

1. **Title of research project:** Exploring cosmic dawn from the sub-Antarctic with PRI^ZM
2. **Academic level:** MSc
3. **Supervisor's name and contact details:** Prof. H. Cynthia Chiang — chiang@ukzn.ac.za
4. **Supervisor's university:** University of KwaZulu–Natal
5. **Description of the research project:**

Probing Radio Intensity at high-Z from Marion (PRI^ZM) is an experiment that is studying cosmic dawn in the universe using low frequency (< 150 MHz) observations of redshifted 21-cm emission from neutral hydrogen. The experiment, which is illustrated in Figure 1, comprises two small antennas that observe the 21-cm signal averaged over a large fraction of the visible sky. Measuring this global signal as a function of frequency/redshift opens a new window into a part of the universe's history that is very poorly understood.

One of the greatest challenges in probing cosmic dawn at low frequencies is terrestrial radio frequency interference (RFI), which swamps the cosmological signal even when the nearest RFI sources are hundreds of kilometres away. PRI^ZM has been funded by the South African National Antarctic Programme (SANAP) for deployments to Marion Island, which lies 2000 km from the nearest continental land masses and offers an exceptionally clean RFI environment. PRI^ZM was successfully installed on Marion Island during the April 2017 takeover voyage, and the instrument is continuing its second season of Austral winter operations.

Given the small scale of PRI^ZM, the student who takes on this project will be able to contribute to a wide range of work spanning both instrumentation and analysis. The student may have the opportunity to participate in the April 2019 voyage to Marion Island, where we will perform on-site instrument characterisation and install new antenna hardware as part of an upgrade programme to expand observations to lower frequencies. The student will also have the opportunities to analyse data from the 2017 and 2018 winter observations, as well as develop additional hardware upgrades for future Marion deployments.



Figure 1: The fully assembled PRI^ZM system on Marion Island in April 2017. PRI^ZM is continuing to observe throughout the 2017 Austral winter.