Spin coherence and relaxation of natural quantum dots at the Si/SiO$_2$ interface$^1$ S. SHANKAR, A. M. TYRYSHKIN, JIANHUA HE, S. A. LYON, Princeton University — While electron spins confined in quantum dots in silicon heterostructures are good candidates to make qubits, little is known about the coherence of electrons at the Si/SiO$_2$ interface. We perform pulsed electron spin resonance on a Metal-Oxide-Silicon transistor and report the spin relaxation ($T_1$) and coherence ($T_2$) times for mobile two-dimensional electrons as well as electrons isolated in natural quantum dots at the Si/SiO$_2$ interface. Mobile electrons have short $T_1$ and $T_2$ of around 0.3 $\mu$s at 5 K. Upon confining electrons into isolated dots with a few meV binding energy, $T_1$ rises dramatically as temperature is decreased, reaching 1.1 ms at 350 mK. Simultaneously, $T_2$ rises and saturates at 10 $\mu$s below 1 K. The long $T_1$ is consistent with a reduced efficiency of Rashba fluctuations in causing spin relaxation in a quantum dot. However $T_2$ is not controlled by $T_1$ below 1 K, but is instead caused by an unknown extrinsic mechanism.

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