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Gate fidelity and coherence time of an electron spin in a Si/SiGe quantum dot ERIKA KAWAKAMI, THIBAUT JULLIEN, PASQUALE SCARLINO, Delft Univ of Tech, D. R. WARD, D. E. SAVAGE, M. G. LAGALLY, University of Wisconsin-Madison, V. V. DOBROVITSKI, Ames Laboratory, MARK FRIESEN, S. N. COPPERSMITH, M. A. ERIKSSON, University of Wisconsin-Madison, L. M. K. VANDERSYPEN, Delft Univ of Tech — Electron spins in Si/SiGe quantum dots are one of the most promising candidates for a quantum bit for their potential scalability and long dephasing time. We realized coherent control of an individual electron spin in a single quantum dot (QD), lithographically defined in a Si/SiGe 2D electron gas. Spin rotations are achieved by applying microwave excitation to one of the gates, which oscillates the electron wave function back and forth in the gradient field produced by cobalt micromagnets fabricated near the dot. Thanks to the long intrinsic dephasing time $T_2^* = 900$ ns and Rabi frequency of 1.4 MHz, we were able to obtain an average single qubit gate fidelity of an electron spin in a Si/SiGe quantum dot of 99 %, measured via randomized benchmarking. The dephasing time is extended to 70 μs using Hahn echo, and up to 400 μs with multipulse dynamical decoupling (128 π pulses). We extract the noise spectrum in the range of 5 kHz -1 MHz using dynamical decoupling and show that the gate fidelity is well explained by this noise characteristic. We discuss the mechanism that induces this noise and is responsible for decoherence.

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