Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Dynamic field-frequency lock for tracking magnetic field fluctuations in electron spin resonance experiments ABRAHAM ASFAW, ALEXEI TYRYSHKIN, STEPHEN LYON, Department of Electrical Engineering, Princeton University, Princeton NJ 08544 — Global magnetic field fluctuations present significant challenges to pulsed electron spin resonance experiments on systems with long spin coherence times. We will discuss results from experiments in which we follow instantaneous changes in magnetic field by locking to the free induction decay of a proton NMR signal using a phase-locked loop. We extend conventional field-frequency locking techniques used in NMR to follow slow magnetic field drifts by using a modified Carr-Purcell-Meiboom-Gill (CPMG) pulse sequence in which the phase of the pi-pulses follows the phase of the proton spins at all times. Hence, we retain the ability of the CPMG pulse sequence to refocus local magnetic field inhomogeneities without refocusing global magnetic field fluctuations. In contrast with conventional field-frequency locking techniques, our experiments demonstrate the potential of this method to dynamically track global magnetic field fluctuations on timescales of about 2 seconds and with rates faster than a kHz. This frequency range covers the dominant noise frequencies in our electron spin resonance experiments as previously reported.

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Date submitted: 06 Nov 2015 Electronic form version 1.4