Multifrequency observations of Fast Radio Bursts

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Fast Radio Bursts (FRBs) are bright (> 1 Jy @ 1.4 GHz), millisecond-long radio flashes whose origin is still largely unknown. They show the typical pulsar-like dispersion signal, where high frequencies arrive earlier than low frequencies, and this delay is proportional to the electron column density between the source and the observer - known as dispersion measure (DM). A DM excess with respect to the Galactic contribution provided the first evidence of the extragalactic nature of FRBs. Further confirmations came from the localization of a fraction of them to nearby galaxies, up to galaxies at z ~ 1. In 2020, an FRB was observed from the Galactic magnetar SGR 1935+2154, providing evidence that magnetars may be the progenitor source of FRB. Despite these observational progresses, the nature of FRBs remains largely debated. Are magnetars the progenitors of all FRB sources? And which type of magnetars? What is the physical mechanism that powers FRBs? Are FRBs a single population or do they belong to different populations? What is their connection with the environment?

This project aims to address some of these questions in order to shed light on the FRB sources. In particular the student will work on the following projects:

- Characterization of the temporal, frequency and energy properties of repeating FRBs through observations at 408 MHz, 1.4 GHz and 5 GHz (using the Northern Cross, Medicina, SRT and Noto radio telescopes). Repeating FRBs are ~ 10% of the total number of FRBs discovered to date and are the ideal candidates to address some of the aforementioned questions by characterizing their spectral, frequency and energy properties;
- A blind FRB survey at 408 MHz with the Northern Cross radio telescope. The Northern Cross will have an 8000 square meter collecting area by the end of 2025 and will be one of the most sensitive instruments to observe FRBs. The survey will aim to generate a catalogue of a few hundreds FRBs in order to study their statistical properties and compare the sample with predictions from population models;
- The localization of FRBs using the CHORD radio telescope. CHORD is a new radio interferometer under construction in Canada and the will have 64 dishes in 2025, with a few outrigger dishes that will provide thousand-kilometre baselines, allowing for a sub-arcsecond location of FRBs. Such precise localization will enable the identification of the host galaxies and, consequently, the FRB redshift. The student will work on analysis of CHORD data in order to produce a catalogue of FRBs with redshift and use them as cosmological probes.