysterious extragalactic events, which were first discovered just over 10 years ago and last for only a fraction of a second.

On 19th June 2019, eight telescopes from EVN teamed up to simultaneously observe a radio source. This source was originally discovered the year before by the CHIME telescope in Canada – another SKA pathfinder. The team, led by Benito Marcote from the Joint Institute for VLBI ERIC, was able to conduct a very high resolution observation with EVN. During five hours of observations the researchers detected four bursts, each lasting for less than two thousandths of a second.

The resolution reached through the combination of the telescopes across the globe, using a technique known as Very Long Baseline Interferometry (VLBI), a technique the SKA will make full use of once built, meant that the bursts could be precisely localised to a region of approximately only seven light years across. This localisation is comparable to an individual on Earth being able to distinguish a person on the Moon with the naked eye!

Read more on the JIVE website here.

STAR CLUSTER PROVIDES TELLTALE SIGNS OF GALACTIC WIND

SOURCE: MAX PLANCK INSTITUTE FOR RADIO ASTRONOMY

An international research team has used pulsar data from CSIRO’s Parkes telescope, one of the SKA pathfinders, to study the Milky Way’s magnetic field and find clues pointing to the galactic wind. The team’s results were published in Nature Astronomy.

The galactic magnetic field plays an important role in the evolution of our galaxy, but its behaviour is still poorly understood. Using pulsars located in a tight cluster of stars in our galaxy’s halo called 47 Tuc, the team discovered an unexpected strong magnetic field in the direction of the cluster that could be explained by an interaction with what’s called the galactic wind - a fast-moving wind of charged particles and gas thought to be coming from the supermassive black hole at the centre of our galaxy. The existence of this galactic wind has never been proven before.

Galactic magnetic fields can influence star formation and help establish the presence of a flow of gas from the galactic disk to its surrounding halo. In the future, South Africa’s SKA precursor telescope MeerKAT, and the SKA itself, will provide even better measurements which could confirm the presence of the Galactic wind and investigate its properties, as well as having the capability to observe other similar clusters and corroborate the results.

Read more on the Max Planck website here.
Using the ASTRON-led Low Frequency Array (LOFAR) radio telescope, astronomers have discovered unusual radio waves coming from the nearby red dwarf star GJ1151. The radio waves bear the tell-tale signature of aurorae caused by an interaction between a star and its planet. The radio emission from a star-planet interaction has been long predicted but this is the first time astronomers have been able to discern its signature. This method, only possible with a sensitive radio telescope like LOFAR, an SKA pathfinder, opens the door to a new way of discovering exoplanets in the habitable zone and studying the environment they exist in.

Red dwarfs are the most abundant type of star in our Milky Way, representing an estimated 80% of stars in the galaxy, but much smaller and cooler than our own Sun. This means for a planet to be habitable, it has to be significantly closer to its star than the Earth is to the Sun. Red dwarfs also have much stronger magnetic fields than the Sun, which means, a habitable planet around a red dwarf is exposed to intense magnetic activity. This can heat the planet and even erode its atmosphere. The radio emissions associated with this process are one of the few tools available to gauge the potency of this effect.

“The motion of the planet through a red dwarf’s strong magnetic field acts like an electric engine much in the same way a bicycle dynamo works. This generates a huge current that powers aurorae and radio emission on the star,” says Dr Harish Vedantham, the lead author of the study and a Netherlands Institute for Radio Astronomy (ASTRON) staff scientist.

The team is using images from the ongoing survey of the northern sky called the LOFAR Two Metre Sky Survey (LoTSS) of which Dr Tim Shimwell, ASTRON staff scientist and a co-author of the study, is the principal scientist. “With LOFAR’s sensitivity, we expect to find around 100 of such systems in the solar neighborhood. LOFAR will be the best game in town for such science until the Square Kilometre Array (SKA) comes online,” says Dr Shimwell.

The team expects this new method of detecting exoplanets will open up a new way of understanding their environment. “The long-term aim is to determine what impact the star’s magnetic activity has on an exoplanet’s habitability, and radio emissions are a big piece of that puzzle,” said Dr Vedantham. “Our work has shown that this is viable with the new generation of radio telescopes, and put us on an exciting path.”

