

THE SQUARE KILOMETRE ARRAY PROJECT & ITALY-SOUTH AFRICA RESEARCH COLLABORATION

by Mattia Vaccari - ph Courtesy of SKA South Africa



Computer Image of the completed SKA South African core in the Karoo

On a 2013 southern winter night, Michael Lesetja would never have thought that he would begin a journey to become part of one of the world's largest science projects. Originally from South Africa's rural Limpopo, Michael worked in Johannesburg assembling electronic components. Yet, after seeing a television programme featuring opportunities to join a South African team working on a future radio telescope to be based in the Great Karoo and a short visit to an Internet Café, he was on his way to become part of the Square Kilometre Array Project. Michael applied for a position as a trainee electronics technician, and since January

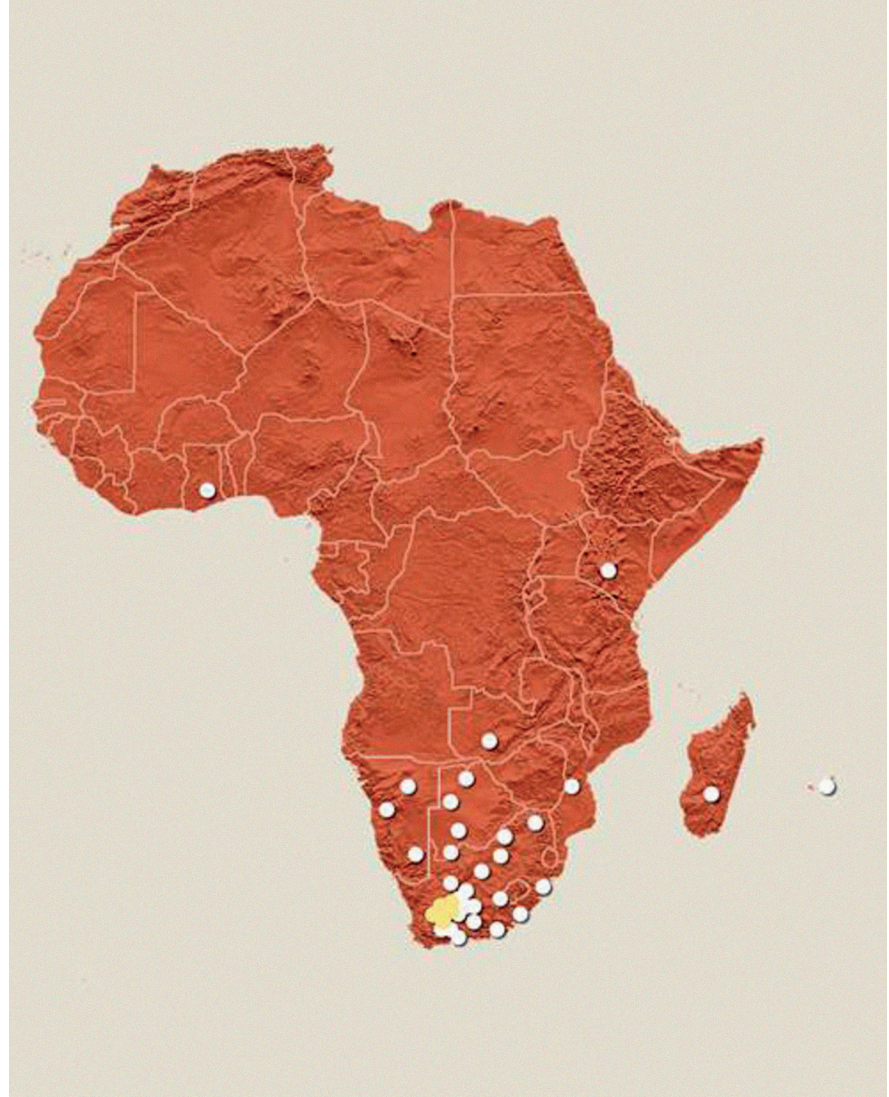
2014 he has been shadowing technicians responsible for telescope maintenance in Carnarvon in the Northern Cape. The expanses of South Africa's Great Karoo desert are not generally associated with cutting-edge scientific research or technological infrastructure. And rural villages in the area did not have much to offer their youth in terms of educational facilities or job opportunities. Yet both are rapidly materializing as a consequence of the multi-billion-Euro project in which a large number of international partners, including South Africa and Italy, are participating. Although still in its infancy, the project has already contributed to increasing educational opportunities in the



research



Lesetja at work at the SKA South African core site in the Karoo



Lesetja at work at the SKA South African core site in the Karoo

Carnarvon area, for example providing computer labs and teacher training to local schools and boosting the local Internet connectivity.

