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Collective atomic effects in cavity QED with application to atomic clocks DAVID TIERI, JILA, University of Colorado Boulder, JAN THOMSEN, The Niels Bohr Institute, University of Copenhagen, JUN YE, MURRAY HOLLAND, JILA, University of Colorado Boulder — Atoms placed in an optical cavity can experience cooperative effects where the atomic dipoles synchronize and collectively acquire a macroscopic phase. This process is reminiscent of the spontaneous symmetry breaking that often occurs in second-order phase transitions. The collective phase can be even more stable than the single-atom linewidth. We investigate Strontium atoms in an optical cavity, where the ultranarrow atomic transition considered is 1000 times narrower than the cavity linewidth. A strong probe laser is introduced along the cavity axis, and is scanned through the atomic resonance. For input intensities slightly above the optical bistablity region, an extremely sharp collective resonance feature occurs. Locking to this rapidly varying dispersion feature could be useful for a variety of precision measurement applications.

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