Below: Artist impression of a red-dwarf star’s magnetic interaction with its exoplanet. Credit: Danielle Futselaar (artsouce.nl)
ASTRONOMERS DETECT BIGGEST EXPLOSION IN THE HISTORY OF THE UNIVERSE

SOURCE: ICRAR

Scientists studying a distant galaxy cluster have discovered the biggest explosion seen in the Universe since the Big Bang. The discovery was made using NASA’s Chandra X-ray Observatory, ESA’s XMM-Newton as well as two SKA pathfinder facilities: the Murchison Widefield Array (MWA) in Western Australia and the Giant Metrewave Radio Telescope (GMRT) in India.

The blast came from a supermassive black hole at the centre of a galaxy in the Ophiuchus galaxy cluster, about 390 million light-years from Earth. It released five times more energy than the previous record holder.

Director of MWA Prof. Melanie Johnston-Hollitt, from the Curtin University node of the International Centre for Radio Astronomy Research, said the event was extraordinarily energetic.

“We don’t know why it’s so big,” she said. “But it happened very slowly – like an explosion in slow motion that took place over hundreds of millions of years.”

It was so powerful it punched a cavity in the cluster plasma – the super-hot gas surrounding the black hole.

The cavity had been seen previously with X-ray telescopes, but scientists initially dismissed the idea that it could have been caused by an energetic outburst, because it would have been too big. The researchers only realised what they had discovered when they looked at the Ophiuchus galaxy cluster with radio telescopes, underscoring the importance of studying the Universe at different wavelengths.

“The radio data fit inside the X-rays like a hand in a glove,” said co-author Dr Maxim Markevitch, from NASA’s Goddard Space Flight Center. “This is the clincher that tells us an eruption of unprecedented size occurred here.”

The discovery was made using MWA’s original configuration of 2048 antennas, but the telescope has since benefitted from a major upgrade doubling its size, which should make it 10 times more sensitive.

Similarly, the archival data from the GMRT, that helped provide higher resolution for a more detailed look at the cluster, are from 2008. “This is a great example of how archival data from the GMRT can be mined for interesting new finds and justifies the efforts and resources NCRA has put in to preserve every bit of interferometric data taken with the GMRT since its inception,” said Prof. Yashwant Gupta, Director of the Indian National Centre for Radio Astrophysics (NCRA). “Today, with the upgraded GMRT, we can do much better with observations of this kind thanks to a much larger bandwidth.”

The results were published in The Astrophysical Journal and a preprint is available here.

Above: This extremely powerful eruption occurred in the Ophiuchus galaxy cluster, which is located about 390 million light years from Earth. Credits: X-ray: NASA/CXC/Naval Research Lab/Giacintucci, S.; XMM:ESA/XMM; Radio: NCRA/TIFR/GMRT; Infrared: 2MASS/UMass/IPAC-Caltech/NASA/NSF
FOCUS ON

ALL SYSTEMS GO: SKA PASSES OVERALL DESIGN REVIEW

BY CASSANDRA CAVALLARO (SKAO)

For some, December signals the wind-down towards the end of the year, but for SKA engineering teams, the last month of 2019 was the opposite as they geared up for a milestone six years in the making.

The System Critical Design Review (CDR), an overall assessment of the SKA design, costing and planning work, took place at SKA Global Headquarters from 9th-12th of December. The result was the best possible outcome: a pass from the independent panel of experts from major astronomical facilities including ESO, NRAO and Gemini Observatory.

“This is the biggest point in the project so far from an engineering point of view,” said SKA Project Engineer Luca Stringhetti at the time, who led the work. “It’s the equivalent of a go/no-go for launch. Now the project can really take off.”

The momentum towards System CDR had been building all year as more engineering design consortia passed their individual element reviews, and progress accelerated on the governance front with the signing of the SKA Observatory Convention. Importantly, this was not only a design review, but also an analysis of the costing, scheduling, risk management and safety plans for the SKA.

“One objective was to give confidence that we are the right organisation with the right people in place to deliver something like the SKA,” said Luca, whose 20-plus years of experience includes four working on the European Space Agency’s Planck telescope Low Frequency instrument. “This outcome, coming from an independent panel of senior people from big projects and organisations, shows that we are, and that what we have done so far is right. That’s both rewarding for the entire team and very reassuring.”

While the meeting took place during one week in December, the work towards it began long before that. From the formation of the consortia in November 2013, through Preliminary Design Reviews in 2015-2016, to the past 12 months of intense preparation for System CDR, the work has been relentless for all involved.

“We were as prepared as possible prior to the review, but even so it was a great relief to hear the outcome,” Luca said. “This success belongs to the whole community, not just those of us who were present for the CDR meeting. It’s like a relay race – maybe the last runner gets the glory, but it would be impossible without a whole team.”

