Título/Title:
The importance of star-formation, black-hole accretion and other physical mechanisms into the Far-IR-radio correlation

Orientador/Supervisor:
Ciro Pappalardo (IA-Lisbon) ciro@oal.ul.pt

Descrição/Description:
One of the most challenging astrophysical questions is to determine the star-formation history of the Universe. In this context, one of the most interesting and intriguing correlations is the one found between the radio and the far infrared (FIR) emission in galaxies. Although both emissions can be related to the current star formation, the apparent direct connection between them is far from obvious.

The main problem arises from the fact that the radio emission can be produced in different ways (e.g. radio emission from an AGN) and the FIR is not always strictly related to star formation processes (e.g. also stars in their late evolutionary stages can produce a radiation field able to heat the dust). Despite all these different emission mechanisms, the relation is surprisingly tight and universal for galaxies over several orders or magnitude in mass and luminosity. Nowadays, a complete theoretical understanding for the tightness of this correlation is still missing. An invaluable insight into the physics of this correlation could be gain by considering a statistical large sample of galaxies were we can precisely measure both the radio continuum and FIR properties. With modern radio continuum surveys and with the large FIR database produced by the Herschel Space Observatory during its lifetime, such samples can be built and explored. The goal of this project is to investigate the influence of the average dust mass and dust temperature into the FIR-radio correlation as well as the significance of the emission of the central super massive black-hole (SMBH) in Active Galactic Nuclei (AGN). With this objective in mind, the student will build a large sample of galaxies with high quality data both in the radio and at FIR wavelengths.

With such sample we will investigate the scatter in the FIR-radio correlation as a function of different dust mass bins, and as a function of redshift. Taking advantage of the multi-wavelength coverage that will be available for a large fraction of the sample, we will be able to investigate the physical differences between different dust heating sources and provide an indication on the reliability of the FIR-radio correlation when the available data does not properly sample the peak of dust emission. The data sample and results to be obtained during the thesis time frame will be crucial for future studies of star-forming galaxies. In particular, the analysis to be conducted will be very important to understand the faint radio population that will be uncovered by the future radio continuum survey, such as the Square Kilometer Array pathfinder and precursor radio continuum surveys from ASKAP (Norris et al. 2011), LOFAR (Rottgering et al. 2011), MeerKAT (Jarvis 2012), and the Jansky Very Large Array (JVLA).