



PhD Projects at ACQAO

THEORY

About ACQAO

The Australian Centre for Quantum-Atom Optics (ACQAO) was formed in 2003 as one of the recently established Australian Research Council Centres of Excellence. It involves collaboration between the Australian National University in Canberra, the University of Queensland in Brisbane, and the Swinburne University of Technology in Melbourne.

The aim of ACQAO is to carry out strategic fundamental research, which combines the ideas of quantum optics, such as squeezing and entanglement, and the techniques of atom optics, such as Bose-Einstein condensation and atom lasers. The theory core of ACQAO has the challenging task of developing the fundamental theory of these novel quantum many-body systems, and proposing new experimental tests for the laboratories.

QUANTUM INFORMATION AND QUANTUM OPTICS

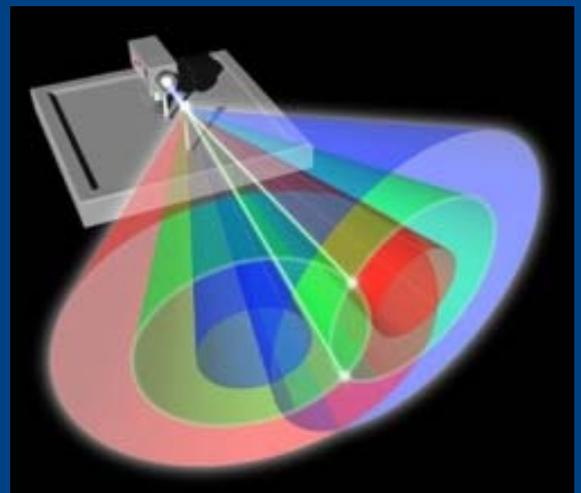
This is at the heart of such phenomena as the Einstein-Podolsky-Rosen paradox and the Bell inequalities. Open questions include how entanglement can be extended to multiple observers, what happens with macroscopic particle numbers, and whether quantum superpositions are affected by gravity.

There is a fundamental question here: *Can we test quantum mechanics in new regimes, including macroscopic systems and/or massive particles?*

Potential applications are to precision measurements below the standard quantum limits.

ACQAO PhD projects in this area cover:

- Storage of optical quantum states in atoms via EIT
- Quantum simulations of pulse propagation in optical fibres
- Quantum state transfer between optical and BEC fields
- Multipartite entanglement and Bell inequalities
- Mesoscopic oscillators and light-matter entanglement
- Signatures of macroscopic coherence and entanglement for optical and spin squeezing
- Entanglement and the failure of local realism make quantum mechanics quite different from classical mechanics.



Supervisors

UQ Prof Peter Drummond <drummond@physics.uq.edu.au>
Dr Margaret Reid <margaret@physics.uq.edu.au>
Dr Murray Olsen <mko@physics.uq.edu.au>

ANU Dr Joseph Hope <joseph.hope@anu.edu.au>

Scholarships and further information

For further details about the research project and information about PhD scholarships please contact one of the prospective supervisors or visit the webpages of the UQ or ANU Nodes of ACQAO:

www.physics.uq.edu.au/BEC/Prospective_Students.html
www.anu.edu.au/Physics/ANUBEC/projects.html