

Astronomy Outreach in the Remote Mid West Region of Western Australia

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Summary

The Square Kilometre Array is a global mega-science project to build the world's largest radio telescope. One of two short-listed locations for the telescope is Western Australia's Mid West region, a geologically stable area with a very low population density making it an ideal location for sensitive radio telescopes. It is vital that the local population, although small, is aware of the project and the impact it will have on the region, so outreach in the local communities is imperative. Over the last few years, many trips have been made to the Mid West with the aim of bringing astronomy to the local population. While outreach in such remote areas brings its own unique challenges, it is every bit as worthwhile as in more traditional locations.

The Square Kilometre Array

A thorough understanding of the physics of the Universe often requires information across much of the electromagnetic spectrum, not just what can be gleaned from visible light with the type of telescopes that the public may be familiar with. Radio astronomy has many important applications and is an essential tool in many diverse fields of astrophysics. At the low energy end of the spectrum, radio waves can penetrate the thick, dusty regions often found in the discs of active galaxies for example, providing vital information on star formation processes and gas dynamics that would be very difficult, if not impossible, to obtain by any other means.

While there are numerous radio telescopes scattered around the planet, the Square Kilometre Array (SKA)¹ will be the most ambitious array of telescopes ever constructed. Radio astronomy is primed to help answer some of the big questions in astronomy, and SKA will provide a huge step forward in capabilities. SKA will address five fundamental unanswered questions about our Universe:

- Testing the predictions of general relativity — was Einstein right?
- How were the first black holes and stars formed?
- How do galaxies evolve?
- What generates galactic-scale magnetic fields?



Figure 1. Artist's impression of what part of the completed SKA might look like. Credit: SPDO/TDP/DRAO/Swinburne Astronomy Productions.

- Are we alone?

Composed of three different types of antennas, the array will operate between 70 MHz and 10 GHz (wavelengths between 4 metres and 3 centimetres) and will have 50 times the sensitivity and 10 000 times the survey speed of any current radio telescope. A large fraction of the antennas will be located in a central core area, but remote stations will also be located across an area the size of a continent. Figure 1 shows an artist's impression of what part of the array might look like when complete.

Any large telescope should be built in the best possible location to maximise the science output. Just as optical telescopes

are severely hampered by light pollution, radio telescopes are very sensitive to interference from manmade sources such as radio and television transmissions, mobile phones and pagers, and numerous other modern technologies which generate radio waves as a byproduct of their operation. There are two locations shortlisted to host SKA: southern Africa, and Australia/New Zealand. Both candidate core sites (Western Australia's Mid West, and the Karoo region of South Africa) have relatively low population densities, and hence low levels of manmade interference, and already host precursor telescopes which are currently under construction. As well as performing exciting new science, these precursors will act as testbed instruments,

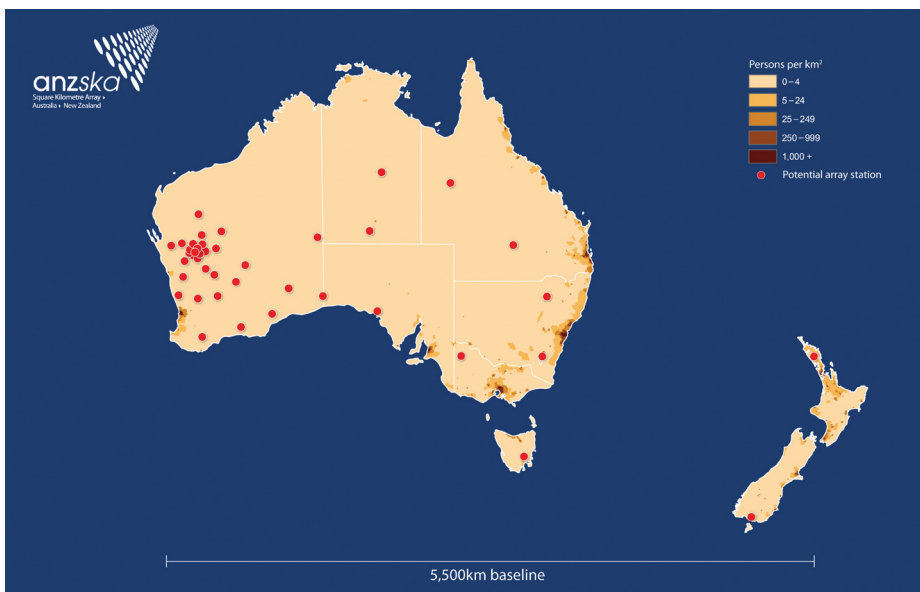


Figure 2. Potential SKA array station placement in Australia and New Zealand overlaid on a population density map. Credit: CSIRO.

