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Controlling Spin and Charge in Quantum Dots and Nanotubes[1]

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This talk summarizes recent experimental progress toward realizing exchange-coupled spin qubits in both few-electron GaAs quantum dots, and gate-defined carbon nanotubes. In the GaAs quantum dots, measurement of the singlet-triplet spin relaxation for separated spins has been realized. These measurements are made at low magnetic fields, and can be studied as a function of magnetic field. We find T2-like relaxation times of order 100 microseconds at 100 mT, with enhanced relaxation at zero field. The experimental method uses pulsed confining gates of a double dot with integrated quantum point contact charge sensors. The relaxation time appears to be limited by hyperfine coupling to nuclear spins. In the carbon nanotube system, we have realized gate-confined double dots and are currently measuring nonlinear double-dot transport, aiming to observe Pauli blockade effects. Up-to-the-minute results will be reported.

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