UCT PhD Project

Mass modeling of galaxies over a billion years of cosmic time

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Project Outline:

The general goal is to do mass modelling first for nearby, well-resolved galaxies, then extend the technique to galaxies at greater distances.

Input HI data for the low-redshift, well-resolved sample includes ATCA mosaics of IMAGINE galaxies, and existing MeerKAT data of PHANGS target galaxies. IMAGINE galaxies also have GBT or Parkes single dish HI data. All have WISE photometry, the PHANGS galaxies also have additional photometry (will need to check) and also possibly CO. We should choose an interesting subset that has the best ancillary data and/or the most interesting properties.

For the higher redshift, lower resolution extension, first we can degrade the resolution and SNR of the low-redshift galaxies to lower resolution, and compare with the high-resolution "truth". Then we can use MeerKAT MIGHTEE HI data for select galaxies, and MIGHTEE multiwavelength imaging for the photometry. In addition to increasing distance, MIGHTEE contains galaxies in various environments, so environment could be an additional variable to explore regarding profile shape.

At some distance, corresponding to some resolution and/or flux limit, resolved mass modelling will no longer be possible, but perhaps integrated quantities could be used as a proxy. We aim to determine where this limit is, and the uncertainties introduced with increasing distance.

All data already exist, so the project is very low risk. The software also exists, with plenty of experts available beyond the primary supervisors for assistance.

Requirements:

Spectral line data reduction for ATCA and/or MeerKAT, depending on the galaxies used. General HI measuring techniques including generation of moment maps and measuring HI fluxes. Modelling software including TiRiFiC and 3DBarolo for less-resolved galaxies. Resolved optical and near-infrared photometry. SED fitting to convert photometry to stellar mass. Coding up a least-square fit for the mass modelling.