Unravelling the Nature of Local Starburst Galaxies

Research Field
Radio Astronomy

Project Suitability
PhD
Honours/Masters

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Radio emission is a superb tracer of star formation across the Universe. As such measuring the star formation history of the Universe is a key science goal of the Square Kilometre Array. Local starburst galaxies have extreme star formation rates (forming thousands of solar masses per year of new stars), but are representative of typical galaxies when the Universe was half its age. Hence to understand these distant galaxies we must obtain a better understanding of their local analogues.

This project will use the deep surveys from the Murchison Widefield Array to build up catalogues of local star-forming galaxies with wide coverage across the electromagnetic spectrum. In the radio, the MWA observations plus complimentary radio surveys will provide measurements across radio spectrum (~0.1 to 10 GHz). The GAMA survey will provide the infrared to optical data. X-ray observations will be available from the eROSITA instrument.

The aims of this project:

(i) create a sample of local starburst galaxies with broad wavelength coverage, in particular model their synchrotron and free-free emission. This catalogue will provide a bench mark for studies of starbursts in the high-redshift Universe and allow us to better understand the origin of radio emission in such sources,

(ii) develop novel models for the broad-band radio data based on the geometry of the galaxy,

(iii) match this sample to eROSITA observations which can be used to constrain the X-ray luminosity/star formation rate relation. Possibly also extend this to higher energies too,

(iv) perform detailed modelling of the subset of starbursts with observations in the infrared from the *Herschel Space Observatory* which will provide a more accurate interpretation of the astrophysics behind the radio emission.

This project will uniquely exploit the frequency coverage of many Australian radio telescopes such as the ATCA and the Curtin-operated MWA.

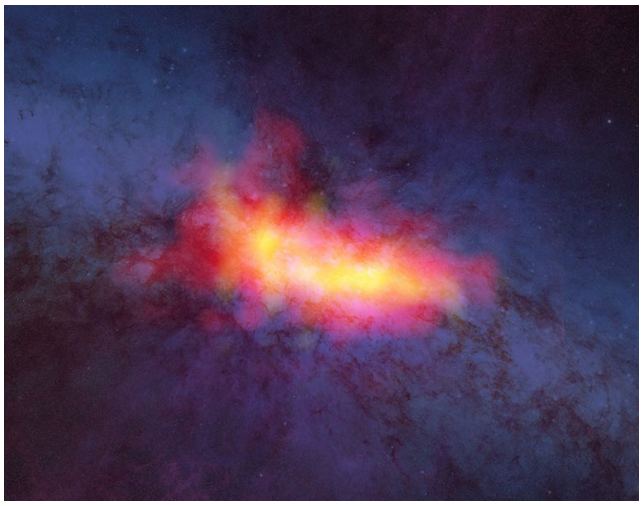

Figure 1. This composite image of starburst galaxy M82 shows the distribution of dense molecular gas as seen by the GBT (yellow and red) and the background stars and dust as seen by Hubble (blue). The yellow areas correspond to regions of intense star formation. The red areas trace outflows of gas from the disk of the galaxy. This project will study such galaxies to understand their complex radio emission and its association with the relativistic particle created by star formation.
Credit: Bill Saxton (NRAO/AUI/NSF); Hubble/NASA.