Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Decoupling a spin qubit from high-frequency Larmor dynamics of a GaAs nuclear spin bath[1] FILIP K. MALINOWSKI, FREDERICO MARTINS, PETER D. NISSEN, MARK S. RUDNER, CHARLES M. MARCUS, FERDINAND KUEMMETH, Center for Quantum Devices, Niels Bohr Institute, University of Copenhagen, EDWIN BARNES, Department of Physics, Virginia Tech, SAEED FALLAHI, GEOFFREY C. GARDNER, MICHAEL J. MANFRA, Department of Physics and Astronomy and Birck Nanotechnology Center, Purdue University — We present a technique of decoupling a spin qubit in a GaAs/AlGaAs heterostructure from low- and high-frequency noise arising from hyperfine interaction of electrons with nuclear spins. We use Carr-Purcell-Meiboom-Gill sequences in which we synchronize the repetition rate of π pulses to difference Larmor frequencies of ^{69}Ga, ^{71}Ga and ^{75}As nuclei. This decouples the qubit both from low-frequency noise due to diffusion of nuclear spins and from noise at selected high frequencies, allowing us to apply more than a thousand π pulses in a sequence. We demonstrate a coherence time of a singlet-triplet qubit of 0.87 ms, i.e. five orders of magnitude longer than the inhomogeneous dephasing time intrinsic to GaAs.

[1]Support through IARPA-MQCO, Army Research Office, LPS-MPO-CMTC, the Villum Foundation and the Danish National Research Foundation is acknowledged.

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Date submitted: 05 Nov 2015 Electronic form version 1.4