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**Cavity QED in the mesoscopic regime** PASCAL DEGIOVANNI, ENS Lyon and Boston University, VALENTIN BONZOM, HICHEM BOUZIDI, ARNAUD LE DIFFON, CLEMENT RUEF, ENS Lyon, TRISTAN MEUNIER, Kavli Institute for Nanoscience, Delft University of Technology, JEAN-MICHEL RAIMOND, Laboratoire Kastler Brossel, Ecole Normale Supérieure — We report on a recent study of the behavior of N atoms resonantly coupled to a single electromagnetic field mode sustained by a high-Q cavity, containing a mesoscopic coherent field. Using a simple effective Hamiltonian model, we show that the strong coupling between the cavity and N atoms/qubits produces an atom-field entangled state, involving N+1 nearly coherent components slowly rotating at different paces in the phase plane. The periodic overlap of these components results in a complex collapse and revival pattern for the Rabi oscillation. Decoherence induced by cavity relaxation, qubit relaxation and dephasing are taken into account. We propose a simple model based on the stochastic quantum trajectories approach. Its results are successfully compared to numerical simulations. Explicit predictions for Rydberg atoms and circuit QED experiments are obtained and suggest that these effects may be observable in the near future.

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