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Dipole potential in a cavity: Bistable or not? DOMINIC MEISER, JILA — The motion of an atom in a far red detuned light field inside a resonantly driven cavity has surprising and counter intuitive features because atoms and cavity field comprise an open quantum system exchanging energy and momentum with the environment. A dilemma arising in this context is whether the atom is attracted to the antinodes of the field where the derivative of the intensity with respect to atomic position vanishes or to some point away from the anti-node where it tunes the cavity less out of resonance such that the intensity at its location is maximum. We study this problem using a microscopic model that avoids the ad-hoc introduction of semiclassical force concepts. If the trapping is provided by few photons in the strong coupling regime, we find that the atom's wavefunction collapses near resonant points away from the field antinodes due to measurements on the cavity field. In the limit of large photon numbers a generally non-conservative semiclassical force with an equilibrium point at the field antinode emerges.

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