Ground-State Cooling of a Single Atom at the Center of an Optical Cavity

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http://link.aps.org/doi/10.1103/PhysRevLett.110.223003 [2]

A single neutral atom is trapped in a three-dimensional optical lattice at the center of a high-finesse optical resonator. Using fluorescence imaging and a shiftable standing-wave trap, the atom is deterministically loaded into the maximum of the intracavity field where the atom-cavity coupling is strong. After 5 ms of Raman sideband cooling, the three-dimensional motional ground state is populated with a probability of (89+/-2)%. Our system is the first to simultaneously achieve quantum control over all degrees of freedom of a single atom: its position and momentum, its internal state, and its coupling to light.

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