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Observation of superradiance in a small ensemble of artificial atoms J.A. MLYNEK, A.A. ABDUMALIKOV JR, C. EICHLER, A. WALLRAFF, ETH Zurich — Superradiant effects can be efficiently addressed in an experimental setting where the atomic linewidth γ is small compared to the coupling rate g and the cavity linewidth κ. We have realized this parameter regime, known as the bad cavity limit, in a circuit QED architecture, consisting of a coplanar wavequide resonator and two transmon qubits. One main advantage of introducing only a small number of two-level systems is the possibility to prepare well defined initial states by exploiting full quantum control of the individual atom states. For the set of initial states presented here the obtained responses are clearly non-exponential and show strong indication of a correlated behavior. Preparing both qubits in superposition states with relative phase ϕ and measuring the amplitude of the emitted signal indicates that the effect arises in an underlying phase locking mechanism. We have further observed the suppression of the emission from one excited qubit due to the presence of a second qubit in its ground state. The coherence properties of the emitted radiation have been analyzed by measuring high order photon correlations and are in good agreement with the theoretical statistics.

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