

Fast Radio Bursts

They are bursts of radio waves from space that are over in a blink of an eye. They are variously attributed by hard-nosed and self-respecting physicists to everything from microwave ovens, to the accidental transmissions of extraterrestrials making their first baby steps in interstellar exploration. The remarkable properties of these Fast Radio Bursts (FRBs) have so enthralled astronomers that, in the decade since their discovery with the Parkes radio telescope, more theories have been advanced to explain them than new bursts have been detected. FRBs are remarkable because they are outrageously bright yet appear extremely distant. As far as astronomers can tell, they come from a long way away – half way across the observable Universe or more! Because of that, whatever makes FRBs must be pretty special – unlike anything astronomers have ever seen.

The field is currently grappling with the most fundamental questions about these events:

- What is their spectrum?
- What is the brightness distribution?
- Do FRBs represent one-off cataclysmic explosions, or do they repeat?
- What is their event rate?
- How distant are these events?

Relatively few FRBs are still known. However, the Australian SKA Pathfinder has now nearly doubled the population of known FRBs, and is now rapidly increasing the sample further. In this project you will work with other members of the Commensal Real-Time ASKAP Fast Transients (CRAFT) team to examine the properties of FRBs and help understand what causes them. CIRA is a key member of the CRAFT survey on the Australian SKA Pathfinder (ASKAP), which is currently detecting Fast Radio Bursts at a high rate, and which will soon be able to localise the bursts to 1" on the sky. We are offering several projects in this field:

1. Searching for repeating FRBs in ASKAP data

Unlike previous FRB surveys, ASKAP constantly monitors the same patches of sky for FRBs. Hence, the region of sky in which any FRB is detected will have been observed many times. Here you will search the ASKAP data at the locations and dispersion measures of known FRBs to look for faint bursts by examining the statistical properties of the noise.

2. Characterising the spectral features of ASKAP FRBs

ASKAP FRBs show mottled structure across the band. What does this mean? Is this due to interstellar scintillation, or can you show that it is an intrinsic property of the FRB emission mechanism?

3. The FRB dispersion measure distribution

The dispersion measures (DMs) of FRBs represent a means to probe the ionized Inter-Galactic Medium, the repository of over half of the Universe's baryonic (normal) matter. But how do we interpret the DM? In this project you would investigate how the DM distribution depends on variations in the distribution of matter along individual sight-lights through the IGM.

The scope exists to expand any one of these projects into a PhD.

(right) FRB 170107, the first Fast Radio Burst detected by ASKAP. To date, over 30 FRBs have been found by CRAFT.

Research Field

Radio Astronomy

Project Suitability

Honours

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