Abstract Submitted
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Non-destructively probing matter-photon correlations described by the Dicke-Hubbard Lattice model[1] SARA RAJARAM, NANDINI TRIVEDI, The Ohio State University — The Dicke-Hubbard Lattice (DHL) Hamiltonian is a prototypical system to study photon matter entanglement across a symmetry breaking quantum phase transition in the matter subsystem. The model describes a cavity containing a periodic lattice, with a single mode photon field delocalized across the cavity. Like the Bose-Hubbard model, the Hamiltonian includes on-site repulsion between atoms and nearest neighbor hopping of an atom from one site to another. In addition, matter-light coupling in the DHL model can excite an atom to a higher band by absorbing a photon and the reverse process. We focus on the DHL model in a region of parameter space in which light is "superradiant" and matter is either a Mott-insulator or superfluid of both bands. Through mean field, exact diagonalization, and quantum Monte Carlo calculations we examine photon statistics across the matter quantum phase transition in order to elucidate how the photon statistics reflect the matter correlations. Doing so provides a novel technique to non-destructively probe the Mott-insulator to superfluid phase transition.

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