Multi-Wavelength and Radio Studies of Star-Forming Galaxies and AGN

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Galaxies are thought to emerge at the centre of dark matter (DM) halos (Silk & Mamon 2012) forming stars in a way connected to the growth of such halos (so-called galaxy–halo connection). On the micro-scale, supermassive black holes (SMBH) accrete gas and grow tightly connected to the properties of the host galaxies (Kormendy & Ho 2013). Feedback processes within galaxies may impact their surroundings, influencing future gas accretion and star formation (SF). Feedback from radio-loud AGN, in particular, is often invoked to explain the observed properties of massive galaxies in the local Universe. Less clear is the role of jet-induced feedback at higher redshifts ($z \gtrsim 1$), where radio-AGN activity shifts towards lower-mass, mostly star-forming galaxies (SFG; Smolcic+17). Shedding light on the interplay between SMBHs, galaxies and DM halos at the peak epoch of cosmic assembly ($1<z<3$; the 'cosmic noon'), requires observations over large cosmological volumes to probe all environments and include the rarest galaxy/AGN populations, while also being gas/dust-insensitive to unveil the dominant contribution of obscured AGN and SF activity (Dunlop+2017; Vito+2018).

In this project, we aim to explore this interplay between star formation and AGN activities using observations from MeerKAT (from programs such as MeerLIRGs, EDFS or MIGHTEE) and existing multi-wavelength datasets across the spectrum. In particular, depending on the interest of the student and the data available, we will focus on one or more of the following angles:

- Characterize the X-ray properties of the galaxies and compare them with the Radio properties to constrain the typical nuclear activity of the galaxies under analysis.
- Characterize star formation and AGN activity in galaxies by analyzing their broad-band spectral energy distributions (SEDs).
- Combine photometric and spectroscopic diagnostics to characterise the galaxies.
- Characterise and statistically constrain the type of Radio population detected by MeerKAT in shallow wide fields.
- Compare local and high-redshift populations, leveraging well-studied samples such as IR-bright galaxies from IRAS and recent large-area radio surveys like MeerKAT MIGHTEE and ASKAP.

The student will have the opportunity to join the research group led by Dr Lucia Marchetti and investigate the prospect of extending the Honours project to an MSc project next year (this project is suitable, but not limited to, SARAO funded student).