

LOOKING BACK IN Time

The Square Kilometre Array

Imagine being able to see as far back in time as the Big Bang. Science fiction? Pure fantasy? No, say the scientists involved with what will be the world's biggest and most powerful telescope, the Square Kilometre Array (SKA).

■■■■ Instead of only one radio telescope, the SKA will consist of an array of about 3,000 antennae, each 15 metres wide, with a combined receiving area of a square kilometre. This will enable the super-telescope to do such things as search for extraterrestrial intelligence, discover how black holes are formed, and detect radio waves and cosmic rays emitted by objects such as stars and galaxies far, far away.

How will the SKA be able to see as far back as the Big Bang? Well, during the Big Bang the Universe began with a large explosion (or "bang") 14 billion years ago, and space itself is still expanding. Because radio waves travel at 300,000 km a second, extremely distant objects are observed as they were in the past. The hot radiation from the Big Bang has been travelling through space for 14 billion years and we can now see it all around us. With the SKA we will also be able to see the radio waves from the first stars which formed after the Big Bang, as well as the radio waves from the gas around them. This means that we will be able to look back in time and see the formation of the Universe's first stars and galaxies.

Both South Africa (and its African partners) and Australia are shortlisted to host





the international € billion (about R18 billion) SKA project. The final decision is expected in 2012.

If the African bid wins, science and technology in Africa will advance, and southern Africa will become a major international astronomy hub, attracting top astronomers and engineers from around the world. Local expertise in science, engineering and technology will grow and benefit South Africa's long term competitiveness in a knowledge intensive global economy.

The 3,000 strong antennae core of the SKA will be in South Africa, with three remote receiving stations in Namibia, four in Botswana, and one each in Ghana, Kenya, Madagascar, Mauritius, Mozambique and Zambia. Each station will have about 30 antennae.

A "radio quiet" area in the Northern Cape has been chosen for the core site because it is far from manmade radio pollution caused by such things as cellphone masts and radio broadcasts.

The spin-offs of the SKA include extraordinary advances in technology, such as the world's fastest supercomputer and ultra-high-speed Internet connectivity with speeds exceeding 100 GB per second. The SKA computers will be a 1,000 times faster than today's fastest computer.

This means that in one hour the SKA can collect the same amount of data that exists on the entire World Wide Web now and transfer it in real time to the control centre.

Another dramatic development is the Reconfigurable Open Architecture Computer Hardware (ROACH) computer board which will allow the central processing units to be switched in and out while the telescopes continue operating. This will revolutionise computers, allowing for upgrades to be done without entire motherboards having to be replaced.

As a precursor to the SKA, South Africa is constructing the impressive Karoo Array Telescope, or MeerKAT, a mid-frequency "pathfinder" or demonstrator radio telescope, alongside the proposed SKA core site. It is one of South Africa's biggest science and engineering projects.

Once completed, the 64 dish MeerKAT will be the Southern Hemisphere's largest radio telescope and one of the world's biggest and most powerful telescopes.

MeerKAT's first seven dishes have been built and have already delivered images of the Centaurus A galaxy, which is 14 million light years away. Plus it is already in demand. Over 43,000 hours of observing time (about five years) have been allocated to radio astronomers from around the world who want to use it for such things as a survey of the distant universe, and to test Einstein's theory of gravity, both of which are also objectives of the SKA.

It would seem that being able to look back in time is not impossible, nor that far off, after all.

Read more about SKA Africa at www.ska.ac.za. ■