proving new technologies for the full SKA. The final site decision will be made in 2012, construction is scheduled to begin in 2016, and the first astronomical observations with SKA should be carried out in 2020.

The Mid West region

The Australian/New Zealand candidate site for the core of SKA is located in the Mid West region of Western Australia (see Figure 2) and is home to the Murchison Radio-astronomy Observatory (MRO) where several telescopes are already under construction, including the Australian SKA Pathfinder (ASKAP) and the Murchison Wide-field Array (MWA). Centred on Boolardy station, a pastoral station 200 kilometres west-south-west of the small town of Meekatharra, the MRO covers a circular area 70 kilometres in diameter.

The Mid West region stretches from the west coast inland to the Gibson Desert. Covering an area of 472 336 square kilometres, the region has a population² of 51 748 or 0.1 people/sq km, more than 65% of whom live in the town of Geraldton on the coast. The remainder live in small communities scattered throughout the region, or on homesteads in pastoral areas accessible only by unsealed dirt roads. The shire of Murchison itself, within which the MRO is located, is the only shire in Australia without a gazetted town. The shire is approximately 50 000 square kilometres in size

and contains 29 pastoral stations with a total population of approximately 160 people. The main industries in the region are mining, agriculture, fishing and tourism.

There are many communities and more than 30 schools in the Mid West region, six of which are classified as remote by the Australian Department of Education and Training. Often the population is largely Aboriginal, especially in the remote communities where schools must cater for a wide range of ages and abilities in just one or two classrooms. In contrast, many of the primary-age children living on pastoral homesteads would have to travel many hundreds of kilometres to reach their nearest school and so are enrolled in a School of the Air where their lessons are largely delivered to them interactively over the internet. Secondary-age children from pastoral stations normally attend high schools in Perth or in regional towns as boarders.

School and community visits

Over the last few years numerous outreach field trips have been undertaken in the region by staff from both the International Centre for Radio Astronomy Research (ICRAR) and the Commonwealth Scientific and Industrial Research Organisation (CSIRO). Due to the distances and logistics involved in such excursions, many of them are planned so that several locations can be visited in a single trip. Recent vis-

its have included the communities of Pia Wadjari, Yalgoo and Yulga Jinna, and the towns of Meekatharra and Cue. Some of these are remote Aboriginal communities, but primary and district high schools in the larger settlements of the Mid West have also been included. Outreach initiatives have also included schools in the larger town of Geraldton, including professional development workshops for local and regional teachers.

Events have also been organised for both Meekatharra and Carnarvon Schools of the Air. Children attending such schools spend most of their time on their home station receiving lessons from teachers via the internet, but regular school camps are held where all the pupils get together in one location for a week or more of activities, and astronomical viewing nights have been held during such camps.

In addition to specific outreach in schools, these visits have engaged the wider community in the region. Public viewing nights are often held following a day of activities within a school, usually on a nearby oval. These are community events with entire families attending and a friendly social atmosphere. Not only is the region an excellent location for radio telescopes due to the low levels of radio interference, the low population density and small number of settlements mean that there is also very little light pollution, making the night sky especially dark.

Projects

In addition to school and community visits, other significant outreach projects have been carried out in the region over the past few years. In 2006–2007 CSIRO's Wildflowers In the Sky involved numerous school visits by professional astronomy educators and astronomers, providing telescopes and training for local teachers. Thanks to this initiative, many of the community schools in the shire of Murchison own simple Dobsonian telescopes. A component of this project involved public viewing nights in each of the towns and communities. Follow-up visits since the project ended have sustained interest and awareness.

