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All-electrical control of a singlet-triplet qubit coupled to a single nuclear spin[1] N. TOBIAS JACOBSON, Sandia National Laboratories, PATRICK HARVEY-COLLARD, Sandia National Laboratories and Universite de Sherbrooke, ANDREW BACZEWSKI, JOHN GAMBLE, MARTIN RUDOLPH, ERIK NIELSEN, RICHARD MULLER, MALCOLM CARROLL, Sandia National Laboratories — Donor nuclear spins in isotopically purified silicon have very long coherence times, suggesting that they may form high-quality quantum memories. We propose that coupling these nuclear spins to few-electron quantum dots could enable nuclear spin readout and two-qubit operations of the joint quantum dot and nuclear spin system without the need for electron spin resonance. As a step towards this goal, our group recently demonstrated coherent singlet/triplet electron spin rotations induced by the hyperfine interaction between electronic spin degrees of freedom and a single nuclear spin in isotopically purified silicon. In this talk, I will discuss the feasibility of universal all-electrical control of such a singlet/triplet electron spin qubit and explore the decoherence mechanisms that we expect to dominate. Finally, I will examine the relative merits of AC and pulsed DC gating schemes.

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