

## **PhD project in ASTROPHYSICS**

**Title of the Project:** *“Study of magnetic field in galaxies from dust polarized emission”*

**INAF-IRA Supervisor :** Rosita Paladino

**Co-Supervisors :** Annie Hughes (IRAP-CNRS Toulouse)

### **Scientific Case:**

The knowledge of magnetic field structure in the cold interstellar medium of galaxies is crucial to understand how magnetic fields influence gas dynamics and in particular their role in regulating star formation, driving galactic outflows and fueling galactic nuclei.

To date, magnetic field studies in external galaxies have mostly used radio synchrotron emission as a tracer of the magnetic field’s strength and structure. This gives only a partial view since synchrotron emission traces mainly the hot and diffuse halo of galaxies.

The dust polarization traces instead the magnetic field in most dense and cold regions, where star formation actually happens. These measurements are crucial to understand the connection between magnetic fields and star formation processes as well as their effects on galaxy structures (disk, spiral arms, jets, nuclei). Furthermore, dust polarization studies can help understand the physics of dust, and the different dust properties inside each galaxy and from galaxy to galaxy.

### **Outline of the Project:**

Current new facilities, such as the Stratospheric Observatory for Infrared Astronomy (*SOFIA*) and the Atacama Large Millimeter Array (*ALMA*) are opening a new perspective on magnetic field studies. By comparing dust polarization and synchrotron emission in external galaxies it will be possible to build a coherent picture of magnetic fields in their interstellar medium.

The PhD candidate will work on the analysis of the emission of polarized dust in nearby galaxies, observed with *SOFIA* (*HAWC+* data from the “Magnetic Fields in Galaxies” *SOFIA* Legacy programme) and *ALMA* (proprietary *ALMA* full polarization data), in close collaboration with international experts. The multi-frequency approach is key to this study so the candidate will be involved in proposals for new observations also with other facilities.

This project is funded by the Italian node of the European *ALMA* Regional Center. Depending on the candidate’s attitude and preferences he/she will have the opportunity to join *ALMA* working groups, in particular those related to polarization improvements of the instrument.

The PhD candidate will work in close contact with *ALMA* and *SOFIA* working groups, and travels to visit collaborators in France, Chile, and USA will be planned.

**Contact:** [rosita.paladino@inaf.it](mailto:rosita.paladino@inaf.it)