Abstract Submitted
for the DAMOP09 Meeting of
The American Physical Society

Simulation of Quantum Operations in a Three-Level System JASON LEE, MAHMOUD LABABIDI, MINGZHEN TIAN, Department of Physics and Astronomy, George Mason University — Lambda-type three-level systems have been studied as potential qubits for quantum computation and quantum memory. Quantum state manipulation through optically controlled quantum operation plays an important role in these settings. In order to understand the physical processes involved and to analyze the state and operation fidelity we developed a theoretical model based on semi-classical theory, which describes the state evolution of the three-level atom driven by the laser pulses. We investigated the fidelity of the quantum operations, which is controlled by laser and atomic parameters in the process, including atomic coherence time, initial state, frequency detuning, amplitude, and phase of the laser control pulses. The simulation encompasses realistic parameters to gauge optimal operation conditions, by optimizing parameters of the laser and atom. We will present the simulation results in comparison to the experiment data. The theoretical model can also be applied to a broader range of processes in three-level systems.

Jason Lee
Department of Physics and Astronomy, George Mason University

Date submitted: 26 Jan 2009 Electronic form version 1.4