DAMOP05-2005-000288

Abstract for an Invited Paper
for the DAMOP05 Meeting of
the American Physical Society

Cavity QED with Trapped Atoms for Quantum Optics and Quantum Information

JASON MCKEEVER, Quantum Optics Group of H. Jeff Kimble, California Institute of Technology, Pasadena, CA

One requirement for the implementation of protocols in quantum information science is the ability to convert quantum information from stationary to travelling form. The strong coupling domain of optical cavity quantum electrodynamics (QED) provides a near-ideal setting for the pursuit of these goals. In our experiments, Cs atoms were trapped inside a cavity in the strong coupling regime. The atoms were confined using an intracavity dipole trap with lifetime of 3 s, in which the trapping field only weakly perturbs the cavity QED interactions. We have also experimentally realized the one-atom laser, whose properties included strongly nonclassical output (photon antibunching and sub-Poissonian photon statistics). Finally, we have achieved single-photon generation in a setting suitable for quantum networks. A strongly coupled trapped atom has been used to generate a stream of single photon pulses "on demand," with intrinsic efficiency near unity. This system should enable the creation of atom-field entanglement and the distribution of quantum states among atoms in distantly separated cavities.