Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Control of the direction and rate of nuclear spin flips in InAs quantum dots using detuned optical pulse trains SAM CARTER, SOPHIA ECONOMOU, Naval Research Laboratory, ANDREW SHABAEV, George Mason University, THOMAS KENNEDY, ALLAN BRACKER, THOMAS REINECKE, Naval Research Laboratory — Using two-color time-resolved Faraday rotation and ellipticity measurements, we show that control of the direction and rate of nuclear spin flips in InAs quantum dots can be achieved through optical manipulation of the electron spin. A circularly polarized pump pulse train excites an ensemble of dots with varying electron spin precession frequencies and pump detunings. Resonant excitation has been described in Ref. [1], in which the electron spin polarization is greatly enhanced when the precession is synchronized to a multiple of the pulse repetition rate. Nuclear spin flips occur rapidly when the electron spin is not synchronized, with equal probability to flip up or down, leading to random walks that eventually lead the system to stable synchronized modes. In detuned dots, rotations of the spin away from the plane of precession lead to asymmetry in the nuclear spin flip rates, giving a clear pathway for nuclear reconfiguration. For dot energies below (above) the pump, the nuclear reconfiguration pushes electron spins towards (away from) synchronization. This effect is observed through a spectral shift in the Faraday rotation/ellipticity amplitudes as a function of probe detuning. [1] A. Greilich, A. Shabaev *et* al., Science **317**, 1896 (2007).

Sam Carter
Naval Research Laboratory

Date submitted: 20 Nov 2008 Electronic form version 1.4