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Long Spin Relaxation and Coherence Times of Electrons In Gated Si/SiGe Quantum Dots[1] 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 semiconductor quantum dots are promising candidate qubits. We report the measurement of 250 μs relaxation (T_1) and coherence (T_2) times of electron spins in gated Si/SiGe quantum dots at 350 mK. The experiments used conventional X-band (10 GHz) pulsed electron spin resonance (pESR), on a large area (3.5 x 20 mm^2) dual-gate undoped high mobility Si/SiGe heterostructure sample, which was patterned with 2 x 10^8 quantum dots using e-beam lithography. Dots having 150 nm radii with a 700 nm period are induced in a natural Si quantum well by the gates. The measured T_1 and T_2 at 350 mK are much longer than those of free 2D electrons, for which we measured T_1 to be 10 μs and $T_2$to be 6.5 μs in this gated sample. The results provide direct proof that the effects of a fluctuating Rashba field have been greatly suppressed by confining the electrons in quantum dots. From 0.35 K to 0.8 K, T_1 of the electron spins in the quantum dots shows little temperature dependence, while their T_2 decreased to about 150 μs at 0.8 K. The measured 350 mK spin coherence time is 10 times longer than previously reported for any silicon 2D electron-based structures, including electron spins confined in "natural quantum dots" formed by potential disorder at the Si/SiO_2[2] or Si/SiGe interface, where the decoherence appears to be controlled by spin exchange.

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[2] S. Shankar *et al.*, Phys. Rev. B 82, 195323 (2010)

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