Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

A new mechanism for spin and valley relaxation in silicon quantum dots RUSKO RUSKOV, CHARLES TAHAN, Laboratory for Physical Sciences, College Park, MD 20740, U.S.A. — We consider spin and valley relaxation in imperfect silicon quantum dots with 1 to 3 electrons. Phonons, spin-orbit coupling, and the electrostatic confining potential of the dot all play roles in both the functional dependence on key parameters (say magnetic field) and the quantitative magnitude of the relaxation rate. Level mixing in the dot allows for spin relaxation via phonons and also explains anti-crossing behavior of dot levels as a function of magnetic field. We show that valley state relaxation can be fast in realistic dots and that spin relaxation can be a few orders of magnitude longer. Our results compare favorably to recent experimental data including the power dependence on magnetic field, location of relaxation hot spots, and the magnitude of the relaxation rates themselves. Some of this work is in collaboration with A. Dzurak group at the University of New South Wales, Australia.

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Date submitted: 09 Nov 2012 Electronic form version 1.4