

Sensitivity of Low-Frequency Polarimetric Phased Array Radio Telescope

The Low-Frequency Square Kilometre Array (SKA-Low) is the next-generation radio telescope that spans the frequency band from 50 MHz to 350 MHz. The SKA-Low has the characteristics of consisting of over a hundred thousand dual-polarized antennas. These antennas are fixed to the ground and are grouped into 256 stations in which the antennas are closely coupled. Telescope pointing is achieved electronically---without mechanical pointing---and the field-of-view (FoV) is wide. These features differentiate the SKA-Low from the more traditional dish-based telescopes which are mechanically pointed, have narrower FoV and in which the dish antennas that do not couple with one another. As a result, many of the key assumptions, equations and figure-of-merit (FoM) that apply to dish-based observation need review.

One of the most essential FoMs is the sensitivity of the telescope. This is a measure of the standard deviation of the estimate of the power of a target source under observation relative to the power of that source. Because the FoV is wide and the antennas point electronically, the target sources are always observed at oblique angles relative of the central axis of the antenna (z-axis in the diagram on the right). Consequently, the conventional formula that states the sensitivity of the telescope at the centre of the beam need to be generalized.

In this project the correct expression for the sensitivity of the polarimetric phased array radio telescope will be formulated. The aim to achieve an expression that is succinct, computable from basic antenna and radiometric parameters, and measurable through observation. It will treat the wide FoV and the antenna coupling, while establishing limits and careful approximations where appropriate.

Research Field

Radio Astronomy

Antennas and Propagation

Project Suitability

PhD/MPhil

Project Supervisor

Dr Adrian Sutinjo

adrian.sutinjo@curtin.edu.au

Co-Supervisors

Dr Marcin Sokolowski

A/Prof Randall Wayth

