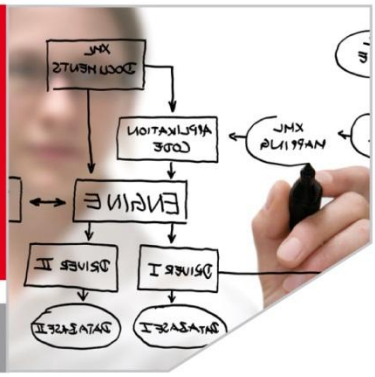
Quantum Computing with Single Atoms in Silicon



Joint Electrical Institutions Sydney - Engineers Australia, IEEE, IET

Public Lecture

Date:	Thursday, 9 May 2013
Time:	5:30 pm for 6:00 pm start
Venue:	Engineers Australia Auditorium, Ground Floor, 8 Thomas Street, Chatswood
Speaker:	Scientia Professor Andrew Dzurak Director, Australian National Fabrication Facility (ANFF-NSW) School of Electrical Engineering & Telecommunications The University of New South Wales
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RSVP:	https://engineersaustralia.wufoo.com/forms/joint-electrical-seminar-9-may-2013/

Quantum information technologies promise to revolutionize the way information is transmitted and processed. These transformational technologies require devices that enable the sensing and manipulation of individual electrons and photons. Spin-based quantum bits (or qubits) in silicon are excellent candidates for scalable quantum information processing due to the very long spin coherence times that are accessible in silicon and because of the enormous investment to date in silicon MOS technology [1]. This talk will discuss spin qubits based on electrons localized on single phosphorus donor atoms in silicon [2, 3] and also very recent experiments in which quantum information can be encoded on the nuclear spin of individual phosphorus atoms [4]. In the latter case, the qubit read fidelity exceeds 99.8% and the write fidelity exceeds 98%, approaching the accuracy values necessary for large-scale fault-tolerant quantum computing.

[1] D.D. Awschalom et al., Quantum Spintronics, Science 339, 1174 (2013).
[2] A. Morello et al., Single-shot readout of an electron spin in silicon, Nature 467, 687 (2010).
[3] J.J. Pla et al., A single-atom electron spin qubit in silicon, Nature 489, 541 (2012).
[4] J.J. Pla et al., High-fidelity readout and control of a nuclear spin qubit in silicon, to appear in Nature (2013).

Speaker Biography

Andrew Dzurak is one of Australia's leading experts in nanoelectronics and quantum computing technologies. He is Director of ANFF-NSW, the NSW node of the Australian National Fabrication Facility (ANFF – see www.anff.org.au), a network of university-based laboratories that provide researchers and industry with access to state-of-the-art facilities for the fabrication of sensors, medical devices, nanophotonics and nanoelectronics.

Following a PhD at the University of Cambridge, Andrew returned to Australia in 1994 to establish nanofabrication facilities at UNSW. He also began work on an initiative to construct in Australia a solid state quantum computer and, with Bob Clark and other colleagues, established the Centre for Quantum Computer Technology in January 2000. The centre has achieved major advances in the international effort to realize large-scale quantum information processing and is an ARC Centre of Excellence. It maintains the world's largest focused collaboration on silicon-based quantum computing. Andrew is the Centre's Work-Package Leader in this area, as well as Lead Investigator for a multi-institutional program grant in silicon quantum computing from the US Army Research Office.

Prof Dzurak has published over 100 scientific papers and is a co-inventor on 9 patents. In 2011 he shared the Australian Eureka Prize for Scientific Research with Andrea Morello, and in 2012 was awarded the New South Wales Science and Engineering award for Excellence in Engineering and Information and Communications Technologies. Andrew is a Scientia Professor of Nanoelectronics in the School of Electrical Engineering and Telecommunications at UNSW.

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