ICRAR & ICRAR-Pawsey Summer Studentships 2016 - 2017
Project Proposal

Project Details	
Project Title	**Observing dying and relic radio galaxies**
Primary Supervisor	Dr Anna Kapinska
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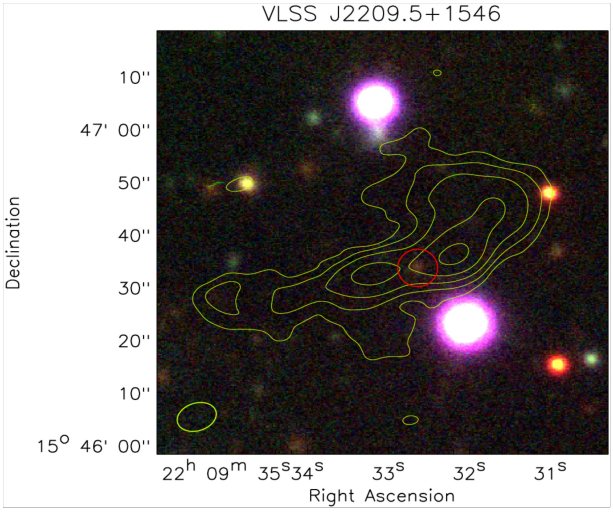
Additional Supervisors & Contact Details	Dr James Miller-Jones james.miller-jones@curtin.edu.au
Additional Resources Required	CASA software, ideally Linux based OS
Student Location for project	UWA, (occasional day/s at Curtin)
Project Description	Radio galaxies, powered by active super-massive black holes, are some of the largest and most powerful objects in the Universe. One of the most prominent features of radio galaxies is a pair of powerful relativistic outflows (jets) ejected in the opposite directions from the vicinity of the central black hole. These jets transport huge amounts of energy into their environments – from pc scales close to the central black hole (interstellar and intergalactic medium) up to Mpc scales that penetrate the largest conglomerations of galaxies (intracluster medium) – altering evolution of both, the galaxies and the large-scale structure of the Universe. The prominent features of radio sources (radio core, jets, hotspots) are fed by a continuous supply of energy from the activity of the super-massive black hole, but once the jet activity stops, these features will disappear very quickly and the radio lobes will continue to expand and to cool via  ***Figure 1:*** *An example of a dying radio galaxy (radio contours) overlaid on an optical image (van Weeren+ 2011). The diffuse radio lobes are oriented east-west, and the red circle pinpoints the host galaxy with the super-massive black hole. The two bright sources (white/purple) are unrelated foreground galaxies.*

	synchrotron and inverse-Compton losses, creating a ‘relic’, or ‘fading’ radio galaxy. Since the spectral shape of the electron population is a result of the underlying physics of the source and its evolution, spectral analyses are crucial piece of information in the studies of radio galaxies. Although every radio galaxy must go through the fading stage, only a few examples of true dying radio sources are currently known and even less have been studied in detail. Before the arrival of the Murchison Widefiled Array (and soon Australian SKA Pathfinder) the telescopes just didn't have enough sensitivity to detect the diffuse emission of dying radio galaxies. In this project you will have the unique opportunity to study the broadband radio spectra of a selection of dying radio galaxies. You will calibrate and image new, ultra-deep radio observations from the Jansky Very Large Array (4-12 GHz). You will combine the JVLA measurements with radio data from the MWA GLEAM survey (72-231 MHz) to derive and interpret the spectral energy distributions of dying radio galaxies.
Student Attributes	
Academic Background	astronomy, physics, computing
Computing Skills	basic familiarity with Linux/Mac operating system and command-line terminal, ideally basic knowledge of python language
Training Requirement	2yr B.Sc. and above
Project Timeline	
Week 1	Introduction to radio galaxies and radio interferometry – discussions and reading, first look at the radio data
Week 2	Introduction to CASA, ds9 software, and python scripting; radio data calibration and imaging
Week 3	Radio data calibration and imaging (JVLA, 4-8 GHz)
Week 4	Report writing (LaTeX scientific typesetting software)
Week 5	Radio data calibration and imaging (JVLA; 4-8 GHz)
Week 6	Radio data calibration and imaging (JVLA; 8-12 GHz)
Week 7	Radio data calibration and imaging (JVLA; 8-12 GHz); data analysis
Week 8	Construction of broadband SEDs of our radio galaxies (MWA + literature + JVLA data; 72 MHz – 12 GHz) and spectral modelling
Week 9	Analysis and interpretation of the results, presentation preparation
Week 10	Report writing (LaTeX scientific typesetting software)
	Final Presentation