Abstract Submitted
for the DAMOP06 Meeting of
The American Physical Society

Rapid control and measurement of clock-state qubits in Yb and Sr

BARRY C. SANDERS, NATHAN S. BABCOCK, Institute for Quantum Information Science, University of Calgary, ARTEM M. DUDAREV, MARK G. RAIZEN, Center for Nonlinear Dynamics and Department of Physics, University of Texas, Austin, RENE STOCK, Institute for Quantum Information Science, University of Calgary — The optical clock-transitions in Yb and Sr are prime candidates for encoding qubits for quantum information processing applications. Electric dipole one- and two- photon transitions between the extremely long-lived $^1S_0$ and $^3P_0$ states are dipole and parity forbidden, respectively. Whereas this results in highly desirable low-decoherence rates, it also represents the main problem for fast coherent manipulation and measurement of qubits for quantum information processing. In this work, we determine the feasibility of using a coherent, recoil-free, three- photon transition [1] for fast coherent rotation of qubits followed by ultrafast readout of the $^3P_0$ state via photo ionization. Rapid control and measurement of atomic qubits are crucial for high-speed synchronization of quantum information processors. Furthermore, we explore the possibility of loophole free tests of Bell inequalities using spatially separated entangled qubits via fast measurements. [1] T. Hong, C. Cramer, W. Nagourney, E. N. Fortson, Phys. Rev. Lett. 94, 050801 (2005)

Barry C. Sanders
Institute for Quantum Information Science, University of Calgary

Date submitted: 01 Feb 2006 Electronic form version 1.4