Title: Analysis of multi-plane phase retrieval techniques  
Supervisor: Yue Li, CSIRO ICT Centre  
Students: 1  

When the frequency of a wave used for imaging is high (>600 GHz), it is difficult to directly measure the phase of the signal. Phase retrieval techniques have been developed to derive the phase of the signal from several intensity measurements and/or a priori conditions. Phase retrieval techniques have applications in astronomy, x-ray crystallography, electron microscopy, antenna measurement, optical and microwave imaging. However, the uniqueness of the phase solution and its stability (sensitivity to noise) for multi-plane techniques still need to be further investigated.

The aim of this project is to evaluate the uniqueness and stability of multi-plane phase retrieval techniques. Possible tasks include:

1. Theoretical analysis of uniqueness and stability of multi-plane phase-retrieval methods. For this task, the student should have skills in
   a. Complex analysis  
   b. Linear algebra  
   c. Optimization theory

2. Evaluate uniqueness and stability of multi-plane phase-retrieval methods using computer simulations. For this task, the student needs to have excellent programming skills in Matlab and adequate understanding of linear algebra.

The project requires the student to be able to work part of the time at the CSIRO site at Marsfield.