Sonderforschungsbereich 631
Festkörperbasierte Quanteninformationsverarbeitung

TECHNISCHE UNIVERSITÄT MÜNCHEN

Seminarvortrag

Dienstag, 20. April 2010
17 Uhr 15
Walter Schottky Institut, Garching

Dr. Andrea Morello

Centre for Quantum Computer Technology
The University of New South Wales
Sydney, Australia

Single-shot readout of an electron spin in silicon

The electron spin of a donor in silicon is an excellent candidate for a solid-state qubit. It is known to have very long coherence and relaxation times in bulk, and several architectures have been proposed to integrate donor spin qubits with classical silicon microelectronics. Here we show the first experimental proof of single-shot readout of an electron spin in silicon. This breakthrough has been obtained with a device consisting of implanted phosphorus donors, tunnel-coupled to a silicon Single-Electron Transistor (Si-SET), where the SET island is used as a reservoir for spin-to-charge conversion. The charge transfer signals are exceptionally large, and allow time-resolved measurements of spin-dependent tunneling on a < 10 microseconds scale, with readout fidelity better than 90%. By measuring the occurrence of excited spin states as a function of wait time, we find spin lifetimes up to ~1 s at B=1.75 T, and a magnetic-field dependence consistent with that of phosphorus donors in silicon. Further experiments are underway to integrate this readout method with coherent spin control.