Curtin University

Searching for transients and variables in the GaLactic and Extragalactic All-Sky MWA (GLEAM) surveys

The Murchison Widefield Array (MWA) is a low frequency (80-300 MHz) radio telescope operating in Western Australia and the only SKA_Low precursor telescope. One of the largest science programs for the MWA is the GaLactic and Extragalactic All-sky MWA (GLEAM) survey, which has surveyed the entire visible sky for two years since the MWA commenced operations. The GLEAM-eXtended (GLEAM-X) survey expanded this with a further two years of observing at higher resolution.

GLEAM and GLEAM-X have collected vast quantities of data. A large part of the first year of this data has been published as an extragalactic source catalogue. However, to produce this catalogue, all of the data was averaged together in time. The original data in full time resolution, as well as newly processed GLEAM-X data, still remain to be investigated. Hidden in these images are possible transient events, such as: flaring M-dwarf stars, reflective space junk, and potentially other undiscovered sources. There are also many astrophysical reasons for sources to change in brightness with time, such as scintillation from intervening plasma, and the flaring and dimming of distant black holes.

The project involves careful analysis of the GLEAM and GLEAM-X data, using the combined catalogue as a reliable reference source. The student will search for objects which do not appear in the combined catalogue (transients), and identify their nature. There is also the potential to monitor the brightness of sources over time (variables). Recently a new method of transient source detection has been developed via visibility differencing, and this project can extend that search to the entire GLEAM and GLEAM-X sky, as well as other public MWA data sets.

Aims of the project:
  i.   Search GLEAM and GLEAM-X data for transient events, either by computational searches of existing images, or visibility differencing;
  ii. (Masters, PhD-only): Determine the variability of large numbers of objects over time and frequency through the GLEAM and GLEAM-X data, and use this to constrain the physics causing the variability from intrinsic or extrinsic causes.

This project would suit a student with good programming skills who is willing to learn more and search a large dataset for potentially interesting events. With approximately 7 million source measurements to search and correlate, organisation and clear thinking are crucial skills.
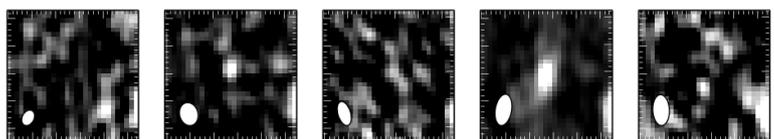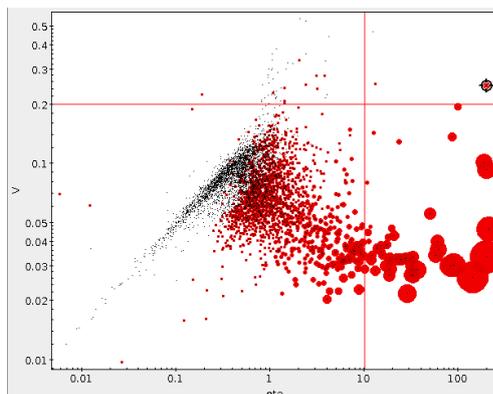
Research Field

Radio Astronomy

Project Suitability

Honours

Masters

PhD

Project Supervisor

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Figure 1   Above: An example set of images, demonstrating a variable source. The source is detected only in the 2nd and 4th images.
Left: The degree (V) and significance (eta) of variability for a subset of sources that will be used in this work.