

Let battle commence

Nature Physics 7, 739 (2011) | doi:10.1038/nphys2126

Published online 03 October 2011

The final bids are in to host a major radio telescope, the Square Kilometre Array.

They are regular opponents on the field of rugby — and may clash this month in the World Cup tournament in New Zealand — but now Australia and South Africa are locked in a competition of a different kind. Each nation has bid to host the Square Kilometre Array (SKA), intended to be the largest and most sensitive radio telescope ever built¹.

As the name suggests, the 3,000 15-m-diameter dishes that make up the SKA are equivalent to a telescope with a collecting area of a square kilometre. A spiral layout — like the arms of a spiral galaxy — has been chosen to maximize image resolution while keeping down the cost; the five arms will extend to distances of more than 3,000 km from the centre of the array.

The resulting sensitivity at radio wavelengths will make it possible to probe the early stages of the Universe, when the first black holes and stars formed; to follow galaxy evolution and investigate dark energy as the source of the accelerating expansion of the Universe; to test the general theory of relativity and the nature of gravity; and to study the origin and evolution of cosmic magnetism. The SKA will also be sensitive to extraterrestrial signals and search for evidence of complex molecules in space.

It's a terrific project and one that both Australia and South Africa are understandably keen to host, having made it to the shortlist in 2006 when other bids from sites in China and Argentina fell by the wayside. The geographic requirements for the SKA site are stringent, based not only on physical features and climate, but also on the characteristics of the ionosphere and troposphere above it. As a counterpoint to the necessary remoteness of the site, issues of connectivity, infrastructure and ease of data distribution must also be factored in — but paramount is the need to avoid radio-frequency interference, particularly from mobile phones

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and other electrical equipment.

Australia's bid sites the core of the array at the Murchison Radio Astronomy Observatory, in Western Australia, and at the centre of a 260-km-radius radio-quiet zone established by the Australian government in 2005. Antennas would also be set up in New Zealand, creating a baseline for the array of up to 5,000 km. As a test bed for SKA technology, the Australian SKA Pathfinder (ASKAP) — a radio telescope comprising 36 12-m antennas — is under development at the site.

South Africa likewise has a precursor project at its core SKA site, in the Karoo region of the Northern Cape: MeerKAT will eventually number 64 antennas of 13.5-m diameter; seven are already in place, forming the KAT-7 telescope. From the high, dry desert of Karoo, the SKA would extend into Namibia, Botswana, Mozambique, Madagascar, Mauritius, Zambia, Kenya and Ghana. Like Murchison, Karoo is protected by government legislation to regulate radio transmissions and other disruptive activity in the region, in the Astronomy Geographic Advantage Act of 2007.

But for both bids, there is concern that the radio protection measures could be compromised. In Australia, government moves to block the issue of new low-bandwidth radio licences within 100 km of the SKA are reportedly being opposed by mining companies, and could also impinge on a \$4-bn rail and harbour project for the transportation of ore and other goods from this area of Western Australia².

Meanwhile, in South Africa, oil company Shell has applied to drill for natural gas across a 90,000-km² swathe of the Karoo, coming close to the SKA site. The inevitable radio interference, and to a lesser extent the seismic activity, caused by mining operations could pose a significant threat to the sensitivity of the SKA — and may also prove a stringent test of the Astronomy Geographic Advantage Act. Dust and vibration could also compromise the operation of the optical South African Large Telescope (SALT), to which the Karoo is also home.

For the moment, all drilling applications, from Shell and other companies, are frozen³ pending a government study of their impact, because the natural gas would be extracted by the process of 'fracking', whereby high-pressure water with additives is pumped into the shale to cause it to fracture and release the gas. Fracking is controversial⁴; there are concerns about its environmental impact, not least because some of the additives used are toxic, carcinogenic — or even secret.

Although mining operations pose a challenge to both bids, the decision on the site for the SKA will be taken in 2012. From 2013, there begins a period of detailed design work, before construction in two phases from 2016; the first phase coming into full science operation in 2020, the second in 2024.

Both bids promote well-suited, southern-hemisphere sites, ably supported by a community of radio astronomers. It's a difficult decision, but may the best site win.



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Australia tackled South Africa in August's Tri-Nations contest, before beating New Zealand in the final. The three nations are now squared up not only in this year's Rugby World Cup, but also in competition to host the Square Kilometre Array, set to be the world's largest radio telescope.