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Centre for Electron Microscopy

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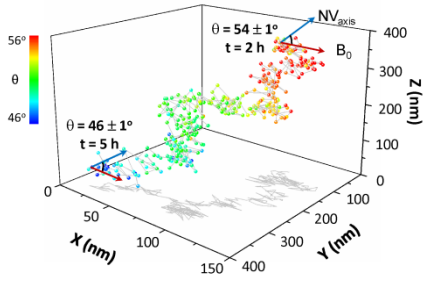
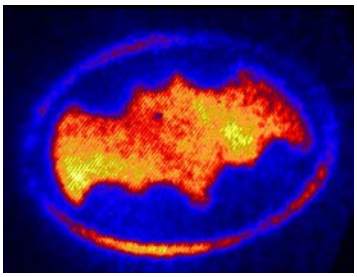
Quantum measurement in living cells, and high-coherence electron bunches from cold atoms

Robert Scholten, School of Physics, The University of Melbourne

Friday 4 May 2012,

Science Lecture Theatre S2, Building 25 , 3.00 pm – 4.00pm





"Quantum technology" normally conjures thoughts of computation and communication, but also has exciting potential applications in new ways of measuring and imaging at the nanometer scale, particularly for biological systems. The NV defect centre in diamond is an especially promising single spin system for quantum measurements in biology. We have demonstrated optically detected magnetic resonance (ODMR), Rabi cycling and spin-echo of individual fluorescent nanodiamond NV centres inside living human HeLa cells. Variations in the decoherence rates linked to changes in the local environment inside the cells offer a new non-destructive imaging modality for intracellular biology.

But even classical imaging is a vexing problem at the atomic scale, where there is demand for new advances, for example to determine the structure of bio-molecules. We have developed a new source of high-coherence electron bunches based on photoionisation of laser-cooled atoms. With laser control of the cold atom cloud, we can shape the electron bunches, and because the electrons are so cold, they retain their shape during propagation. While labeled by colleagues as "the world's most expensive TV", it offers the control needed to generate ultra-high-brightness bunches for coherent diffractive imaging at nanometer and femtosecond resolution.

Convenor: Prof Joanne Etheridge
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Visitors are most welcome: Please note that there is a designated Visitors Car Park (S2) clearly ground-marked by white paint and tickets, at a cost of $3.50/hour for up to 3 hours, available from a dispensing machine. This high-rise car park is located on the following Clayton Campus Map, Ref. E3.

Printable version of the Clayton campus map (pdf 833 kb) (Please right click to open link)