# Section A: Overview

1. Academic level of research project: **Masters**
2. Broad field of research: **Astronomy/Astrophysics**
3. Title of the research project: **Time variability of radio sources in the Small Magellanic Cloud**
4. Supervisor: **A/Prof. Vanessa McBride**
5. Co-supervisor: **Dr Tana Joseph, Dr Brad Frank**
6. Registered at University of Cape Town

# Section B: Research Project

The Small Magellanic Cloud (SMC) is a nearby (66 kpc) irregular dwarf galaxy, and has been extensively studied in the X-ray, gamma-ray, optical and radio regimes over the years. Because the SMC has been a target of microlensing surveys (e.g OGLE, MACHO) over the last decade there is also a wealth of time-resolved data on the SMC.

In 2019 May we observed two areas of the SMC with MeerKAT. The fields are centred on two young high mass X-ray binaries still within their natal supernova remnants, and so the fields also contain a large number of serendipitous detections of other sources within the SMC as well as background radio galaxies shining through the SMC.

In this project we set out to explore the time variability of the MeerKAT radio data that's already in hand. These comprise 2 sets of 6 hour observations.
We envisage exploring the time variability by:

1. Imaging both fields on different timescales, ranging between 0.5 and 6 hours. This will allow detection of objects variable on timescales of a few hours.
2. utilising other techniques, such as Bayesian blocks, folding algorithms and Fourier transforms for characterising variability on these large datasets.

At the very least we expect to be sensitive to flare stars in the foreground of our own Galaxy, which vary on a timescale of minutes to hours, and low mass X-ray binaries in the SMC, which may vary on timescales of hours to months, depending on their accretion state. We may also find other categories of astrophysical objects that show time variability, depending on both the brightness of these sources and the techniques we use to characterise the variability.

Combining the radio variability with optical variability signatures (which we have in hand from ongoing OGLE observations at roughly daily cadence) may be an additional way of probing the nature of the variable source population in these sample fields of the SMC.

The expected output would be a catalogue of radio detections in the Small Magellanic Clouds with a flag indicating the type and extent of radio variability. We expect the student to generate at least one publication in an international journal of high standing.