Abstract Submitted
for the DAMOP06 Meeting of
The American Physical Society

Cavity QED with atom chips and micro-resonators BENJAMIN LEV, PAUL BARCLAY, JOSEPH KERCKHOFF, OSKAR PAINTER, HIDEO MABUCHI — Cavity QED provides a rich experimental setting for quantum information processing, both in the implementation of quantum logic gates and in the development of quantum networks. Moreover, studies of cavity QED will help elucidate the dynamics of continuously observed open quantum systems with quantum-limited feedback. To achieve these goals in cavity QED, a neutral atom must be tightly confined inside a high-finesse cavity with small mode volume for long periods of time. Microfabricated wires on a substrate—known as an atom chip—can create sufficiently high-curvature magnetic potentials to trap atoms in the Lamb-Dicke regime. The integration of micro-resonators, such as microdisks and photonic bandgap cavities, with atom chips forms a robust and scalable system capable of probing the strong- coupling regime of cavity QED with magnetically trapped atoms. We have recently built an atom-cavity chip utilizing a fiber taper coupled microdisk resonator. This device combines laser cooling and trapping of neutral atoms with magnetic microtraps and waveguides to deliver cold atoms to the small mode volume of the high-Q cavity. We will relate our progress toward detecting single atoms with this device.

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Date submitted: 26 Jan 2006 Electronic form version 1.4