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

Project Details	
Project Title	**Simulating bursts of radio waves from cosmic rays**
Primary Supervisor	Dr. Clancy W. James
Primary Supervisor Availability	Available for the entire duration: Nov 27 2017-Feb 16 2018, except the Christmas break from Dec 25 2017 to Jan 5 2018.
Contact Details	clancy.james@curtin.edu.au 08 9266 9473
Additional Supervisors & Contact Details	Dr. Marcin Sokolowski
Additional Resources Required	None
Pawsey Centre Hardware Use	None
Software Required	List all software requirements here. Student Desktop Requirements: • CORSIKA Pawsey Centre software installations required: • n/a
Student Location for project	ICRAR-Curtin
Project Description	Cosmic rays are the highest-energy particles in nature. Mostly protons, they reach energies more than a million times higher than that achieved at the Large Hadron Collider at CERN. Produced by something in the universe, when a cosmic ray hits the top of the atmosphere, it generates a huge 'extensive air shower' of secondary particles, some of which reach ground level. This gives off a burst of radio-waves lasting less than a microsecond, allowing radio telescopes operating at the highest time resolution to study these rare particles. The project will involve simulating the radio emission using a program called 'CORSIKA'. The goal is to determine what the bursts of radio waves would look like to the Murchison Widefield Array, a radio telescope in Murchison Shire, WA, and how best to detect them. Key issues to explore would be: what is the best frequency to look at? And – how energetic do the cosmic rays have to be in order to generate a detectable radio pulse? The project would form part of design studies for the Square Kilometre Array's High Energy Cosmic Particles Focus Group.

Student Attributes	
Academic Background	The student should have taken some physics course covering electromagnetism, and have a basic understanding of electric fields. Some familiarity with Fourier transforms would also be helpful.
Computing Skills	None – the project will utilize Python, but this will be learnt during the program
Training Requirement	
Project Timeline	
Week 1	**Pawsey training (or inductions and project introduction)**
Week 2	Introduction to CORSIKA and air showers
Week 3	Running CORSIKA – simple test output
Week 4	Introduction to Python – reading CORSIKA output
Week 5	Plotting in Python and graphical displays
Week 6	Fourier transforms in NumPy
Week 7	Simulating radio-telescope responses: MWA
Week 8	Investigate signals at different wavelengths
Week 9	Explore the effects of different air shower properties
Week 10	**Final Presentation and Reporting**