MSc Project 2024

Supervisor : Lucia Marchetti (UCT)

Co-Supervisor : Isabella Prandoni (INAF-IRA

lucia.marchetti@uct.ac.za

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MULTI-WAVELENGTH STUDY OF SFGs AND AGNs DETECTED IN THE RADIO IN G23

Background: The discovery of submillimetre galaxies (SMGs) showed that much of star formation activity in the early Universe was shrouded in dust. While rare in the Local Universe, infrared-luminous systems rise dramatically in number with increasing redshift, until at $z > 1$ they host a substantial (dominant) fraction of the comoving infrared luminosity density. Both infrared template modelling and multi-wavelength follow-ups of SMGs have shown both starbursts and AGN dust tori contributing to the high infrared luminosities of these objects, but the underlying physics of such emission is still under debate. Understanding the nature of these SMGs it is of critical importance to study the Cosmic Star Formation History of our Universe. However, interpreting the far-infrared and sub-millimetre observations alone is challenging because of the limited angular resolution and sensitivity of the submm instruments, often requiring sophisticated deblending procedures and cross-match with multi-wavelength data to clearly identify and classify the detected objects. In this project we aim to exploit existing multi-wavelength surveys combined with the extra information available from new ASKAP Radio observations to better disentangle the relative contribution to the submm/Radio emission of star formation and AGN.

Aims & objectives: The GAMA-23 field is the largest of the two Galaxy and Mass Assembly (GAMA) southern fields (G23, G02). As part of the GAMA survey (Driver et al. 2011), it has a wide multi-wavelength photometric and spectroscopic coverage. The G23 has been chosen to be the pilot field for the first ASKAP/EMU observations and a Radio catalogue has been published in (Gurkan et al. 2022). The PI of this MSc project is leading the multi-wavelength "Data Fusion" in the field which will be crucial for the characterization of radio sources. More specifically, the student will work in a team towards the classification of radio sources as SFGs, radio-quiet or radio-loud AGNs. The results obtained in G23 will then serve as a reference for the rest of the wider ASKAP/EMU observations where the multi-wavelength coverage is not as good.

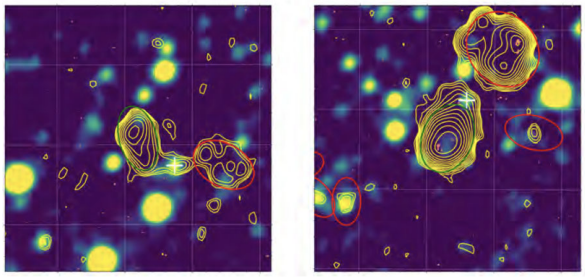

Figure 1: Example postage stamps of radio sources in the G23 field. ASKAP contours (yellow) and VLASS contours (salmon) on WISE images (colour). Each postage stamp is centred at the position of the source component to be inspected (indicated by a green ellipse). The red ellipse shows the neighbouring source and the white cross indicates the host galaxy position (Gurkan et al. 2022)

The student will be supervised by the PI of the multi-wavelength workpackage and co-supervised/advised by Dr Isabella Prandoni (INAF-IRA), Chair of the Radio quiet AGN working group within the ASKAP/EMU consortium, and Prof. Mattia Vaccari, lead of the HIPPO data-fusion project. The student is not required to have any specific knowledge, however some knowledge of python coding and of Topcat (`https://www.star.bris.ac.uk/~mbt/topcat/`) and Stilts (`https://www.star.bris.ac.uk/~mbt/stilts/`) are desirable.

Alignment with National Imperatives: this project aligns with the following national imperatives:

1. NRF Broad Category: Environmental, Material, Physical and Technology. Our research aims to

exploit observations of the sky at various wavelengths to better understand the physical processes at play in the Universe.

2. National Priorities:

   (a) Job creation: Graduate training in astronomy will contribute to nurturing a new generation of professional Astronomers and data scientists.

   (b) Transformation: the scientific goals of this project aim to promote transformation in science by nurturing a new generation of researchers with the skills that are the basis for South Africa's development in science and technology.

3. National Strategies:

   (a) Grand Challenge – Astronomy: this project addresses SA's parallel needs to promote research excellence and innovation and drive human capital development and transformation identified as part of DSI/NRF's national strategy for multi-wavelength astronomy.

4. Sustainability Development Goal:

   (a) Quality Education: Graduate training in astronomy and STEM subjects will contribute to increasing the offer of quality education for all.

National Infrastructure Platforms: this project will make use of MeerKAT and the IDIA/Ilifu cloud facility.

References :

- Gurkan et al. 2022, "Deep ASKAP EMU Survey of the GAMA23 field: properties of radio sources" Monthly Notices of the Royal Astronomical Society, Volume 512, Issue 4, pp.6104-6121
- Driver et al. 2020, "Galaxy And Mass Assembly (GAMA): Data Release 4 and the $z < 0.1$ total and $z < 0.08$ morphological galaxy stellar mass functions", Monthly Notices of the Royal Astronomical Society, Volume 513, Issue 1, pp.439-467