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INNOVATION

SA acquires new radio telescope

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Rhodes University officially launched the Transient Array Radio Telescope (Tart) at the Waainek site in Makhanda recently.

The building and deployment of a Tart at Rhodes University is a collaborative effort between the institution, the University of Otago, and Stellenbosch University.

The design for a highly low-cost, open-source 24-element radio interferometer was initially developed by Dr Tim Molteno and his group at the University of Otago to provide a test-bed for developing and testing state-of-the-art calibration and imaging algorithms for radio astronomy.

This initiative originates from early brainstorming in 2021 between Square Kilometre Array (SKA) research chair Professor Oleg Smirnov, physics lecturer at Rhodes University Dr Stanley Kuja, Rhodes University mathematics lecturer Dr Patrice Okouma, and University of Otago senior lecturer in physics Dr Tim Molteno.

Kuja, as project lead engineer, oversaw the installation and testing of the Tart with the assistance of two young graduates, Rikus Human from Stellenbosch University and Sonia Ghosh from the Raman Institute in India, who is an intern at Rhodes University.

A particular innovation of the Rhodes University group was the layout of this version of the Tart, which consists of 24 movable antennas mounted along three beams arranged in the shape of a Y. This layout echoes the iconic Very Large Array (VLA) radio telescope (New Mexico, US), both in the shape and reconfigurability.

DR STANLEY Kuja, Professor Tony Booth, Professor Oleg Smirnov and Sonia Ghosh at the launch of the Rhodes University Transient Array Radio Telescope at the Waainek site in Makhanda. | Supplied

At Rhodes University, the Tart will provide a platform for student training, research in machine learning, electromagnetic compatibility (EMC) metrology, and community engagement in the form of Stem consolidation for Makhanda's pupils as a collateral benefit.

In addition, the Tart will give Rhodes University students early exposure to the entire value chain of the SKA.

Rhodes University provides the required infrastructure (electrical power, internet, and a secure site at Waainek), managed by the director of the Centre of Biological Control (CBC), Professor Martin Hill, and the Waainek research facility manager, Samella Ngxande-Koza.

Tlaba Mochebelele is Rhodes University's first postgraduate student to work on data from the Waainek Tart and its pathfinders at Stellenbosch University and the University of Otago.

Okouma said: "This setup will lay the ground for the intake of more postgrad students since Tart provides data of significant value for testing various mathematics-based algorithms for radio interferometry as well as fully fledged state-of-the-art techniques in machine learning."

Kuja added that since radio frequency interference (RFI) is a major concern in radio astronomy, intelligent techniques in characterising RFI at the Waainek site can be transferred to the SKA-MeerKAT project.

"It's a perfect instrument for learning and experimentation," said Smirnov.

"Our South African flagship, MeerKAT, can be a little intimidating for students – competition for time is stiff, data volumes are huge, and the instrument is at a remote Karoo site. The Tart is right here; it is very hands-on, and data is freely available to all."