Abstract Submitted
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Nuclear spin coherence of neutral ^{31}P donors in isotopically enriched ^{28}Si[1] E.S. PETERSEN, A.M. TYRYSHKIN, S.A. LYON, Princeton Univ, S. TOJO, K.M. ITOH, Keio Univ, M.L.W. THEWALT, Simon Fraser Univ, H. RIEMANN, N.V. ABROSIMOV, IKZ, P. BECKER, PTB Braunschweig, H.-J. POHL, VITCON — In natural silicon the nuclear spin coherence of neutral ^{31}P donors is limited to about 1 second by flip-flopping ^{29}Si nuclear spins. Here we eliminate this process by using isotopically enriched ^{28}Si with 50 ppm of ^{29}Si. This allows us to examine other processes which may decohere the ^{31}P nuclear spins. We use X-band pulsed ENDOR at 1.7 K to examine isotopically enriched Si crystals with donor concentrations from 10^{14} to 4x10^{15} P/cm^3 and find a dependence of ^{31}P nuclear spin coherence time on donor concentration. The measured nuclear spin echo decays are fit by a stretched exponential function, exp(-(t/T_2)^n), with n ranging from 0.7 to 1. This differs from n of about 2 commonly seen for spectral diffusion due to indirect spin flip-flops. The measured T_2 times decrease significantly when the donor concentration increases, changing from 8 s at 10^{14} to 0.2 s at 4x10^{15} P/cm^3. From the observed donor concentration dependence at higher densities, we conclude that direct electron spin flip-flops are responsible for ^{31}P donor nuclear spin decoherence.

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