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Electron Spin Relaxation and Coherence Times in Si/SiGe Quantum Dots[1] R.M. JOCK, JIANHUA HE, A.M. TYRYSHKIN, S.A. LYON, Princeton University, C.-H. LEE, S.-H. HUANG, C.W. LIU, National Taiwan University — Single electron spin states in Si/SiGe quantum dots have shown promise as qubits for quantum information processing. Recently, electron spins in gated Si/SiGe quantum dots have displayed relaxation (T_1) and coherence (T_2) times of 250 μs at 350mK. The experiments used conventional X-band (10 GHz) pulsed Electron Spin Resonance (pESR) on a large area (3.5 x 20 mm^2), double gated, undoped Si/SiGe heterostructure, which was patterned with 2 x 10^8 quantum dots using e-beam lithography. Dots with 150 nm radii and 700 nm period are induced in a natural Si quantum well by the gates. Smaller dots are expected to reduce the effects of nearly degenerate valley states and spin-orbit coupling on the electron spin coherence. However, the small number of spins makes signal recovery extremely challenging. We have implemented a broadband cryogenic HEMT low-noise-amplifier and a high-speed single-pole double-throw switch operating at liquid helium temperatures. The switch and preamp have improved our signal to noise by an order of magnitude, allowing for smaller samples and shorter measurement times. We will describe these improvements and the data they have enabled.

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R.M. Jock
Princeton University

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