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Controlling discrete and continuous symmetries in "superradian" phase transitions ALEXANDRE BAKSIC, CRISTIANO CIUTI, Laboratoire MPQ, Universite Paris Diderot — The Dicke model describing the interaction of a single-mode boson field to an ensemble of two-level systems is an important paradigm in quantum optics. In particular, the physics of the "superradiant phase transition" is the subject of a vigorous research activity. Recently, we explored a model describing a collection of two-level systems, each one coupled to both quadratures of a boson mode [1]. We show that by tuning the two quadrature coupling constants it is possible to control the symmetries of the system, with the possibility of having a U(1)-symmetry even in presence of non-rotating wave (anti-resonant) coupling terms, which are relevant in the ultrastrong coupling regime. We determine the rich phase diagram of such model and show the appearance of Goldstone and amplitude modes. We also show an example of circuit QED configuration where those effects can be observed, by coupling both capacitively and inductively a Josephson junction artificial atom to a superconducting resonator.

[1] A. Baksic and C. Ciuti, arXiv:1310.3780 (2013).

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