Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Optically controlled electron-nuclear spin dynamics in a quantum dot[1] EDWIN BARNES, Condensed Matter Theory Center, Dept. of Physics, University of Maryland, SOPHIA ECONOMOU, Naval Research Lab — In recent years, a large number of experiments involving coherent and incoherent control of electron spins in quantum dots have revealed the important role of the nuclear spins of the host material. Experiments with optical controls, both pulsed and continuous wave, have shown that the feedback of the nuclear spins on the electron spin strongly affects the electron spin response. However, a microscopic theory of this mechanism is not available at present. We introduce a formalism that allows us to investigate this system without invoking any phenomenological spin-flip rates for the nuclei. We derive the electron-nuclear dynamics under the influence of external periodic pulsed control to second order in the electron-nuclear hyperfine coupling. Our formalism should have wide applications in both coherently and incoherently driven electron spins interacting with a nuclear spin bath, including self-assembled and gated quantum dots.

[1]Work (EB) supported by LPS-CMTC and CNAM

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Date submitted: 19 Nov 2010 Electronic form version 1.4