Detecting Fast Radio Bursts from Extragalactic Explosions

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Description:
The origin of the phenomenon know as fast radio bursts (FRBs, rapid flashes of light observed from across the Universe) is still a mystery to be solved. One theory is that they are produced by the remnants of merging neutron stars, which are the dense remnants leftover from supernovae that are made entirely of neutrons. Merging neutron stars are detected by gravitational wave detectors such as Advanced LIGO or through their production of a short gamma-ray burst (GRB; a burst of gamma-ray light that outshines their host galaxy) by dedicated space telescopes. Such signals are predicted to be the earliest electromagnetic radiation to be produced by these gravitational wave events, allowing the earliest accurate position estimates of these otherwise poorly-localised events and enabling the study of the most fundamental questions relating to the physics of nuclear matter.

Artists impression of an FRB: Dana Berry/NASA/Skyworks Digital

The PhD candidate will use the "rapid-response mode" to trigger MWA Voltage Capture System (VCS) follow-up observations of neutron star gravitational wave mergers detected by LIGO in its upcoming observing run (beginning December 2022) and short GRBs detected by Swift to study the origin of FRBs, collecting high time resolution data that will allow them to search for distant, dispersed signals. There is also the opportunity for the student to use MWA to search for the low-frequency components of FRBs detected at higher-frequencies by triggering VCS observations on FRB alerts broadcast by facilities such as ASKAP and UTMOST-2D.

The MWA has recently undergone an upgrade, allowing the student opportunities to be involved in software and pipeline problem-solving and development, and will involve collaboration between slow transient (explosions and outbursts) and pulsar astronomers, drawing on wide expertise in the field of radio transient astrophysics. The student will also have access to Pawsey supercomputing resources to conduct their research. We are looking for a candidate who enjoys a computational challenge with strong programming and problem-solving skills. Experience in observational techniques, particularly in radio astronomy, coding and scripting languages, and scientific writing will all be beneficial.