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Conditional Quantum Beats in Cavity QED DAVID NORRIS, REBECCA OLSON KNELL, JIETAI JING, L.A. OROZCO, Joint Quantum Institute, Department of Physics, University of Maryland and NIST, College Park, MD 20742
— We study optical correlations in a cavity QED system, which supports two modes of orthogonal linear polarization, traversed by Rb atoms from a low velocity beam. The combination of the two modes with the magnetic structure of the atoms allows us to separate photons originating from spontaneous emission from those that come from the drive. Conditional measurement of the undriven mode intensity (intensity autocorrelation) reveals quantum beats at the Larmor frequency for an applied magnetic field. Detection of the first fluorescent photon prepares a superposition of two magnetic sublevels of the ground state that evolves dynamically until the next excitation event. The detection probability for a second fluorescent photon then exhibits a modulation with frequency proportional to the magnitude of the weak magnetic field (less than 10 G.) The appearance of these fringes depends upon the geometry of the applied magnetic field, the polarization of the drive, and the detuning of the cavity, providing several options for the implementation of quantum control. The transition to strong driving causes the oscillations to disappear. We explore the implications of this coherence for the realization of a quantum eraser in cavity QED. Work supported by NSF.

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