Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Optical nuclear spin polarization in the presence of heavy hole hyperfine interactions HUGO RIBEIRO, FRANZISKA MAIER, DANIEL LOSS, University of Basel — In self-assembled quantum dots, the form of the effective hyperfine Hamiltonian for heavy holes states is still under debate. The first theories suggested an Ising-like type of interaction with a strength on the order of 10% of the one of the electron and with opposite sign. Consequently, flip-flop terms similar to those of the electronic hyperfine Hamiltonian are very weak and do not provide an efficient mechanism for exchange of angular momentum. However, due to band mixing, matrix elements of the hyperfine Hamiltonian taken with the same effective heavy hole state are non-zero and can lead to transitions in the nuclear spin state. Here, we propose an experiment aiming at detecting and simultaneously cancel the effective hyperfine heavy hole non-collinear interaction. Although its relative strength is in average three orders of magnitude smaller than the electronic hyperfine coupling constant, the effective non-collinear interaction is efficient at polarizing nuclear spins. Our results force a complete reinterpretation of experiments dealing with nuclear spins in optically active quantum dots.

Hugo Ribeiro
University of Basel

Date submitted: 15 Nov 2013 Electronic form version 1.4