Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Electric-field control of a hydrogenic donor's spin in a semiconductor[1] AMRIT DE, CRAIG E. PRYOR, MICHAEL E. FLATTÉ, Department of Physics and Astronomy, University of Iowa — The orbital wave function of an electron bound to a single donor in a semiconductor can be modulated by an applied AC electric field, which affects the electron spin dynamics via the spin-orbit interaction. Numerical calculations of the spin dynamics of a single hydrogenic donor (Si) using a real-space multi-band $k \cdot p$ formalism show that in addition to breaking the high symmetry of the hydrogenic donor state, the g-tensor has a strong nonlinear dependence on the applied fields. By explicitly integrating the time dependent Schrödinger equation it is seen that Rabi oscillations can be obtained for electric fields modulated at sub-harmonics of the Larmor frequency. The Rabi frequencies obtained from sub-harmonic modulation depend on the magnitudes of the AC and DC components of the electric field. For a purely AC field, the highest Rabi frequency is obtained when E is driven at the 2nd sub-harmonic of the Larmor frequency. Apart from suggesting ways to measure g-tensor anisotropies and nonlinearities, these results also suggest the possibility of direct frequency domain measurements of Rabi frequencies.

[1]C.E.P. would like to acknowledge an NSF NIRT. M.E.F. would like to acknowledge an ONR MURI.

Michael Flatte
University of Iowa

Date submitted: 21 Nov 2008 Electronic form version 1.4