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Unconventional criticality in the driven Jaynes-Cummings model
JONATHAN CURTIS, JEREMY YOUNG, Joint Quantum Institute, Dept. of Physics, UMD and NIST, College Park, MD 20742, USA, HOWARD CARMICHAEL, Dept. of Physics, University of Auckland, Auckland 1010, New Zealand, MOHAMMAD MAGHREBI, Dept. of Physics and Astronomy, Michigan State University, East Lansing, MI 48824, USA, ALEXEY GORSHKOV, Joint Quantum Institute and Joint Center for Quantum Information and Computer Science, Dept. of Physics, UMD and NIST, College Park, MD 20742, USA, MICHAEL FOSS-FEIG, United States Army Research Laboratory, Adelphi, Maryland 20783, USA — We study the single-atom Jaynes-Cummings model in the presence of cavity damping and coherent cavity drive. The undamped version of this model is known to exhibit an eigenstate transition, closely related to spontaneous dressed-state polarization, when the cavity driving strength exceeds the atom-cavity coupling. We investigate the consequence of this transition for the steady state at small cavity damping rates. Numerical and analytical evidence suggests the existence of a critical exponent (the so-called photon flux exponent) that is intermediate to the case of either a quantum or a thermal phase transition with respect to the underlying Hamiltonian. We contrast this finding to the well-studied (large-N) limit of many atoms, showing new evidence that the critical behavior for a single atom is of a fundamentally different nature.

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