That team represents more than 600 engineers and experts in 20 countries around the world.

The panel of 10 experts was chaired by ESO’s Director of Programmes Adrian Russell, who previously worked at the ALMA Observatory.

Describing the SKA’s progress over the past few years as “quite
remarkable”, Adrian said: “It must feel inside the project that things have really come together in the last 12 months. Certainly looking from the outside it’s very, very impressive.”

As expected, the panel issued actions and recommendations which will be used to finalise documentation in order to develop the SKA Construction Proposal. Of course, the road ahead will include many challenges, it could hardly be otherwise in such an ambitious project.

“That’s one of the attractions for astronomers and engineers, working out how to overcome these challenges,” said Alison Peck of Gemini Observatory, a member of the review panel. “I think the SKA really has the right team in place to do that. There are a lot of experts on board and people are so eager to make the SKA the best telescope it can be.”

The panel announced its conclusions at the end of four long days, and six strenuous years. And then… everyone went back to work, ready for the next task, the next meeting, the next milestone to be reached, and in particular preparing the SKA Construction Proposal in 2020. For Luca, though, it’s important for people to recognise the magnitude of this moment.

“This is the biggest point in the project so far from an engineering point of view. It’s the equivalent of a go/no-go for launch. Now the project can really take off.”

Luca Stringhetti, SKA Project Engineer
Out the back of CSIRO’s Astronomy and Space Science headquarters in suburban Sydney is the world’s most advanced ‘shed’. Unremarkable from the outside, this high-tech haven is where research engineers escape their offices to road-test technologies and piece together next generation radio telescopes. Despite the raging bushfires which blanketed Sydney in smoke over Summer, a dedicated team led by Research Engineer Dr Grant Hampson, transformed this workshop to create an integration test facility for the SKA-Low telescope.

Until recently, the 180 square metre space was used to test technologies for the Australian Square Kilometre Array Pathfinder (ASKAP) radio telescope. ASKAP is now operational, and the test facility has become the SKA-Low Prototype System Integration facility (SKA-Low PSI) – aimed at accelerating the development of SKA-Low.

The SKA-Low PSI will mimic the Murchison Radio-astronomy Observatory’s “super-computing” control building – a major centre of telescope control, monitoring, signal processing and communications. The new test facility offers a geographically accessible location for the SKA-Low telescope’s digital ‘backend’ prototypes.

The SKA-Low PSI is enabling engineers to set up the telescope’s electronic systems and experience some real world challenges in an environment that mimics the site central facility. They can be executing continual tests which allows them to resolve issues and iron out unforeseeable bugs.

Hampson says there can be physical bugs, like a square connector versus a round connector – the classic square peg in a round hole. It may be surprising that an international project at the cutting edge of technology could encounter such a basic problem. However, these are very common and unavoidable in projects of this scale.

‘Integrate early and often’ is a common saying in the engineering world. Bringing parts of the telescope together through early integration is a valuable opportunity to run tests, join the dots, and deliver precious savings in project time and money.

“We’re going into this next phase of bridging to try and de-risk some of those interfaces and some of the test infrastructure needed to do that,” says Hampson. “It’s an important facility because you’re looking at the integration of products for SKA - it’s not only hardware but it’s software as well.”

Apart from the physical bugs, the software must ‘talk to each other’, and these software interfaces can also be driven through the SKA-Low test facility. SKA data flows are very complicated and testing these at the SKA-Low PSI gives developers the time they need to work through many of the complexities.

Most SKA products are developed independently, in local manufacturing and test facilities around the world in the various member countries. However, at some point they need to come together through early integration.

Left: Yuqing Chen, CSIRO System Engineer, standing next to the upgraded Italian Frigo liquid chiller for the SKA-Low PSI facility. Credit: CSIRO
together for a complete demonstration. The SKA-Low PSI will initially be this place, and colleagues can come and tour the facility and see all the products in one place.

The SKA Office plays the important role of identifying the next product to be brought in for testing, and SKAO will be sending someone to work in the facility with the Low PSI team.

In construction, the SKA-Low PSI will be superseded with the Assembly Integration Verification (AIV) System Integration Test Facility (ITF) to be located in Geraldton, Western Australia. The AIV System ITF will be used for ‘qualifying’ products before they are placed on site.

The SKA-Mid telescope is also working on a PSI facility. Hampson says together we can learn a lot and help each other get SKA up and running.

"IT’S AN IMPORTANT FACILITY BECAUSE YOU’RE LOOKING AT THE INTEGRATION OF PRODUCTS FOR SKA – IT’S NOT ONLY HARDWARE BUT IT’S SOFTWARE AS WELL."

