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Single-shot readout of spin qubits in Si/SiGe quantum dots[1]

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Si/SiGe quantum dots are an attractive option for spin qubit development, because of the long coherence times for electron spins in silicon, arising from weak hyperfine interaction and low spin orbit coupling. I will present measurements of gate-defined single and double quantum dots formed in Si/SiGe semiconductor heterostuctures. Control of the gate voltages on these dots enables tuning of the tunnel coupling to the leads and to other dots. Careful tuning of these tunnel rates, in combination with fast, pulsed-gate manipulation and spin-to-charge conversion, allow spin state measurement using an integrated quantum point contact as a local charge detector. Single spin qubit readout relies on the Zeeman energy splitting from an external magnetic field for spin-to-charge conversion. Two-electron singlet-triplet qubits, on the other hand, can be measured by using Pauli spin blockade of tunneling between the dots to readout the qubit even at zero magnetic field. I will present real-time, single-shot readout measurements of both individual spin [1] and singlet-triplet qubits [2] in gated Si/SiGe quantum dots. Work performed in collaboration with J. R. Prance, Zhan Shi, B. J. Van Bael, Teck Seng Koh, D. E. Savage, M. G. Lagally, R. Joynt, L. R. Schreiber, L. M. K. Vandersypen, M. Friesen, S. N. Coppersmith, and M. A. Eriksson.

[1] C. B. Simmons et al. Physical Review Letters 106, 156804 (2011).
[2] J. R. Prance, et al., e-print: http://lanl.arxiv.org/abs/1110.6431

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