ICRAR & ICRAR-Pawsey Summer Studentships 2017-2018
Project Proposal

Project Details	
Project Title	**Finding the closest pulsar with the Murchison Widefield Array**
Primary Supervisor	Ramesh Bhat
Primary Supervisor Availability	27 November – 24 December 2017 29 January – 16 February 2018
Contact Details	+08 9266 9176, ramesh.bhat@curtin.edu.au
Additional Supervisors & Contact Details	Steven Tremblay, +08 9266 9172, steven.tremblay@curtin.edu.au
Additional Resources Required	Access to the Pawsey supercomputing facility
Pawsey Centre Hardware Use	The Galaxy cluster, astrofs (for data storage and data products)
Software Required	List all software requirements here. Student Desktop Requirements: • Linux operating system, and ~5 TB disk space on a moderate/high performance desktop Pawsey Centre software installations required: • Pulsar data processing software and MWA tools (all installed and supported by the pulsar group)
Student Location for project	ICRAR-Curtin
Project Description	Pulsars are nature's premier laboratories for advancing extreme physics, including testing strong-field gravity and probing matter at nuclear densities. Numerous surveys over the past decades have led to the discovery of over 2500 pulsars; a vast majority of them (>90%) are located at distances of a few to several kilo parsecs. The integrated electron column density along the sight line from the Earth to the pulsar is called the dispersion measure (DM) and is a useful proxy for pulsar distance. Currently the closest pulsar known has DM = 2.4 and an inferred distance of 130 parsecs. A candidate signal at even lower DM has been detected in recent observations made with the Gauribidanur telescope, however poorly localized on sky along declination. The Murchison Widefield Array (MWA) presents an ideal telescope for important confirmation and verification studies of this curious candidate. In this project you will undertake a systematic analysis of observational data collected with the MWA, spanning the highly elongated error box of the candidate signal. Data processing will involve forming a large number of sensitive pencil beams by reprocessing raw voltage data and searching for periodic pulsations at the expected DM. If confirmed, this will be the closest pulsar ever known, with important implications for pulsar searches with the MWA and SKA, besides serving as a powerful probe of the local interstellar medium.

Student Attributes	
Academic Background	Basic exposure to Physics and Astronomy (essential), and signal processing (desirable)
Computing Skills	Familiarity with Linux, programming and scripting languages (e.g. C, python) – desirable; but in general good aptitude for working with computers and learning new skills
Training Requirement	The use of supercomputers for data processing, refresher course (reading) in radio astronomy, interferometry and pulsar astronomy
Project Timeline	
Week 1	Pawsey training (or inductions and project introduction)
Week 2	Orientation on Pulsar Search Techniques (Read/refresh relevant chapter from the Pulsar Handbook)
Week 3	Trial runs of the standard search software (e.g. PRESTO) on pre-generated MWA data
Week 4	Streamline (and tailor) the MWA pulsar search pipeline using training dataset(s) collected (as part of other projects)
Week 5	Benchmark the full processing pipeline (at the frequency band of interest) including beamforming + processing costs
Week 6	Develop necessary wrapper tools + book-keeping ideas for candidate assimilation
Week 7	Data processing of the full observation (~40 TB of data), and work through data management issues
Week 8	Scrutiny and assimilation of the results, devise suitable plans for follow-up investigations
Week 9	Initial follow-up investigations, and prepare for presentation
Week 10	Final Presentation and Reporting