Dr Grant Hampson, Research Engineer
The cuddly koalas wrapped around a donation jar amid a sea of Australian snacks set the scene for SKA HQ’s most recent charity fundraiser.

Organised by our Australian staff, the event was an opportunity to show support for SKA’s friends and colleagues affected by the country’s ongoing bushfire crisis. With 18 nationalities represented at SKA HQ, it was also the first time some had experienced Aussie cuisine, including Vegemite sandwiches, lamingtons (a chocolate and coconut cake) and fairy bread (bread, butter and sugar sprinkles). The donations were distributed to charities supporting firefighters – almost 90% of whom are volunteers in Australia – and animal welfare charities.

A few weeks earlier HQ staff had gathered for the now annual tradition of Christmas Jumper Day, a nationwide event organised by charity Save the Children to support their life-saving work in more than 100 countries around the world. The day coincided with a large meeting at the HQ and some of our international visitors got into the spirit by wearing festive knits! Among the most inventive outfits was that of Federico Di Vruno, RFI and EMI Domain Specialist, who stuck Post-It notes to his jumper in the shape of a Christmas tree.

Together the two events raised close to £1,000 for the charities involved.

You wear many hats within the SKA – tell us about your roles.

As director of SKA-France, I coordinate the scientific and technological preparatory activities in France. I’m also an astronomer based at Observatoire de la Côte d’Azur, and part of the SKA Science Working Groups. That keeps me connected to my field of research, extragalactic continuum analysis, and to developments in radio astronomy more broadly.

What have you been doing this week?

I’ve been attending two big meetings. One was to organise contracts relating to the SKA scientific data handling and processing software. France is extremely interested in the corresponding hardware part, so we want to collaborate with our international colleagues developing software in order to create a synergy between these two parts of the SKA.

The second was the Council Preparatory Task Force (CPTF) where we discussed the future construction proposal for the SKA. France is an observer as we’ve not yet signed the SKA Observatory Convention, and my role is as an advisor. There were challenging discussions and that’s extremely constructive – it’s what we need in this phase.

What’s the current status of SKA in France?

After CNRS, the leading institute of SKA-France, joined the SKA Organisation in July 2018, we have kept working with the community to identify the SKA scientific and technological domains of greatest interest for France as well as for the SKA project. At the moment, Maison SKA-France is further developing its funding application for France to eventually engage into the SKA Observatory.

How have you found being at the HQ with so many colleagues here this week?

I come here quite often and it’s always great; the building’s design encourages interaction, while allowing us to have quiet discussions when needed. Sometimes buildings aren’t conceived in this way, so people don’t have the opportunity to meet. I planned half the meetings I had, but the other half came from just running into people, and that allowed us to progress so much work during this week.

Visitors to the HQ joined staff in donning festive attire for SKAO’s Christmas Jumper Day.
In February, the SKA’s Council Preparatory Task Force (CPTF) held its penultimate face-to-face meeting at SKA Headquarters. Chaired by Patricia Kelly – previously IP Australia Director General and former SKA Board member – the CPTF represents all seven signatories to the SKA Observatory Convention, plus those countries which have expressed a bona fide intent to join at a later date as well as observers. Its task, as the name suggests, is to prepare all of the policies and documentation required for the SKA Observatory Council – the future governing body of the SKA when it becomes an intergovernmental organisation – to hit the ground running at its first meeting.

Since forming the day after the Convention was signed in March 2019, the CPTF has held an impressive 12 meetings in just 11 months. Members have had to rapidly cover a huge amount in this short time frame, including negotiations on such major policy issues as SKA project funding; the critical “Tier 2” policy documents on things like operations, access, procurement and intellectual property; membership arrangements as the project comes online; and preparations for the transition of the current SKA Organisation, to the future SKA Observatory.

“Coming to consensus on these key policy issues is a significant undertaking,” said CPTF Executive Officer Jerry Skinner. “But progress over the last 12 months has been excellent and I think, with more of these important discussions due to take place in coming months, future Members and Observers will be very well prepared for that crucial first Council meeting likely to be in July.”

There will be two subject-specific CPTF video-conferences in March and April, with the final three-day face-to-face CPTF meeting due to take place in May at SKA HQ.

SKAO volunteers recently braved the stormy weather, lashing rain and ankle deep mud to plant trees on the National Trust’s Dunham Massey estate near Manchester, UK and embody the Organisation’s foundational value of sustainability.

