Abstract Submitted
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Real-Time Cavity QED with Single Atoms and a Microtoroidal Resonator[1] N.P. STERN, D.J. ALTON, H. LEE, K.J. VAHALA, H.J. KIMBLE, California Institute of Technology, Pasadena, CA 91125, USA — Strong coupling in cavity quantum electrodynamics (cQED) with atoms and microtoroid resonators allows coherent interactions between matter and light to dominate irreversible dissipation in a scalable quantum node with high photonic coupling efficiency.[2] Previous microtoroid cQED experiments use post-selection of atom transits from the photon record,[3,4] imposing limitations on experimental complexity and necessitating an indirect measure of strong coupling.[2] Using fast logic electronics, we achieve real-time detection of falling atom transit events of duration 2-4 μs in 250 ns followed by conditional switching of the input beam while the atom is coupled to the cavity. Laser detuning and intensity switching after atom detection enables measurement of Rabi splitting, directly confirming strong coupling. Monte Carlo simulations of atom trajectories and spectra reveal that transits detected in real-time serve as a probe of dipole and van der Waals forces between resonator and atom, here in a regime of strong atom-cavity coupling.

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[2]T. Aoki, *et al.*, *Nature* **443**, 671 (2006).
[3]B. Dayan, *et al.*, *Science* **319**, 1062 (2008).
[4]T. Aoki, *et al.*, *Phys. Rev. Lett.* **102**, 083601 (2009).

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