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Bistability and domain formation in driven-dissipative photon cavity arrays MICHAEL FOSS-FEIG, Army Research Lab, RYAN WILSON, US Naval Academy, ALEXEY GORSHKOV, Joint Quantum Institute — Atomic, molecular, and optical systems afford exciting opportunities to engineer simple, driven-dissipative quantum systems. Even when these systems reach a steady state, they generally remain far from thermal equilibrium, creating many difficulties in describing them theoretically. We confront some of these difficulties in a simple context by studying coupled arrays of non-linear optical cavities [1]. In the limit of strong photon-photon interactions, and making a mean-field approximation, this system exhibits collective bistability between bright and dark states, in close analogy to single-mode quantum optical systems studied decades ago [2]. While this mean-field picture hints at the existence of a first-order phase transition in the true steady state, we are unaware of any general arguments for whether, and if so in what spatial dimensions, such a transition actually exists; the answer depends upon the detailed dynamics of domains in the presence of both quantum and dissipative fluctuations. We study the effects of such fluctuations at various levels of approximation, and develop some simple qualitative pictures of what is going on in the true quantum steady state. [1] R. Wilson et al., arXiv:1601.06857 (2016) [2] P. D. Drummond and D. F. Walls, J. of Phys. A 13, 725 (1980)

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