The far-infrared to radio correlation of star forming galaxies at low frequencies

How stars formed in the early Universe is one of the major questions to be answered by the Square Kilometer Array (SKA) and its pathfinder instruments. Radio emission is impervious to the effects of dust obscuration, making it the most robust measure of star formation for the most distant galaxies. Our current recipes to estimate star formation based on radio emission are calibrated against the far-infrared to radio correlation (FRC) – a tight relationship between radio and infrared luminosities spanning many orders of magnitude. In the local Universe (z <0.1) the physics that drive the FRC are thought to be well understood. What remains to be seen is how it behaves with increasing redshift, as in the literature there has been both evidence for and against its evolution. Understanding how the FRC may evolve, if it indeed does, is a crucial step towards interpreting star formation in the earliest epochs of the Universe.

Research Field
Radio Astronomy

Project Suitability
Honours
Masters

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This project would focus on exploiting the broadband radio data that is beginning to become available from SKA-precursor instruments, including data from the GaLactic and Extragalactic All-sky Murchison Widefield Array eXtended (GLEAM-X) survey, and the Evolutionary Map of the Universe (EMU), to characterize the spectral properties of star forming galaxies. At low frequencies there is an exciting opportunity to investigate the radio turnovers introduce by free-free absorption, and how these may evolve across the FRC. Combining these data with higher frequency data from existing projects (including the GAlaxy and Mass Assembly Legacy ATCA Southern Sky project) and targeted follow up observations could produce a set of radio templates to be used to provide a reference of the behaviour to be expected from star forming galaxies at higher redshifts.

Aims of the project:

i. Use new GLEAM-X and EMU data to examine the radio spectra of star-forming galaxies;
ii. Search for free-free absorption and examine potential correlation with infrared emission;
iii. Propagate the behavior found to predict the FRC at high redshifts.

This project is well suited to a student with a strong interest in astrophysics and astronomy, and good computing and organisational skills.

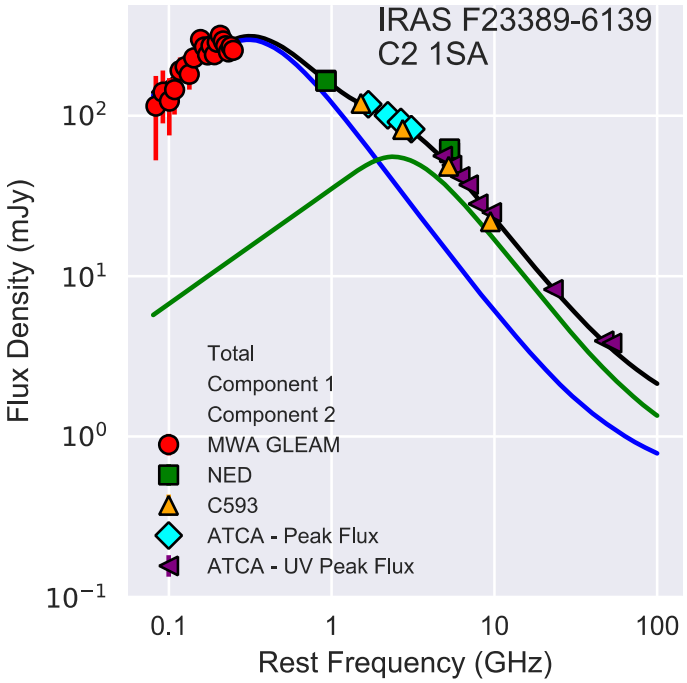

Figure 1 An example of the spectral shape of a star forming galaxy at radio wavelengths from Galvin et al. (2018). MWA GLEAM data constrained a turnover that was modelled as free-free absorption.