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Cavity QED with Microtoroidal Optical Resonators[1] D.J. ALTON, C. LACROUTE, P. FORN-DIAZ, A. MCCLUNG, N.P. STERN, TAKAO AOKI, H. LEE, E. OSTBY, K.J. VAHALA, H.J. KIMBLE, Norman Bridge Laboratory of Physics, California Institute of Technology 12-33, Pasadena, CA 91125, USA —
Quantum control of strong interactions between a single atom and a single photon has been achieved within the setting of cavity quantum electrodynamics (cQED). To move beyond proof-of-principle experiments involving one or two conventional optical cavities to more complex scalable systems that employ many microscopic resonators requires localization of atoms on distance scales ∼100 nm from a resonator's surface. A single atom trapped near the surface of a fiber-coupled microtoroidal resonator provides a promising system that allows access to a new regime of cQED. Here, due to its proximity to the surface of the resonator, an atom experiences both strong 1-photon and surface interactions [1]. To advance beyond transient observations [1], we are currently working to trap single atoms within the evanescent field of a microtoroidal resonator using a single tapered fiber to provide both optical coupling and a dipole trap for the atoms [2-4]. Our goal is to realize a flexible experimental platform for investigations of small quantum networks using strong interactions of single atoms and photons.

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[3] E. Vetsch et al., Phys. Rev. Lett., 104, 203603 (2010).
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