The Square Kilometre Array, or SKA, (www.skatelescope.org) is an international effort to build the world's largest radio telescope, with a total collecting area of one square kilometre, or one million square metres. First conceived in the early 1990s, only in 2012 it was decided that the distributed array of radio telescopes will be jointly hosted by South Africa and its partner African countries (70%) and Australia (30%). Given the cost, size and complexity of the project, the construction will be split into a Phase 1 (2018-

2013) and a Phase 2 (2023-2030), and telescope operations would then continue at least until 2050.

The core of the SKA's African instrument will be located in South Africa's Great Karoo desert, close to the town of Carnarvon in the Northern Cape, but sparsely distributed radio dishes will extend across the African continent and adjacent islands, as far as Ghana, Kenya, Madagascar and Mauritius. The remote and scattered location of the radio dishes will pose formidable engineering challenges in a number of areas such as digital electronics, power generation, data storage, transfer and processing. For this reason, a substantial fraction of the SKA budget is being allocated to



The KAT7 prototype at the SKA South African core site in the Karoo

technological development programmes bringing together academia and the industry.

When compared with existing radio telescopes, the SKA thus represents a huge leap forward in astronomical instrumentation and it is expected to deliver a correspondingly transformational increase in research capabilities when operational. It is hoped that it will shed light on some of the most interesting questions of modern astronomical enquiry. Does Einstein's 100-year old and surprisingly resilient Relativity Theory hold up to its most stringent tests to date? When and how did the first luminous objects form soon after the Big Bang? How did stars and black holes within galaxies evolve jointly over cosmic time? Do nearby stars emit radio waves that could be associated with intelligent life? Perhaps more importantly, the SKA will open a new window on the Universe that will certainly allow us to make discoveries we cannot now even imagine.

South Africa's National Research Foundation (NRF, www.nrf.ac.za) and Italy's National Institute for Astrophysics (INAF, www.inaf.it) are two of the founding partners of the SKA Organisation, which includes eleven members in total. The two countries have thus had a chance to forge a productive working relationship involving, not only scientists and engineers, but also key industrial partners.

South Africa will of course have a central role in developing local infrastructure as well as in managing telescope operations, and the Italian SKA Industry Consortium, including Finmeccanica and Telespazio as well as a significant number of SMEs, was formed in 2011 to encourage and coordinate Italian participation in the bidding process for SKA construction and operations.

The SKA South Africa project (www.ska.ac.za) has been investing heavily in human capacity development, providing a funding pipeline for, among other uses, training



SKA South Africa scientists in Giardini Naxos, Italy, for the June 2014 SKA Science conference

research

apprentices, technicians such as Michael Lesetja, science and engineering MSc and PhD students, post-doctoral research fellows, university lecturers and research chairs. Several Italian scientists have accepted the challenge of developing astronomical research in South Africa and have taken up research or teaching positions at the country's universities. Last but not the least, in August 2014 the Italian Ministry of Foreign Affairs and International Cooperation approved a number of collaborative research proposals, including two

projects aimed at bringing closer South African and Italian scientists working in radio astronomy through student co-supervision, research visits and workshops. Scientists from the two countries will thus have a chance to work jointly on training the next generation of radio astronomers as well as shaping the future of radio astronomy. While it is still early days in a long-term project, the SKA promises to provide an important avenue to boost collaboration in research and development between South Africa and Italy ♦

Italian scientists have accepted the challenge of developing astronomical research in South Africa and have taken up research or teaching positions at the country's universities. Last but not the least, in August 2014 the Italian Ministry of Foreign Affairs and International Cooperation approved a number of collaborative research proposals, including two



Continuing collaboration, cooperation, community service and dialogue