NASSP Honours/MSc Project 2024

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Multi-wavelength and MeerKAT study of Infrared bright SFGs and AGNs.

Problem statement. IR/submm bright galaxies dominate the star formation rate density of the Universe at redshift z=1-3. Both star formation and AGN activity are contributing to the high infrared/submm luminosities of these objects, but the underlying physics of such emission is still under debate. In this project, we aim to contribute to the understanding of the nature of IR/submm galaxies by exploiting Radio and multi-wavelength datasets.

The project Herschel enabled the observations of the "obscured" side of galaxy evolution, finding that the peak of the SF rate density, SFRD, is dominated by objects defined as SF-AGN (Gruppioni et al. 2013, 2015), showing both SF and AGN activity in their broad-band spectral energy distribution (SEDs, from UV to far-IR). Interestingly, these Herschel high-z objects, which are more difficult to observe, appear to show the same SEDs of local IR galaxies such as the IRAS Revised bright galaxy sample - RBGS, Sanders et al. 2003 or the IRAS 12-μm Galaxy Sample - 12MGS, Rush et al. 1993. These IR local galaxies can thus be exploited as a gateway to understanding the physics at play not only in the low-z regime but also in their high-z analogues. With this in mind, we have started coordinated observing campaigns with MeerKAT and SALT to study these sources in great detail. In particular, we have already obtained MeerKAT snapshot observations (MeerLIRGs, PI: Jarrett; 12MGs, PI: Marchetti) of ALL the 298 RBGS ($S(60\mu m) > 4.24$ Jy) distributed across the Southern sky (Condon et al. 2021) and of a complementary sample of 12MGS. A wealth of multiwavelength data are already available for these sources including new spectroscopic data from SALT (Optical). This combined with the Radio data and spectral models makes it possible to strongly constrain the AGN and the SF activities in these galaxies. In particular we want to exploit the spectroscopic data to disentangle between SFGs and AGNs using the well-known BPT diagram and line profile fitting of typical AGN emission lines such as Hβ(4961 $\mathring{A}$) , [O III](4959, 5007 $\mathring{A}$), [O I](6300 $\mathring{A}$), Hα(6563 $\mathring{A}$) , [N II](6583 $\mathring{A}$), [S II](6716, 6731 $\mathring{A}$).

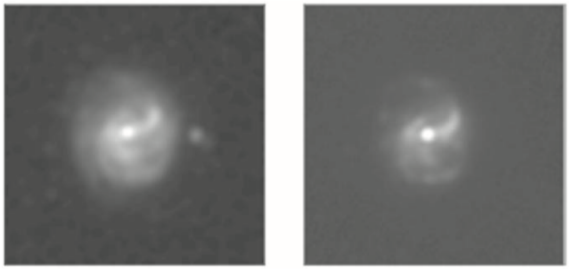

Figure 1: Comparison of NGC6156 from MeerKAT (left) and from Herschel (right) from Condon et al. 2021.

Although this project focuses primarily on the MeerLIRGs survey, similar analysis can be extended and conducted on the MeerKAT MIGHTEE and ASKAP surveys. This can be taken into consideration according to the interest of the candidates and level (honours vs MSc) of the project undertaken. The main scientific focus of the project can be agreed together with the student according to her/his main interest. The analysis is by nature modular and can therefore accomodate both honours and MSc projects.

References :

James J. Condon, William B. Cotton, Thomas Jarrett, Lucia Marchetti, Allison Matthews, Thomas Mauch, Malebo Moloko (2021): *A MeerKAT 1.28 GHz Atlas of Southern Sources in the IRAS Revised Bright Galaxy Sample*, https://doi.org/10.48479/dnt7-6q05