
Understanding the host galaxies of fast radio bursts

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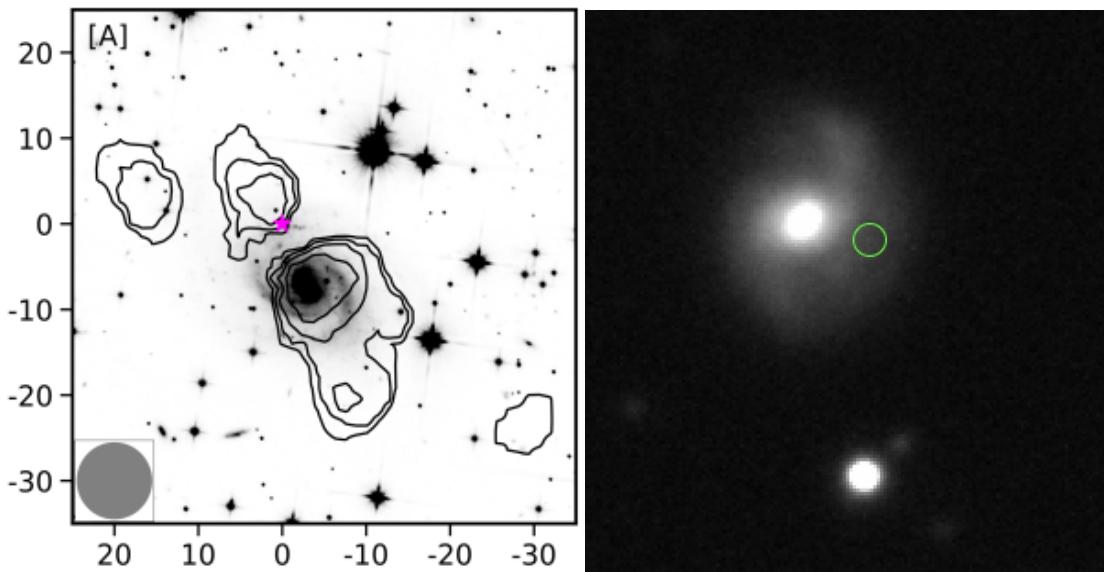
Description:

Fast radio bursts are extremely powerful radio transients, so luminous they are visible across the Universe, which occur within mere milliseconds. FRBs have been detected in distant galaxies and used to find the previously ‘missing baryons’ in the Universe. Yet, to date only a handful of FRBs have been localised, and the origin of FRBs is not yet known.

To best address this, we need to better understand the host galaxies FRBs reside in, through localisation of their radio signal. The Curtin Institute for Radio Astronomy (CIRA) is a member of the Commensal Real-time ASKAP Fast Transients Survey (CRAFT) with the Australia Square Kilometre Array Pathfinder (ASKAP). By localising the FRB emission to within an arc-second on the sky, we can identify the host galaxies, and CRAFT is expected to localise \sim 1 FRB every two days. We hence will have a large catalogue of host galaxies to analyse and follow-up with multi-wavelength data.

In this project the aims are to:

- Analyse existing radio and other multi-wavelength information of FRB host galaxies
- Analyse new high-time resolution data of the FRB emission uniquely available to CRAFT to combine with our knowledge of the host galaxy to understand the medium the FRB signal propagates through
- Conduct new observations to study the neutral hydrogen, the star-forming fuel, of these host galaxies to inform models on the creation of FRB progenitors
- Analyse simulated hydro dynamical galaxy simulations and link the populations in these simulations to our observed sample



Caption: The neutral hydrogen gas (Kaur et al. 2022) overlaid as contours on optical data indicating a disrupted gas distribution, where the FRB emission position is given by the pink star (left), and the CRAFT localisation of a new FRB to within a nearby spiral galaxy (right).

FRBs are a new phenomenon that are still not well understood, and hence the FRB field is rapidly changing; the student should be prepared to adapt their research.