# Tracing past radio AGN activity in the BASS sample

**Research Field**
Radio Astronomy

**Project Suitability**
Honours
Masters

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The growth of central supermassive black holes (also known as Active Galactic Nuclei, AGN) is episodic and not well understood. The Swift BAT AGN Spectroscopic Survey (BASS) is a very large survey (>1000) of hard X-ray selected AGN with complementary optical spectroscopy observations aimed at furthering our understanding of growth and structure around nearby supermassive black holes. A significant recent BASS discovery is the significant excess of late-stage nuclear mergers – a result that is consistent with theoretical simulations which find a strongest excess of nuclear mergers in gas-rich major-merger host galaxies of obscured luminous black holes (Koss et al 2018). The prevalence of mergers suggests that these galaxies do not reside in isolation. High angular resolution is required to pinpoint the origin of the emission.

Current radio continuum studies of this sample have found that while these black holes are accreting very efficiently, at higher radio frequencies they are not radio-silent but typically classed as radio-quiet (Wong et al 2016; Smith et al 2016) and that likely to not be dominated by a jet origin but related to outflow winds (Baek et al 2019; Smith et al 2020 submitted). Low radio frequency observations are currently missing but crucial for tracing past jet episodes and for estimating the mechanical energy that would be injected into the ISM and IGM of the host galaxy. Studying these galaxies with the Murchison Widefield Array will enable the modelling of the radio emission and potentially the age of the jet emission. The GaLactic and Extragalactic All-sky MWA – eXtended (GLEAM-X) survey can be used for this work.

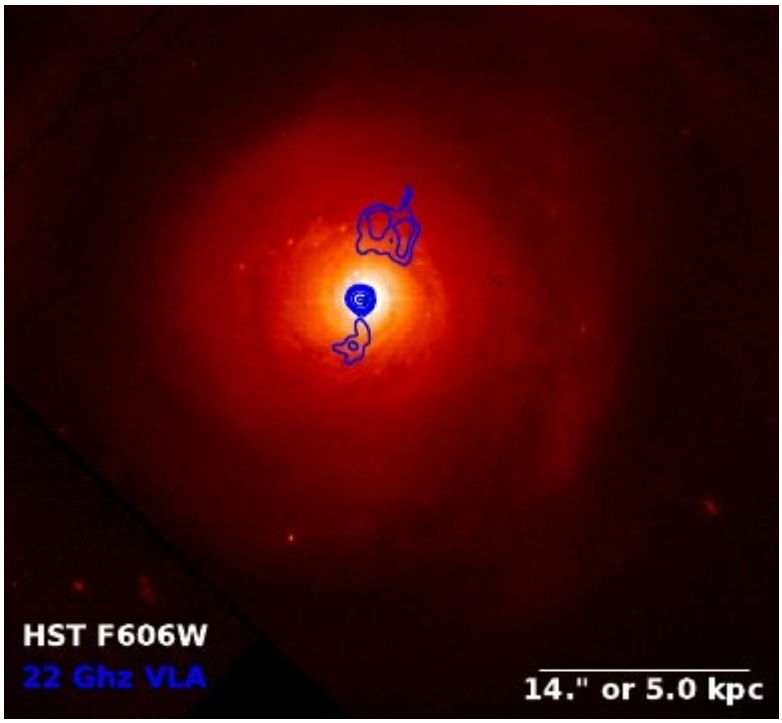


*Figure 1 Example BASS galaxy. VLA 22GHz observations are shown as blue contours overlaid on the HST optical image of the host galaxy*

Aims of the project:

i. Examine and characterise the low-frequency radio spectral energy distribution from GLEAM-X observations of a sample of nearby galaxies where AGN activity has restarted (selected via their hard X-ray emission);
ii. (Masters) Estimate contribution of jet emission to observed radio emission across the band.

This project uniquely exploits the frequency coverage of the MWA over 20 bands and the Phase 2 long-baseline observations which provide sufficient resolution for pinpointing the source of the observed low-frequency emission. It allows us to look back into the past of supermassive black holes and examine how they feed and grow. This project suits a student with a strong interest in astrophysics and astronomy.

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