Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Protocol for Hybrid Entanglement Between a Trapped Atom and a Quantum Dot[1] EDO WAKS, CHRISTOPHER MONROE, University of Maryland — We propose a quantum optical interface between an atomic and solid state system. We show that quantum states in a single trapped atom can be entangled with the states of a semiconductor quantum dot through their common interaction with a classical laser field. The interference and detection of the resulting scattered photons can then herald the entanglement of the disparate atomic and solid-state quantum bits. We develop a protocol that can succeed despite a significant mismatch in the radiative characteristics of the two matter-based qubits. We study in detail a particular case of this interface applied to a single trapped ^{171}Yb ion and a cavity-coupled InGaAs semiconductor quantum dot. Entanglement fidelity and success rates are found to be robust to a broad range of experimental nonideal effects such as dispersion mismatch, atom recoil, and multi-photon scattering. We conclude that it should be possible to produce highly entangled states of these complementary qubit systems under realistic experimental conditions.

[1]This work was supported by IARPA, ARO, NSF, and the Physics Frontier Center at the JQI.

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Date submitted: 19 Nov 2009 Electronic form version 1.4