ACQAO

AUSTRALIAN RESEARCH COUNCIL
CENTRE OF EXCELLENCE FOR
QUANTUM-ATOM OPTICS

# PhD Projects at ACQAO

## THEORY

### About ACQAO

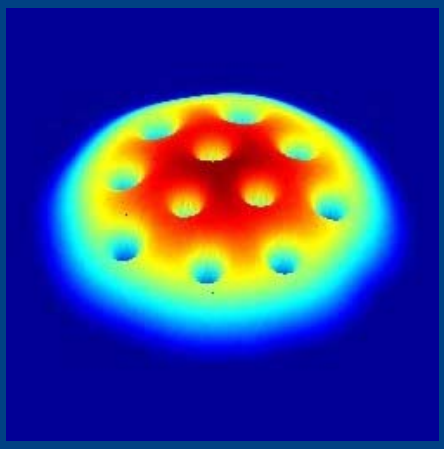
The Australian Centre for Quantum-Atom Optics (ACQAO) was formed in 2003 as one of the recently established Australian Research Council Centres of Excellence. It involves collaboration between the Australian National University in Canberra, the University of Queensland in Brisbane, and the Swinburne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

## BOSE-EINSTEIN CONDENSATES & ATOM LASERS

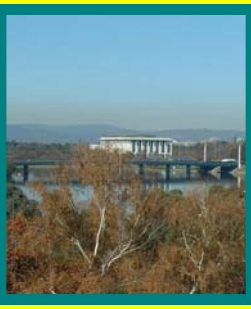
**The field of Bose-Einstein condensation (BEC) is a significant, rapidly growing research area at the forefront of contemporary physics. Its attraction lies in its ability to display phenomena well known from other fields, such as condensed-matter physics, in a clear and unambiguous manner, allowing accurate and powerful theory to be applied to "real-life" experimentally relevant situations. Its significance was recognized with Nobel Prizes in Physics in 2001 for the first observation of BEC in 1995.**

**BECs can be thought of a macroscopic number of particles sharing the same wave function, and the atoms have similar coherence properties to a laser. The development of the atom laser promises state-of-the-art measurement devices, but more fundamentally, BECs allow us to model the quantum fields that underlie nearly all of modern physics in systems where we have unparalleled experimental control. Predicting the behaviour of these systems is a major theoretical challenge, and designing improved atomic sources is a critical requirement for future experiments.**



**This topic involves developing theoretical techniques for studying BECs at finite temperatures, and applying them to understand the physics of condensates in a variety of situations. Research interests include:**

- **Theory of a continuous atom laser**
- **Coherence properties of atom lasers and BECs**
- **Controlling trapped atomic gases through feedback**
- **Rotating condensates and the formation of vortex lattices**
- **Dynamics of BEC formation**
- **Fluctuations and topological structures in lower dimensional systems**



### Supervisors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### 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 ANU or UQ Nodes of ACQAO:

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