The event was organised by Manchester’s City of Trees charity with local rangers to improve the age diversity of trees on the site, and increase wildlife diversity. At the invitation of web design agency Carbon Creative, Team SKA planted around 150 trees in total, including oak, birch, beech and crab apple saplings as part of a 2,000 tree planting effort that day!

SKAO has been working with Carbon Creative since 2011. The environmentally-friendly agency was set up with a goal to minimise its carbon footprint since the beginning, and has planted a tree for every piece of SKA work undertaken. That’s resulted in more than 400 new trees as a direct result of work provided by the SKA Organisation!
Tell us about your early life Shari – were you always keen on science?
I grew up on farms in Tasmania, an island off the south coast of Australia – I’m one of five sisters. We were often doing dumb experiments like pulling apart a phone and putting it back together! I wasn’t particularly fascinated by space, but I do remember as a child seeing Saturn through a telescope for the first time, which was pretty awesome.

How did you end up getting into astronomy?
I was quite a latecomer to it, although I had a natural aptitude for science. At university I studied maths, physics and chemistry, and sort of fell into astronomy because the University of Tasmania had radio telescopes, which is pretty unusual. One of my lecturers was a radio astronomer so I started doing radio projects, and that’s what ultimately led to me pursuing a PhD.

Why did astronomy appeal to you over the other sciences?
With astronomy it seemed like there were such basic questions that we didn’t know the answers to, so that was attractive because you feel you can really make a contribution. I got hooked on trying to figure things out; the fact we don’t understand how stars form is pretty mind-boggling considering we want to study things like galaxies. If we don’t understand how the small scales work then how can we truly understand the big scales?

How did your career develop after your PhD?
I went straight to CSIRO’s Astronomy and Space Science division where I’d obtained a Bolton Fellowship (Australia’s longest-standing prize fellowship), which was great because you could do any astronomy research you want. That instilled a real love for telescopes, because I was working with all the national facilities at our disposal: the Australian Telescope Compact Array, the Parkes telescope, Mopra and the Australian Long Baseline Array. I spent six years at CSIRO before moving to the University of Sydney, and it’s from there that I joined the SKA.

You’re an active researcher in the field of star formation – tell us about that.
Most of my work has centred around the use of masers as probes of star formation. Masers are like space lasers which emanate from gas clouds. They’re extremely bright and emit at radio frequencies, so they can penetrate the dusty parts of the Milky Way.
Way – that helps us to locate new stars and tell us about how those regions evolved. I also lead a project called StarFISH – Star Formation in the South Hemisphere – to map the dense gas structure of our galaxy, which can give us a really clear view of its spiral arms. Everyone chooses cute animal names so I chose a starfish!

How did you get involved with the SKA?
I was involved through working with the precursor instruments, particularly one of the ASKAP surveys. I love science but really love telescopes, so SKA HQ is a pretty obvious place to work from that perspective – getting to know the telescopes right from the get-go. Now day-to-day I’m writing and reviewing documents around how we’re going to operate the SKA. That’s essential to work out how much it will cost to run and maintain, to plan how many staff you’ll need at particular times, and so on. And because we’re going to operate it for at least 50 years, it’s very important!

Do you find people are surprised when they learn you grew up on a farm?
Sometimes, but I find that interesting. People might think that country bumpkins are a world away from astrophysics, but is that really true? Isn’t it more to do with the environment you grow up in, your access to knowledge, the encouragement around you? I always had those things. My dad is a civil engineer and my mum has a science degree, and they were definitely open to us doing whatever makes us happy. So I might have been driving a tractor, but I might have been thinking about maths while I was doing it!

My school was not fancy – agricultural studies was compulsory in years 7 and 8, we used to go to our school farm in our gumboots and school dresses. But that wasn’t really restrictive to me. That said, it was really important for me to go back there a couple of years ago, when I did a session allowing the students to use the Parkes radio telescope live. It was important to me to show them I came from this school, and now this is what I’m doing in my career. To make sure everyone knows there isn’t a restriction placed upon them just because of where they grew up or which school they went to.

What advice would you give about following this career path?
The honest answer is be sure you want to do it, and then work hard at it. If you love it, it doesn’t really matter what anyone throws at you. I have certainly been tested during my career - I have had people question my abilities and ambitions - but the science has always picked me back up and reminded me why I love my job. You have to know that you’re capable and stick with it through those moments.

