Abstract Submitted
for the MAR07 Meeting of
The American Physical Society

Electric field dependence of the electron g-factor for a Si donor in bulk GaAs A. DE, CRAIG E. PRYOR, MICHAEL E. FLATTÉ, Department of Physics and Astronomy, University of Iowa — Modulation of the electron g-factor by an applied electric field may be used to coherently manipulate spins for quantum information processing. We present numerical calculations of the electric field dependence of the g-factor of an electron bound to a silicon donor in bulk GaAs. The calculations were carried out using 8-band $k.p$ theory in the envelope function approximation, which is implemented using finite differences on a real-space grid. The binding energy of the Si impurity in GaAs was fit to experimental data by adding a central cell correction to the donor site. Electrically modulating the impurity's g-factor is possible as the electric field modifies the binding energy for the Si donor. In our calculations, it is seen that the variation in g is nearly quadratic as a function of electric field (up to 0.2 mV/nm) and for $E = 0$, $d^2g/dE^2 = 1.2$ $(\text{mV/nm})^{-2}$. The largest variation in g is obtained when the applied magnetic field and electric fields are in the same direction. The proposed scheme provides a realizable alternative to quantum information processing using quantum dots.

Amrit De
Department of Physics and Astronomy, University of Iowa

Date submitted: 20 Nov 2006 Electronic form version 1.4