Abstract Submitted
for the MAR07 Meeting of
The American Physical Society

Optically detected quantum dynamics of hydrogenic donor qubits[1] DAN ALLEN, SANGWOO KIM, MARK SHERWIN, Department of Physics, UCSB — Orbital states of electrons bound to shallow donors in GaAs provide many of the advantages of trapped atoms for quantum information studies, including optical readout and long lived excited levels. Shallow donors (e.g. S, Si) have a scaled hydrogenic potential with a bound electron 1S-2P transition at 1 THz (4 meV). In a 5 T magnetic field the 1S state and lowest 2P state ($2P^-$) serve as qubit levels. A cycling transition exists for detecting neutral donors in the ground state via the donor bound exciton resonance; excited bound states are dark. Using this optical quantum nondemolition measurement, the relaxation (T_1) of donors after THz excitation of the 1S- $2P^-$ transition is observed to be $> 1\mu$s. High resolution spectroscopy indicates dephasing (T_2^*) of an ensemble of neutral donors is limited by inhomogeneous broadening to 50 ps. In order to measure the decoherence time (T_2), which is expected to be much longer, a rephasing technique is required. For Hahn echo measurements of T_2 a 0-24ns, diffraction- compensating free space THz delay line has been constructed.

[1]Supported by NSF-NIRT grant CCF 0507295

Dan Allen
Department of Physics, UCSB

Date submitted: 17 Nov 2006 Electronic form version 1.4