One of the most important things is to be exposed to science. Astronomy is the gateway drug into Science, Technology, Engineering & Maths; lots of people who think they’re not interested in science, see a pretty astronomy picture and are interested straight away. It’s also something people can connect to; if you’re talking about very small scales in biology, people can’t necessarily understand that, whereas everyone can see the stars […]
You’re also a L’Oreal UNESCO for Women in Science Fellow – what do awards like this mean to you?
The initial award was AUD$25k to aid my science, but the best part was that it opened some doors for jobs in the future. After the initial award we also decided to match up PhD students with former recipients to mentor them into the workplace. These kinds of awards go some way to levelling the playing field for women. This one puts the spotlight on a group of women every year – we’re in the newspapers and on radio stations, and hopefully some kids see us and think: “Actually scientists look like everyone, and I can be a scientist.”

What’s the most exciting thing about being part of Team SKA?
The colleagues are a large part of my enjoyment here – the people are super great, and my job is also really varied. Being part of the next-generation radio telescope, you can’t really do much better than that.

How have you found the transition from Australia to SKA HQ?
Cold [laughs]. Although it snowed today so that was magical! I’ve spent a lot of time in Manchester over the years so from a personal perspective the transition hasn’t been too difficult – apart from missing my cat, Murphy.

How do you think astronomy is doing in terms of diversity, and the SKA in particular?
A lot of astronomers and institutions are working really hard to correct some past wrongs, but we still have a long way to go in some areas. My impression has been that the SKA is doing comparatively well in terms of national representation and gender diversity, but it would be great to see more women in senior leadership roles. Diversity is important because you need people who think differently in order to attack any problem that you’re working on. Gender is a big part of that, but also nationality, culture, background, age – the more diverse group of people you have, the more representative solutions you’ll find.

How do you think diversity is doing in terms of gender and the SKA in particular?
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Daniel Juan-Carlos Breen. Work-wise it’s been a learning curve but I do like a challenge. There are a few Aussies here which makes me feel at home, and it’s also the most welcoming place I’ve ever worked. People came to my office just to introduce themselves and I’ve never experienced that before.

When you’re not in the office how do you unwind?
I like socialising. Travelling, exploring, being on beaches. Baking too – the more difficult the cake the more the enjoyment. It takes all day and has eight different layers, that’s a challenge I like. I enjoy baking for people’s birthdays in the office, and it’s embarrassing for that person so I quite enjoy that part too!

Shari returned to her Tasmanian high school to run a session for students to use Parkes radio telescope. Credit: Shari Breen

Left: As well as being an award-winning astronomer, Shari is a keen baker (seen here celebrating her cat Murphy’s first birthday). Credit: Shari Breen
THOUSANDS FLOCK TO WEST AUSTRALIAN ASTRONOMY FESTIVAL SHOWCASING SKA

BY ICRAR

Kids, parents, friends, couples and a handful of die-hard Star Wars fans descended on Curtin University to celebrate all things astronomy and the SKA once more.

The crowd of more than 3000 turned out to view the night sky through giant telescopes, listen to talks from local researchers and science communicators, and learn more about the SKA as part of the annual Astrofest event.

Astrofest is the largest annual astronomy festival in Australia and a regular fixture on the Perth science calendar, packed with SKA-themed content.

Visitors took part in a selfie competition with a SKALA antenna, and explored SKA augmented reality colouring sheets (try it here!). They built SKA dishes out of LEGO, and listened to Australia’s Astronomer at Large Dr Fred Watson present an update on the SKA project.

The Australian SKA site was shown off with a 3D model of the site, including models of the precursor telescopes already on site, and visitors were also treated to a virtual tour of the observatory.

“While very few people travel to the Murchison region, we’ve been able to engage the community through virtual tours and hands-on activities that make them feel like they’re on site,” said ICRAR Astronomy Ambassador and Astronomy WA Co-Chair Kirsten Gottschalk.

Astrofest is coordinated every year by the International Centre for Radio Astronomy Research (ICRAR) on behalf of Astronomy WA.
ASTROFEST IN PICTURES

Credit for all images: ICRAR
BY SARAO

The Human Capital Development (HCD) programme at the South African Radio Astronomy Observatory (SARAO) hosted their 14th Postgraduate Scholarship Conference this past December in Durban, KwaZulu-Natal, attended by more than 220 participants.

The conference aims to bring together SARAO-supported postdoctoral fellows, postgraduate students, supervisors, radio astronomy scientists and engineers in Africa, and from elsewhere in the world, to network with each other and develop an interactive community around the SKA precursor telescope MeerKAT, the SKA in Africa, and other radio astronomy initiatives. SARAO has been managing an HCD programme since 2005, and to date the programme has provided funding to nearly 1168 undergraduate and postgraduate students, postdoctoral fellows, university academics, as well as students studying to be technicians and artisans.

