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Superradiant Phase Transitions and the Standard Description of Circuit QED OLIVER VIEHMANN, JAN VON DELFT, Physics Department, ASC, and CeNS, LMU Munich , FLORIAN MARQUARDT, Institute for Theoretical Physics, FAU Erlangen-Nuremberg — We investigate the equilibrium behavior of a superconducting circuit QED system containing a large number of artificial atoms. It is shown that the currently accepted standard description of circuit QED via an effective model fails in an important aspect: it predicts the possibility of a superradiant phase transition, even though a full microscopic treatment reveals that a no-go theorem for such phase transitions known from cavity QED applies to circuit QED systems as well. We generalize the no-go theorem to the case of (artificial) atoms with many energy levels and thus make it more applicable for realistic cavity or circuit QED systems.

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