

## Are polarised variable sources important as a foreground to the Epoch of Reionisation?

The formation of the first luminous sources and their subsequent reionisation of the intergalactic medium, called the Epoch of Reionisation (EoR), was a pivotal period in the history of the Universe. The most promising method to observe the EoR is via tomography of the redshifted 21 cm line of neutral hydrogen. Due to the expansion of the Universe, 21 cm emission from the EoR redshifts to radio frequencies between 100 – 200 MHz. Detecting this cosmic signal is a goal for current and next-generation low-frequency radio telescopes, including the Murchison Widefield Array (MWA).

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### Research Field

Radio Astronomy

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### Project Suitability

PhD

Honours

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### Project Supervisor

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A significant challenge to radio EoR experiments is identifying and removing foreground emission produced by a variety of astronomical sources. Most egregious is the instrumental coupling between polarised and total intensity radio emission, commonly referred to as 'leakage'. This coupling can produce emission structures that have similar characteristics as the EoR signal. Because the level of polarisation leakage is expected to be below the instrumental and sky noise, it is challenging to identify (see Figure 1). This makes it one of the least explored effects that could potentially contaminant the EoR.

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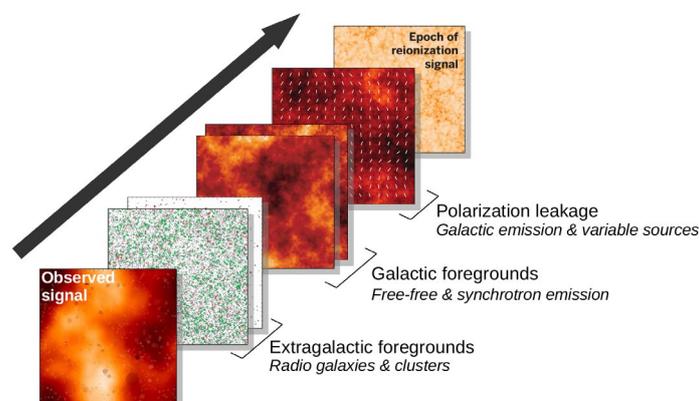
### Co-Supervisors

Dr Cathryn Trott

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In particular, the intrinsic spectral structure of variable polarised sources could contaminate the EoR signal via leakage. Rowlinson et al. (2016) conducted a blind search for total intensity variable sources using the MWA, revealing no new low-frequency variable sources. However, Lynch et al. (2017a, 2017b) showed that much greater sensitivities could be achieved with the MWA using polarised images, detecting polarised variable sources below the sensitivity of total intensity MWA imaging. The results of this work suggest that there may be weak, polarised transients that would not have been detected by Rowlinson et al. (2016). It is currently unknown if these polarised sources contribute significantly to the polarised foreground for the EoR.

The goal of this project is to constrain the importance of polarised transient sources as a foreground to the EoR. The proposed project will involve developing models for different types of variable sources to characterise them as foreground sources as well as processing and analysis of large observational datasets from the MWA to measure the occurrence of polarised variable sources.



*Figure 1: Foreground components must be removed one at a time to detect the EoR signal. First bright extragalactic point sources will be removed using most recent sky-models. Next total intensity Galactic emission will be removed using its spectral smoothness. Removing polarization leakage will come at the very end.*