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Electrically Detected Magnetic Resonance of Shallow Donors in Accumulation Layer MOSFETs CHEUK CHI LO, J. BOKOR, University of California, Berkeley, T. SCHENKEL, R. DE SOUSA, Lawrence Berkeley National Labs, JIANHUA HE, G. SABOURET, S. SHANKAR, F. R. BRADBURY, A. M. TYRYSHKIN, S. A. LYON, Princeton University — The ability to read out the spin state of a single donor-bound electron is an essential, but not yet demonstrated, capability for building a quantum computer processor using the spins of electrons bound to Si donors as the qubits. We present measurements of the spins of ensembles of shallow donors embedded in the channel of a MOSFET. Our approach is based on spin-dependent transport arising from the fact that the scattering cross-section of conduction electrons with donor electrons depends on whether the two electrons form a spin singlet or triplet. Our measurements are done on accumulation layer MOSFETs doped with phosphorus or antimony. In continuous wave EDMR experiments, with large area devices (up to 100x100 microns) the measured signals, $\Delta R/R$ of the channel, is of the order 10^{-6}. The EDMR signal is a function of the field modulation frequency, with pronounced passage effects observed above 1kHz. This result implies that the spin relaxation time, T_1, of the donors in the FET channel may be quite long, in excess of 1ms at 5K. A long T_1, of this magnitude, suggests that it may be possible to scale the devices to submicron dimensions and read out the state of an individual donor electron spin.

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