In addition, the conference provides an opportunity for the postgraduate students and postdoctoral fellows to share their research with the community, and with each other, and to provide them with important experience in presenting their work.

The conference, which has been held annually since 2006, has also been instrumental in demonstrating to the rest of the world Africa’s competence in radio astronomy research, and every year new international collaborations and partnerships are formed as a result, and new international researchers are motivated to come and work in Africa, either as visiting professors, or as full-time academics and Research Chairs.

Above image: Delegates at the 14th Postgraduate Scholarship Conference held by the SARAO Human Capital Development Programme in KwaZulu-Natal, South Africa. Credit: SARAO

COMING UP...

PUBLIC COMMUNICATION OF SCIENCE AND TECHNOLOGY (PCST)
https://www.pcst.co/conferences
26 - 28 May 2020 | Aberdeen, UK

UK SKA SCIENCE TOWN HALL MEETING
http://ska.astro.ljmu.ac.uk/
24 March 2020 | Liverpool, UK

SPIE ASTRONOMICAL TELESCOPES AND INSTRUMENTATION
https://spie.org/conferences-and-exhibitions/astromerial-telescopes-and-instrumentation?SSO=1
14 - 19 June 2020 | Yokohama, Japan

EUROPEAN ASTRONOMICAL SOCIETY ANNUAL MEETING (FORMERLY EWASS)
https://eas.unige.ch/EAS2020/
29 June - 3 July 2020 | Leiden, the Netherlands

EUROSCIENCE OPEN FORUM (ESOF)
https://www.esof.eu/en/
5 - 9 July 2020 | Trieste, Italy

14TH ASIA-PACIFIC REGIONAL IAU MEETING (APRIM) AND ASTRONOMICAL SOCIETY OF AUSTRALIA ANNUAL MEETING
https://aprim2020.org/
6 - 10 July 2020 | Perth, Australia

BLUEDOT FESTIVAL
https://www.discoverthebluedot.com/home
23 - 26 July 2020 | Jodrell Bank, UK

COMMUNICATING ASTRONOMY WITH THE PUBLIC (CAP)
https://www.communicatingastronomy.org/cap2020/
21 - 25 September 2020 | Sydney, Australia

CONFERENCE ON DARK AND QUIET SKIES FOR SCIENCE AND SOCIETY
https://www.iau.org/news/announcements/detail/ann20003/
5 - 8 October 2020 | Canary Islands, Spain
A busy few months around the SKA world has led to some major news stories, starting with the successful System Critical Design Review in the second week of December (see our feature on page 18-19). The review of the SKA’s overall design, costing and planning marked the culmination of six years of work involving hundreds of engineers and scientists in 20 countries. Now all efforts turn to implementing the expert panel’s recommendations in order to prepare the SKA Construction Proposal.

On the governance front, Italy became the second country to ratify the SKA Observatory Convention in January. The text of the law passed by the Italian Senate outlines a financial commitment of 120 million euros over 10 years for the project. The Convention comes into force when five countries – including SKA hosts Australia, South Africa and the UK – have ratified.

In science news, an international team of astronomers including one of SKAO’s Project Scientists for the first time detected the dragging of space-time in a distant binary star system, something previously only measured around Earth with satellite experiments. According to Einstein’s general relativity, the rotation of a massive object drags the space-time in its vicinity. Using a pulsar orbiting a white dwarf, the team were able to detect for the first time this swirling of space-time around the fast-rotating object. Read more on this result on page 14.

The SKA Organisation also announced it will engage in closer collaboration with the Cherenkov Telescope Array Observatory (CTAO) under a new agreement signed by the two research infrastructures. Despite operating at opposite ends of the electromagnetic spectrum, there are a number of similarities between the two projects: both are large international collaborations, comprise two arrays on different continents, and have begun transitions on the governance front. The new Memorandum of Understanding (MoU) will facilitate greater sharing of knowledge and expertise in areas including engineering, science, technology and administration.

Artists’ impressions of the SKA (left) and CTA (right) antennas, which will operate in the radio and gamma-ray bands respectively. SKAO and CTA recently signed an MoU to facilitate greater sharing of knowledge and expertise in a number of areas. Credits: SKAO / Gabriel Pérez Diaz, IAC/Marc André-Besel, CTAO

**NEWS FROM AROUND THE WEB**

**INSIDE HPC**

**Simulating SKA telescope’s massive dataflow using the Summit supercomputer** – How researchers used the world’s fastest supercomputer, Summit, to prepare for the vast quantities of data that will flow from the SKA in the future.

