A unique astrophysical laboratory in our extra-Galactic backyard: Centaurus A

Research Field
Radio Astronomy/Engineering

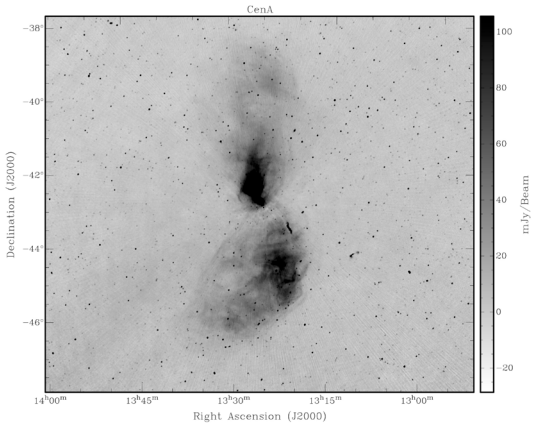
Project Suitability
PhD
Honours

Project Supervisor
Dr Benjamin McKinley
ben.mckinley@curtin.edu.au

Co-Supervisors
Prof. Melanie Johnston-Hollitt

Radio galaxies are characterised by extremely powerful radio jets emanating from the accretion disk of a supermassive black hole residing at the centre of the host galaxy. They are so luminous that radio telescopes can observe them out to the far reaches of the Universe. One radio galaxy, however, is unique in that it is far closer than any other. This radio galaxy, Centaurus A, is only 13 million light years away and due to this proximity, is extremely bright and extends across a large area of sky (about 7 degrees, which is 14 Moon diameters!).

Counter-intuitively, this brightness and size actually makes it difficult to observe, since most radio telescopes are designed to look much further afield. Radio imaging of Centaurus A is particularly challenging due to the large range in brightness and spatial scale that it spans. Instrumental effects have hampered previous efforts to reveal the complex feedback mechanisms that govern the evolution of the radio source as relativistic particles stream from the dense, bright core to form both large and small-scale structures in the faint radio lobes.



The Murchison Widefield Array (MWA) has recently undergone a significant upgrade, which has effectively doubled the angular resolution of the telescope. This provides an opportunity to examine extended sources in greater detail than ever before. Improvements to imaging algorithms have also enabled us to combine data from both the original MWA and the new phase 2-extended configuration. We have now produced what is arguably the best view of the entire radio source to date, with the potential to gain new insights into the physics at work in the lobes and the transition regions where energy is transferred between small and large scales.

In this project you will analyse these exciting new images of Centaurus A and compare the radio data to both archival and new observations covering almost the full electromagnetic spectrum. You will also have the opportunity to make new images and improve our calibration and imaging strategies. By observing our closest neighbouring radio galaxy in unprecedented detail, you will be able to unlock secrets that are hidden in more distant galaxies, but have far-reaching implications for our physical understanding of the Universe.