A MeerKAT 1.28 GHz Continuum Study of Luminous Infrared Galaxies in the Southern Hemisphere

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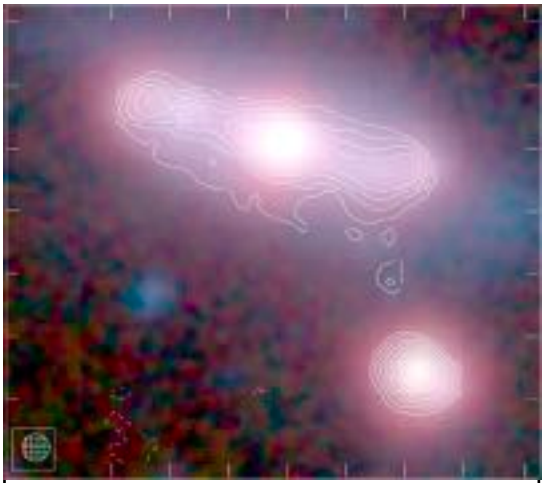
Relatively rare in the local universe, luminous infrared galaxies (LIRGS) account for over half of the cosmic far-infrared background and most of the stars formed at $z > 1$, and hence are an important population to understand galaxy evolution in the early universe.

LIRGS are often associated with interacting and merging systems, whose complexity demands high spatial imaging to disentangle the star-forming components, as well as any AGN that maybe harbored deeply within their dusty shrouds. The very tight infrared-to-radio correlation makes L-band radio continuum emission an excellent complementary tracer of current star formation, and delineator of AGN. For this reason we require the interferometric mapping abilities of MeerKAT, to spatially resolved local-universe LIRGS and to combine with infrared imaging from the IRAS, Spitzer and WISE space missions.



Luminous infrared galaxy merging pair, NGC7771/0 as imaged by WISE. The white contours are VLA 1.49 GHz continuum. Both data sets have a similar 6 arcsec beam.

Basis: We have begun a MeerKAT survey of 122 southern galaxies with IRAS S(60 μm) > 5.24 Jy. These will complete high-resolution L-band continuum coverage of (1) the all-sky IRAS Revised Bright Galaxy Sample (RBGS) of 629 galaxies and (2) its subset of 201 luminous starburst galaxies (plus a few AGNs), which define the Great Observatories All-sky Luminous Infrared Galaxies Survey (GOALS).

Project: The new MeerKAT images plus published VLA images will be used to (1) distinguish AGN activity from star formation, (2) improve the local radio luminosity function of starburst galaxies, and (3) trace the evolution of dust-obscured merger-driven starbursts as a function of merger stage. The MSc project (w/ potential to upgrade to PhD) entails: (1) participation with the MeerKAT data reductions (conducted at SARAO and NRAO), (2) learning and using data analysis tools to study radio continuum maps, and (3) combining with infrared imaging measurements (including WISE mid-infrared) to disentangle the star-forming and non-thermal (AGN) components and produce a new catalogue of radio and infrared luminosities for the local universe LIRGS. Such catalogues will be the drivers for advanced work that include luminosity functions, and linking local-universe analogs to the LIRG realm in the early universe.

Potential Impact: The impact of this study is: a) a better understanding of star formation and AGN activity in the most luminous galaxies, b) to reveal the power for MeerKAT to image and resolve merging galaxy systems, and c) a legacy imaging resource for the whole astronomical community.

Alignment with National Imperatives: This project utilizes and exploits the South African MeerKAT radio interferometer, one of the primary science drivers in South Africa, under the auspices of the Minister of Science, and the Department of Science and Innovation, and the National Research Foundation. This project aligns with the following national imperatives: i) NRF Broad Category: Environmental, Material, Physical and Technology: Astronomy is a physical technical discipline and strong usage will be made of cutting-edge technology in South Africa (MeerKAT). ii) National Priority: Transformation: the training of transformed, science-and-technology based researchers is the basis of South Africa's future in the Fourth Industrial Revolution. iii) Grand Challenge: Astronomy: this project is astronomy, where usage is made of South Africa's cutting-edge technology to understand the Universe and our place in it. iv) Sustainability Goals: Quality Education. Astronomy is a STEM-discipline that forms the basis of the future development of South Africa and an educated population.

National Infrastructure Platforms: SARAO, MeerKAT