

Searching for Primordial Black Holes as Dark Matter

Free floating intermediate mass black holes (many tens of solar masses) are prime candidates for the unknown 'dark matter' which makes up most of the mass of the Universe. They are cold (slow-moving) and would be very hard to spot in the halo of our galaxy. One method to detect them would be via gravitational lensing of distance extra-galactic sources when they pass close to their line of sight. These events would be rare but distinguished by their symmetric variability over time as the black hole reaches and then passes its closest separation to the background source. They would also affect all frequencies equally as lensing does not depend on frequency unlike most intrinsic variability. The Murchison Widefield Array telescope provides us with a great opportunity to discover these [symmetrically achromatic variable \(SAV\) events](#) due to its wide field of view, regular observations of calibrator sources and wide frequency coverage.

Research Field

Radio Astronomy

Project Suitability

PhD

Honours

Project Supervisor

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The aims of project this project are:

- (i) produce images of all archive observations around calibrator sources and search for any transient sources,
- (ii) select SAV events, model them, and estimate implications for dark matter,
- (iii) follow-up on-going SAV events with high resolution radio, millimetre and optical observations to observe the distortion of the background source and estimate mass of lensing source,
- (iv) use this large data set to provide an archive of calibration solutions and assess the health of the array over time.

This project will provide novel constraints (or determination) on the nature of dark matter and by providing an archive of calibration solutions it will be of great benefit to the wider astronomical community using MWA data.

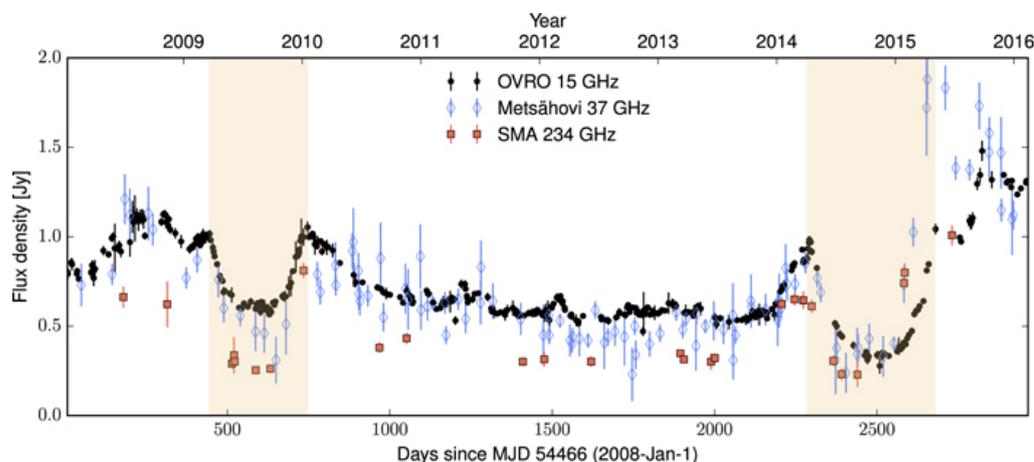


Fig 1. Examples of SAV events from [Vedantham et al. \(2017\)](#) potentially caused by free floating black holes in the halo of the Milky Way.