High Speed Single Dopant Spin Manipulation with a Single Electrical Gate

VICTORIA POVILUS, University of Iowa Department of Physics and Astronomy, J.-M. TANG, University of New Hampshire Department of Physics, M.E. FLATTÉ, University of Iowa Department of Physics and Astronomy — Ultra-low-power computation with spin based electronics can be achieved through coherent spin manipulation. Naturally occurring Mn ions with a bound hole in GaAs provide a uniform system with the potential for fast, all electrical spin manipulation applicable to high-density scalable spin-based electronics [1] and can be probed optically [2]. In an effort to increase device scalability by utilizing a single gate we consider a configuration in which three fields, DC magnetic, DC electric and AC electric, are parallel. With a DC magnetic field of 2.5 T and total electric field strength of 200kV/cm, we predict Rabi periods on the order of picoseconds with high visibilities. Assuming each Mn experiences a random electric field, which modifies its spin precession, we performed an ensemble calculation using this Hamiltonian to predict polarization curves from a PL measurement on low concentration Mn in GaAs. In addition we calculate how these curves are affected by a bias DC electric field.