Abstract Submitted
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Strong interactions of single atoms and photons near a dielectric boundary[1] N.P. STERN, D.J. ALTON, T. AOKI, H. LEE, E. OSTBY, K.J. VAHALA, H.J. KIMBLE, California Institute of Technology, Pasadena, CA 91125, USA — Quantum control of strong interactions between a single atom and 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 $N > 1$ microscopic resonators requires localization of atoms on distance scales ~ 100 nm from a resonator's surface where an atom can be strongly coupled to a single intracavity photon while at the same time experiencing significant radiative interactions with the dielectric boundaries of the resonator. As an initial step into this new regime of cQED, we use real-time detection and high-bandwidth feedback to select and monitor motion of single Cesium atoms through the evanescent field of a microtoroid[2]. Direct temporal and spectral measurements coupled with simulations reveal both the significant role of Casimir-Polder attraction and the manifestly quantum nature of the atom-cavity dynamics, here in a regime of strong coupling, setting the stage for trapping atoms near micro- and nano-scopic optical resonators.

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[2]D. J. Alton, *et al, Nature Physics* (2010); available as arXiv:1011.0740.

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