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Superradiance and Phase Multistability in Circuit Quantum Electrodynamics MICHAEL DELANTY, STOJAN REBIC, JASON TWAMLEY, Centre for Engineered Quantum Systems, Macquarie University, Sydney, NSW 2109, Australia — By modelling the coupling of multiple superconducting qubits to a single cavity in the circuit-quantum electrodynamics (QED) framework we find that it should be possible to observe superradiance and phase multistability using currently available technology (M. Delanty, S. Rebić and J. Twamley, arxiv:1007.2231). Due to the exceptionally large couplings present in circuit-QED we predict that superradiant microwave pulses should be observable with only a very small number of qubits (just three or four), in the presence of energy relaxation and small differences in the qubit-field coupling strengths. This paves the way for circuit-QED implementations of superradiant state readout and decoherence free subspace state encoding in subradiant states. The system considered here also exhibits phase multistability when driven with large field amplitudes, and this effect may have applications for collective qubit readout and for quantum feedback protocols. Furthermore, we extend our analysis to superradiance and collective effects in multi-resonator circuit-QED systems.

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