



Sonderseminar

**Mittwoch, 13. Februar 2013
12:00 Uhr**

WSI, Seminarraum S 101

“Universal set of quantum gates for a pair of ^{31}P donor spin-qubits in silicon”

We present an experimentally viable strategy for performing a universal set of quantum gate-operations for a pair of ^{31}P donor-electron spin-qubits in silicon. The desired system is an isolated pair of donors, sufficiently spaced, such that the Heisenberg exchange coupling between the electrons is at least an order of magnitude weaker than the ^{31}P hyperfine coupling. Our proposal relies on the ability to prepare the nuclear spins of the two donors in an antiparallel state, using readout and control techniques recently demonstrated. Arbitrary SWAP operations can be achieved assuming modest control over the exchange interaction via the detuning of donor electrochemical potentials. The same configuration allows for high fidelity single-qubit rotations using electron spin resonance techniques. In addition, we show that a CNOT operation can be implemented as a conditional single-spin rotation in the presence of exchange coupling, where the coupling has a wide range of acceptable values and does not require tuning. Therefore, our proposal has the advantage of substantially relaxing the requirements on nanofabrication techniques, donor positioning and electrostatic gate control.

**Dr. Arne Laucht
University of New South Wales
Sydney, Australia**