Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Sorting Category: 17.1.3 (E)

Integrating MREV and XYXY Pulse Sequences to Decouple Dipolar Interactions in ESR Experiments ALEXEI TYRYSHKIN, STEPHEN LYON, Princeton University — Dynamical decoupling (DD) techniques employ a series of strong refocusing pulses to combat decoherence in quantum systems. A great number of the new improved DD sequences have been designed recently aiming to decouple from a specific kind of decohering noise, arising in the direction of an externally applied quantizing field. MREV-type pulse sequences have long been used in NMR community to decouple spins from another source of decoherence - the dipolar interactions between like spins. Here, we report on our experience while using MREV sequences in ESR experiments on donors in silicon. We find MREV sequences to be very sensitive to even small instrumental errors in the applied pulses. The errors accumulate upon repeating the MREV pulse sequence, destroying the coherenence instead of protecting it. A possible solution to this pulse error problem is found by integrating an MREV pulse sequence with a self-correcting XYXY sequence. The new MREV-XYXY sequence appears to satisfy all the requirements of a "good" DD sequence: (1) providing a protection to an arbitrary coherent state with good fidelity (at least 95% after more than 17,000 pulses), (2) decoupling from dipolar interactions of like spins, and (3) cancelling the phase noise arising from fluctuations in the magnetic field.

Ryan Jock
rjock@princeton.edu
Princeton University

[X] Prefer Oral Session
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Date submitted: 08 Dec 2011 Electronic form version 1.4