

ICRAR & ICRAR-Pawsey Summer Studentships 2018-2019

Project Proposal

Project Details	
Project Title	Cleaning in 3 dimensions: Advanced Deconvolution Techniques for modern radio telescopes
Primary Supervisor	John Morgan
Primary Supervisor Availability	All times except for the first two weeks of December
Contact Details	john.morgan@icrar.org
Additional Supervisors & Contact Details	Rajan Chhetri rajan.chhetri@icrar.org
Additional Resources Required	None
Pawsey Centre Hardware Use	Probably not required
Software Required	<p>List all software requirements here.</p> <p>Student Desktop Requirements:</p> <ul style="list-style-type: none"> • Standard python packages including h5py <p>Pawsey Centre software installations required:</p> <ul style="list-style-type: none"> • None
Student Location for project	ICRAR-Curtin
Project Description	<p>Just as stars twinkle in the night sky due to turbulence in the atmosphere, radio sources twinkle due to turbulence in the solar wind, a phenomenon known as interplanetary scintillation (IPS). As well as being useful for predicting space weather events, IPS can also be used to identify and study extremely compact sources.</p> <p>Using the MWA optimally for these observations has required us to go back to the drawing board and develop our own methods and algorithms for analysing them. In the future, these techniques could also be applied to the SKA-low, allowing it to function as a space weather observatory as well as opening up a whole slew of new astrophysics. See www.icrar.org/ips for a summary of our work.</p> <p>In this project, the student will work out how to optimally <i>deconvolve</i> IPS images. This is a critical step in making a radio image, and will allow us to make more sensitive observations. In completing the project the student will master the basic steps of radio interferometry data analysis. A useful side-effect of this work is that we will also be able to measure key parameters of the ionosphere which is highly relevant for future calibration and imaging algorithms.</p> <p>This project would suit a student who is interested in doing astronomy with future radio telescopes and would really like to dig down into guts of how radio images are made. We can modify the project to concentrate more on Space Weather, High-performance computing or SKA science, depending on the interests of the student</p>
Student Attributes	
Academic Background	At least some programming experience required

Computing Skills	Python programming experience might be useful, but certainly not required.
Training Requirement	Very little absolutely required beyond some fairly basic python programming. The student will be taught about Radio Astronomy data processing in a fair amount of detail.
Project Timeline	
Week 1	Pawsey training (or inductions and project introduction)
Week 2	Research imaging IPS and Deconvolution
Week 3	Write reference implementation of Hogbom clean and demonstrate its use on a mean and variability image
Week 4	Make reference implementation usable by other people (i.e. fully documented etc.). Begin to explore timeseries data.
Week 5	Continue developing full timeseries deconvolution
Week 6	Look into time- and position-dependent effects on the PSF
Week 7	Re-reduce all IPS data with new algorithm
Week 8	Quantify improvement
Week 9	Draw up catalogue of new IPS sources
Week 10	Final Presentation and Reporting