ACQAO

AUSTRALIAN RESEARCH COUNCIL
CENTRE OF EXCELLENCE FOR
QUANTUM-ATOM OPTICS

PhD Projects at ACQAO

THEORY

About ACQAO

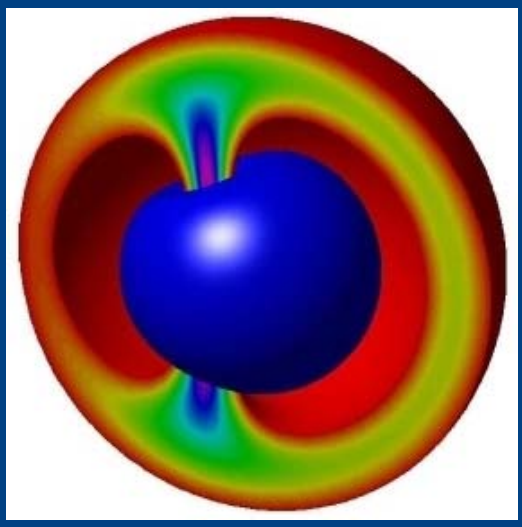
The Australian Centre for Quantum-Atom Optics (ACQAO) was formed in 2003 as one of the recently established Australian Research Council Centres of Excellence. It involves collaboration between the Australian National University in Canberra, the University of Queensland in Brisbane, and the Swinburne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

FIELD THEORY & QUANTUM CORRELATIONS

The simplicity and controllability of ultracold atomic experiments means that they are able to implement well-known models in many-body quantum physics and quantum field theory to a high accuracy. Examples include the well-known Bose and Fermi Hubbard models, which are realised by means of atoms in optical lattice potentials. These physically important models are fundamental to condensed matter physics and possess quantum phase transitions. Similar technology can also to implement reduced dimensional Bose and Fermi gases, where quantum correlation effects are important.

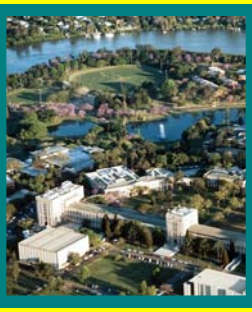
Also, the equations for excitations in a BEC can be cast in the form of relativistic field equations, with a metric that corresponds to curved space-time. Thus BECs that can be used to study phenomenon analogous to black holes and Hawking radiation in systems that can be probed in the laboratory.



Because dynamics and correlations can now be quantitatively studied in the laboratory, new questions are being put to these well-known models, in many cases demanding deeper theoretical understanding and new methods of solution.

PhD topics in this area include:

- **Quantum statistics of BECs**
- **Correlations and thermodynamics of one-dimensional Bose gases**
- **Quantum properties of BECs in lattices**
- **BECs as analogues of interacting quantum fields and black holes**



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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 Faculties, ANU IAS or UQ Nodes of ACQAO:

www.anu.edu.au/Physics/ANUBEC/projects.html
rsphy2.anu.edu.au/nonlinear
www.physics.uq.edu.au/BEC/Prospective_Students.html

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