Curtin University

Monitoring low-frequency radio sky for transients

Although low-frequency (<400 MHz) radio sky is not reported to be highly variable in terms of transient objects, there have been increasing number of transients detections by new low-frequency instruments. Sensitivities of the existing instruments are not high enough to detect all (or at least many) of the low-frequency counterparts of transients detected at higher electromagnetic energies (up to gamma-rays). However, there have been several recently reported low-frequency transient detections. Such as for example detection of the outburst of the black hole candidate X-ray binary MAXI J1348-630 at 154 MHz and 216 MHz with the Murchison Widefield Array (MWA) by J. Chauhan et al (2019) or detection of a very bright transient (> 800 Jy) of unknown nature by the Long Wavelength Array (Varghese, S. et al (2019)). Hence, although the abundance of low-frequency radio transients is small there are events (including some of unknown nature) which can be observed at low radio-frequencies.

Research Field
Engineering / Radio Astronomy

Project Suitability
Honours (as appropriate) / Masters other 1 year projects with possible extension into a PhD

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This project aims to develop tools for automatic identification of transients in the MWA data. Over the last two years many observations of calibrator sources were reduced, calibrated and imaged in order to develop a database of calibration solutions for the MWA, specifically for the All-Sky Virtual Observatory (ASVO). Hence, there is a large set of images of the calibrator fields which could be analysed in search for transients as a first and minimal step of the project (Honours / 4th project / Summer Student level).

The project can be extended further to enable near-real time reduction, imaging and transient search of MWA observations collected daily by the telescope (for instance create a few images per each observed field), which can also be easily imaged using the earlier mentioned calibration database (daily updated with new calibration solutions). Finally, the next extension would be to perform all-sky scans with the MWA every few months in order to monitor sky variability on a few-month timescale (pilot observations have been collected and a new proposal for future observations is being prepared).
All these efforts will aim towards a real or near-real time transient detection system for the upcoming low-frequency component of the Square Kilometre Array (SKA-Low) including all-sky images from the precursor stations (AAVS1 or EDA).