**LA RECHERCHE**

**Le radiotélescope SKA abordera tous les champs de l’astrophysique** – Chair of the SKA Board of Directors Dr Catherine Cesarsky explains how the SKA will change our understanding of astrophysics. Read the full article [in French].

**NEWSWEEK**

**China’s enormous alien-hunting telescope is now fully operational** – An overview at the science studies that China’s Five-hundred Aperture Spherical Telescope (FAST), an SKA pathfinder, will undertake now that commissioning is complete.

**PHYSICS WORLD**

**The 10 most important future big-science facilities in physics** – In a blog post, Physics World’s news editor weighs in on his top facilities of the coming decades.
**Evora acolhe supercomputador ligado ao projeto do maior radiotelescópio do mundo** – One of Portugal’s top daily newspapers looks at the recent inauguration of Oblivion, the new supercomputer whose main user will be the ENGAGE SKA consortium [in Portuguese]

**Big Bang & India: All you need to know about 7 mega-science projects on show in Delhi** – As Vigyan Samagam makes its final stop in New Delhi, learn about the seven international projects showcased in the exhibition.

**The next generation of alien hunting telescopes is coming** – Vice takes a look at the upcoming radio telescopes – in particular ngVLA and SKA – that will revolutionise the search for extra-terrestrial intelligence by looking for radio leakage.

**The largest scientific structure ever powers up in Africa** – A close-up look at the first SKA prototype dish to be constructed on site in South Africa’s Karoo.

**Pawsey’s new AUS$2m HPE supercomputer to support Square Kilometre Array** – The Pawsey Supercomputing Centre in Perth, Western Australia, announces a new 78-node cluster to process data from the Murchison Widefield Array (MWA), an SKA precursor telescope.

**SKA OPERATIONS SCIENTIST/SAFE PRODUCT MANAGER**
Deadline: 30/04/2020
Apply here

**COMING SOON:**
IT Network & Security Engineer
Domain Specialist RFI &EMC

As we continue to grow, new roles will continue to be advertised. To set up alerts and receive notifications when jobs are advertised, register on SKAO’s recruitment website and follow us on LinkedIn.

**AUSTRALIA – COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATION (CSIRO)**
Software Research Engineer
Deadline: 15/03/2020
Apply here

**FRANCE – OBSERVATOIRE DE PARIS**
PhD on Search and study of exoplanets in radio with NenuFAR and SKA
Deadline: 23/04/2020
Apply here

**GERMANY – MAX PLANCK INSTITUTE FOR RADIOASTRONOMY (MPIFR)**
Project Scientist
Project Manager
Deadline: 18/03/2020
Apply here

**SPAIN – INSTITUTE OF ASTROPHYSICS OF ANDALUCIA (IAA)**
Software Engineer
Project Scientist
Deadline: Open
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**AUSTRALIAN SKA PROJECT DIRECTOR’S UPDATE – DECEMBER 2019**

**CSIRO MRO NEWS – DECEMBER 2019**

**ICRAR ASTRONOMY NEWSLETTER – FEBRUARY 2020**

**SKA-FRANCE – BULLETIN – JANUARY 2020**

**ASTRON NEWS – JANUARY 2020**

**RADIONET**

**RADIONET NEWSLETTER – FEBRUARY 2020**

**MEDIA INAF LATEST SKA NEWS**
About the SKA

The Square Kilometre Array (SKA) Organisation leads an international effort to build the world’s largest radio telescope. The SKA will be constructed in Australia and South Africa with a later expansion in both countries and into other African countries. Its global headquarters is located at Jodrell Bank in the UK.

The SKA will conduct transformational science and help to address fundamental gaps in our understanding of the Universe including the formation and evolution of galaxies, fundamental physics in extreme environments and the origins of life in the Universe.

Front cover: Artist’s impression of a red-dwarf star’s magnetic interaction with its exoplanet. Using the ASTRON-led Low Frequency Array (LOFAR) radio telescope, astronomers have discovered unusual radio waves coming from the nearby red dwarf star GJ1151. The radio waves bear the tell-tale signature of aurorae caused by an interaction between a star and its planet. The radio emission from a star-planet interaction has been long predicted but this is the first time astronomers have been able to discern its signature. (Image credit: Danielle Futselaar – artsouce.nl)

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