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Spin resonance of 2D electrons in silicon MOS structures[1] S. SHANKAR, A. M. TYRYSHKIN, S. A. LYON, Princeton University — Metal-oxide-silicon (MOS) heterostructures are a well developed technology, but not much is known about the electron spin properties of this system. However the promise of utilizing electron spins in MOS structures as qubits for quantum information processing calls for detailed study of these properties. We have previously reported an ESR signal at g = 1.9999(1) originating from 2D electrons in a MOSFET. The signal arises from mobile 2D electrons at gate voltages above threshold and weakly confined electrons below threshold. The signal intensity for confined electrons follows the expected Curie-like 1/T temperature dependence characteristic of isolated, independent spins. At high electron densities, where the Fermi energy is large compared to the microwave frequency, one might expect a simple Pauli susceptibility temperature dependence. In particular, electron spin susceptibility is expected to become constant at low temperatures. Perhaps surprisingly, we find that below about 4 K, the spin susceptibility decreases as the temperature is lowered. At electron densities from 3×10^{11} to 10×10^{11} cm^{-2}, the signal intensity falls by a factor of 5, as the temperature is reduced from 4 to 2 K. A more sophisticated analysis is required to explain the temperature dependence of the mobile 2D electron ESR signal.

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