Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Electron spin coherence of shallow donors in germanium A.J. SIGILLITO, R.M. JOCK, A.M. TYRYSHKIN, Department of Electrical Engineering, Princeton University, K.M. ITOH, Department of Applied Physics and Physico-Informatics, Keio University, S.A. LYON, Department of Electrical Engineering, Princeton University — The presence of magnetic nuclei is one major source of electron and nuclear spin decoherence in semiconductors. Germanium is one of the few semiconductor materials that can be isotopically enriched to have no magnetic nuclear isotopes, making it a promising material for quantum computing applications. In this talk we report T_1 and T_2 relaxation times for ^{75}As and ^{31}P donors in natural Ge and isotopically enriched ^{74}Ge for temperatures down to 350 mK. We find that T_1 is limited by a direct phonon process at these temperatures, in agreement with previous reports. Above 2K, the coherence time for donor spins is limited by T_1, while below 2K it is limited by spectral diffusion from ^{73}Ge nuclear spins. In isotopically-enriched ^{74}Ge (3.8% residual ^{73}Ge) we find a T_2 of 110 us for ^{75}As donors. Electron Spin Echo Envelope Modulation (ESEEM) data will be presented identifying the hyperfine coupling of the donor electron to several ^{73}Ge lattice sites with couplings ranging from 200 kHz to 1 MHz.

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Date submitted: 14 Nov 2014 Electronic form version 1.4