PhD position
Experimental quantum simulation with dopant atoms in silicon

Description
The University of New South Wales and the Centre for Quantum Computation and Communication Technology (CQC2T) seeks up to two enthusiastic students, possibly starting with an internship, for experiments on silicon nano-electronics in the field of quantum simulation. One of the most rapidly advancing fields in quantum physics, quantum simulation aims to experimentally control and directly measure properties like correlations and entanglement in many-body quantum systems whose behaviour cannot be solved efficiently by classical computers [1,2].

This project will build on our recent efforts on measuring quantum states of single dopant atoms in silicon, resulting in the first measurements of donor wavefunctions in silicon by scanning tunneling microscopy (STM)[3-5], and the first quantum simulation of a two-site Hubbard model [6]. The project will leverage unique STM-based approaches for placing donors in silicon crystals with atomic precision [7] acting as long-lived qubits [8] in the simulator. Objectives include fabrication of spin systems (chains, lattices, see opposite) in the deep quantum regime, and low-temperature measurement of their energy states, spin dynamics and spin correlations. These long-term directions in quantum simulation also have direct relevance to important and hotly debated phenomena in condensed matter physics.

Working on a newly commissioned ultra-low-temperature STM laboratory, the student will benefit from world-recognised expertise on quantum electronics and atomic-scale fabrication. Strong skills on low-temperature and scanned probe measurements, ultra-high vacuum, high-frequency measurement and nano-electronics will be developed. Strong international collaborations (USA, Europe) are maintained with groups on experimental and theoretical sides.

Environment
The CQC2T consists of eighteen investigators across six Australian institutions and four broad aims in quantum information science and technology. The research will be conducted at the University of New South Wales (UNSW) node of the CQC2T, which also houses state-of-the-art nanofabrication facilities. UNSW is located in Sydney, a diverse, metropolitan city in Australia.

Criteria
Desirable: Experience in experimental condensed matter physics, nano-electronics, numerical simulations.

Salary
PhD: 30,849 AUS$annum stipend (tax-free).

Contact
Please contact ASAP as international student scholarship deadlines are August 18th www.cqc2t.org

For any further information, please contact:
Dr. Joe Salfi (Discovery Early Career Fellow)
Prof. Sven Rogge (Principal Investigator)
Dr. Benoit Voisin (Post-doc)

References