Determining the Accretion/Jet Connection in Super-massive Black Holes

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Description:
There is now compelling evidence that nearly all galaxies host a super-massive black hole at their centres. Furthermore, these black holes are believed to play a key role in the evolution of their host galaxy. We know that they evolve via accretion and mergers (along with their host galaxy). Their accretion history can be constrained by current X-ray and mid-infrared surveys, but to obtain a full picture of accretion we need to use radio surveys to trace the relativistic jets produced at low accretion rates. However, astronomers have a very incomplete view of how the radio jets are related to the accretion onto the black hole, which must ultimately power it. While the physics of super-massive black holes are similar to Galactic black holes, they are millions of times larger and evolve on much slower timescales than their Galactic cousins. So to study these black hole processes in galaxies, one must look for patterns and trends in large populations.

In this project, you will use ultra-deep radio observations from the Murchison Widefield Array and the Australian Square Kilometre Array Pathfinder to produce large samples of distant radio sources selected at low-frequency. These data are already in hand and require processing. These radio images cover the GAMA survey fields, which have a wealth of multi-wavelength across X-ray to radio wavelengths. In particular, the 50,000 spectroscopic redshifts will allow us to conduct a census of radio sources as a function of radio luminosity and jet power.

By combining these observations with other tracers of black hole accretion, you will develop models that connect the accretion onto black holes with the production of powerful radio jets. This work will need to take into account the distribution of black hole masses and spins as well as the different modes of accretion.

An additional output of this project will be the establishment of a suite of intrinsic X-ray to radio spectra for a vast array of different classes of galaxies including those with active black holes and those with high star formation rates. Such a rich data set will provide a big legacy to the community.

The successful candidate will join an experienced international collaboration who have been working on radio surveys for many years. In particular, you will work closely with colleagues at UWA and CSIRO. There will be opportunities to present your research at national and international conferences. Additionally there is potential scope to spend time at CSIRO in Perth as an industry intern.

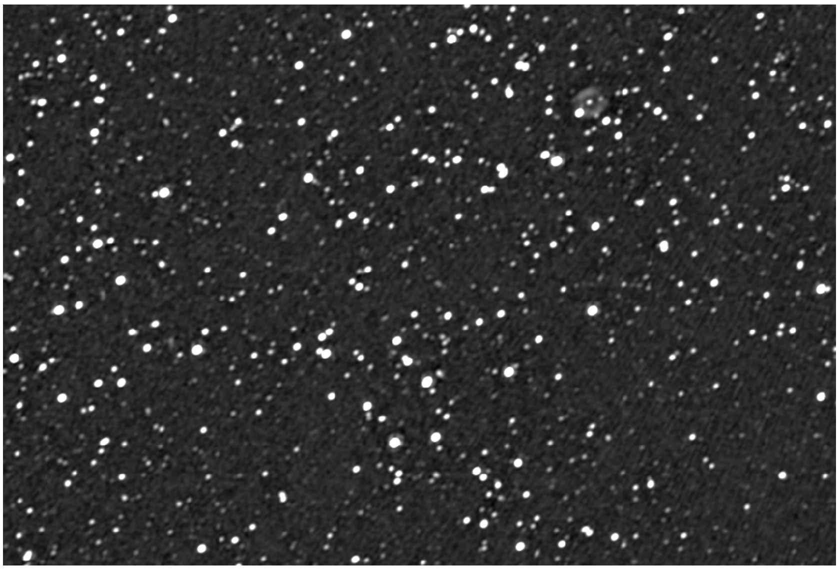

Fig 1: A small section of one of the deepest MWA images produced so far. These radio sources are mainly powered by relativistic jets from super-massive black holes. You will create deeper images over much wider areas. When that data is combined with the plethora of multi-wavelength available, you will develop models to connect the jet activity with the accretion onto the central black hole.