One highly successful project was Ilgarijiri, a collaboration between local indige-

nous artists from the Mid West region and astronomers from the ICRAR in Perth, carried out as part of the International Year of Astronomy 2009. Following a tour of the MRO and a cultural exchange around a campfire at Boolardy station, the artists created more than eighty pieces of unique Aboriginal art for an exhibition that toured Australia during 2009. The title of the exhibition, *Ilgarijiri* is a word in the local Wajarri-Yamatji language meaning “things belonging to the sky”.

In 2010 a project was carried out with the Carnarvon School of the Air under the Universe Awareness (UNAWA) banner as part of the International SKA Forum held in the Netherlands. The aim was to link up a primary school in each of the SKA candidate areas with a school in the Netherlands and give the students the chance to talk to each other and learn about other countries and cultures, as well as finding out about the radio telescopes being built in their respective countries. The link took place via the internet in May 2010 and was filmed for a short video which was distributed to participants at the SKA Forum in June. The project also resulted in the distribution of Earth balls and teaching materials to a large number of schools in all three countries.

Challenges

Due to the wide geographical spread of schools and the nature of outback travel, tours in the region require both careful planning and flexibility. Off-road vehicles are required to reach many of the communities, even in good conditions, and a satellite phone is necessary for emergency communication due to lack of mobile coverage (one factor which makes the area such a radio-quiet zone, ideal for placing a sensitive radio telescope!). Supplies of food and water need to be carried in case of emergency; in the event of a breakdown it can be many hours before help arrives. In summer, temperatures routinely reach more than 40 degrees Celsius, and in the wet season the roads can flood, making them impassable and cutting off communities for weeks at a time.

All schools in the region are generally well-resourced and all have internet access via satellite, but there are various issues. Due to the often very remote locations, there is

a very high turnover of teachers in many schools and a high proportion of newly qualified teachers, very few of whom have any science specialisation. One result of this is that knowledge can leave the community very quickly, and training in the use of telescopes usually has to be carried out on each visit.

There is a high proportion of indigenous students in the region, and most of the pupils in remote schools are Aboriginal. While many of them have a good level of ability in English, they can have different attitudes and knowledge levels to “city” kids. Especially in the smaller remote communities, activities must often be aimed at a mixed group containing children at several different stages of education.

Visits to the region usually include viewing nights for both schools and the wider community. The best telescopes for trips to the area are Dobsonians due to their simplicity; power cannot always be guaranteed at remote locations and the set-up time before an event is often very short, so simple telescopes are a must.

However, not all visits result in successful night-time viewing events. Sometimes the weather fails to cooperate and in such cases it is often possible to do an informal Ask an Astronomer session instead or (if facilities are available) a demonstration of a planetarium program such as Stellarium, and some additional astronomy in the classroom the following day. Daytime activities include using planetarium software, model Solar Systems, solar viewing, and launching water rockets.

Conclusions

Recent outreach in the Mid West has included successful visits to several remote schools and communities with whom good links have been established. These efforts have resulted in an increased local awareness of SKA, the reasons why the Mid West is an ideal location for radio telescopes, and the local impact these projects will have on the region.

For all the difficulties associated with outreach in remote areas, the extra effort is worth it. The local communities are always interested and usually turn out in large numbers to attend viewing nights, and the

kids are always curious and full of questions. School ovals provide great locations for viewing nights (although power is usually not available) and due to the lack of light pollution the skies are stunning.

Due to outreach initiatives such as Wildflowers In the Sky, several of the remote communities now have their own optical telescope, although sometimes operational knowledge is lacking due to the high turnover of staff.

Outreach in Western Australia’s Mid West region in particular is important both for creating a general awareness of SKA and developments under way at the MRO, and for getting local children interested and aware of the possibilities and jobs that these developments will bring.

Flexibility is vital when conducting outreach in areas such as this. It is always helpful to have a backup plan, and some extra resources and activities, just in case!

Acknowledgements

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Notes

¹ www.skatelescope.org

² As of 2006; source, Mid West Development Commission statistics

Biographies

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