Abstract Submitted
for the MAR07 Meeting of
The American Physical Society

Fast spin state preparation in a single charged quantum dot[1] XIAODONG XU, YANWEN WU, BO SUN, JUN CHENG, QIONG HUANG, DUNCAN STEEL, H. M. Randall Laboratory, The University of Michigan, Ann Arbor, MI 48109, USA, ALLAN BRACKER, DAN GAMMON, Naval Research Laboratory, Washington DC 20375, CLIVE EMARY, LU SHAM, Department of Physics, The University of California, San-Diego,La Jolla, California 92093 — Electron spins trapped inside of semiconductor dots (QD) are promising candidates for quantum bits (qubits). Quantum computation requires both the initialization of qubits with a high fidelity and a continuous supply of fresh ancillary qubits. The latter is the key for quantum error correction (QEC). Here, we demonstrate fast spin state preparation (laser cooling of an electron spin) in a single charged InAs self-assembled QD by applying magnetic field in the Voigt geometry. The preparation efficiency of the spin state is 98.9% at a magnetic field of 0.88T, which corresponds to the cooling of spin from 5 K (experimental temperature) to 0.06 K. To reach the same efficiency by thermal equilibration, a 69 T static magnetic field should be applied. The spin cooling rate of $3 \cdot 8 \times 10^9 s^{-1}$ is achieved. This is three orders of magnitude faster than the spin decoherence rate, which is on the order of$1 \times 10^6 s^{-1}$.

[1]This work is supported by U.S. ARO, AFOSR, ONR, LPS, and FOCUS-NSF.

Xiaodong Xu
H. M. Randall Laboratory, The University of Michigan,
Ann Arbor, MI 48109, USA

Date submitted: 28 Nov 2006 Electronic form version 1.4