ABSTRACT

"Towards a CQED system with **trapped ions**" Nan Yu and Lute Maleki, Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA, 91109.

Cavity QED in the strong coupling regime offers a system of well-understood photon-atom interaction and dissipations. The ability to control and measure the system at single quantum levels makes it possible to study in detail the quantum structure and dynamics of the system. This capability can be used in turn to process and extract quantum information, as has been proposed recently to use cavity QED system as building blocks for **quantum computing** and networking.[1] One of the prerequisite for such implementation is to have atoms tightly confined in the cavity with known positions. Unfortunately, much of the cavity QED work in the past used atomic beams with unavoidable number and position fluctuations. Several techniques can be potentially used to confine atoms in a cavity including various light traps for neutral atoms and rf traps for ions. We describe our initial experimental cavity QED system with trapped single Yb^+ ion. In the face of daunting experimental challenges of achieving strong coupling condition at this point, our first exploratory system consists of a rf trap of 1 mm diameter inside a cavity of 10 mm mirror separation. We will describe some aspects of the experiment design and the system parameters. We will also discuss the expected technical hurdles and possible solutions, as well as proposals for future cavity QED systems.

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[1]Q. A. Turchette *et al.*, Phys. Rev. Lett. **75**, 4710 (1995); T. Pellizzari *et al.*, *ibid.* **75**, 3788 (1995); J. I. Cirac *et al.*, *ibid.* **78**, 3221 (1996); S. J. van Enk *et al.*, *ibid.* **79**, 5178 (1997).