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Blue trapping and dispersive observation of single atoms. T. PUPPE, I. SCHUSTER, A. GROTHE, A. KUBANEK, K. MURR, P.W.H. PINKSE, G. REMPE, Max-Planck Institute for Quantumoptics — A single atom strongly coupled to a high-finesse cavity constitutes a fundamental quantum system of matter-light interaction. An established tool to localize an atom in the cavity mode is the optical dipole trap. So far, only red-detuned dipole traps have been demonstrated in cavity QED. Since the atom is trapped in a region of high intensity, the AC-Stark effect shifts the atomic energy levels. We store single atoms in a blue-detuned intracavity dipole trap. Here, the Stark shift vanishes while the atom is strongly coupled to a cavity mode. Strong coupling and a Stark shift much smaller than the trap height is directly observed in the normal-mode spectroscopy. The blue trap allows us to explore the regime of dispersive atom-light interaction. As a practical application, we demonstrate that a single atom, can efficiently be detected while spontaneously scattering only a few photons. The realization of the blue intracavity dipole trap now allows measurements in cavity QED while preserving the free-space properties of the atom.

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