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Scalable gate architecture for a one-dimensional array of semiconductor spin qubits[1] DAVID ZAJAC, THOMAS HAZARD, XIAO MI, JASON PETTA, Princeton University — Electron spins in quantum dots have become one of the most intensely researched candidates for quantum computation due to their long lifetimes and their ability to be fabricated using standard semiconductor fabrication techniques. However realizing entanglement between large numbers of spins will require the fabrication of large, robust arrays of quantum dots. We demonstrate an array of nine quantum dots with three single dot sensors as a proof-of-concept device for a scalable, one-dimensional gate architecture*. We measure average single dot charging and orbital energies of 6.9 meV and 3.0 meV respectively, with standard deviations less than 20% across the array. We achieve a charge sensitivity of 8.2 x 10^{-4} e/Hz with our single dot charge sensors, which allows for the detection of real-time tunneling events in the array. Using real-time charge detection we perform single shot spin readout and measure a spin relaxation time of $T_1 = 170$ ms at a magnetic field of $B = 1$ T. We also measure the capacitive coupling of two adjacent double quantum dots to be 200 eV, suggesting that 50 GHz two-qubit gates may be possible. *D. M. Zajac et al., Phys. Rev. Appl. (in press).

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