Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Perturbative study of interacting photons in open lattices ANDY C.Y. LI, Northwestern University, FRANCESCO PETRUCCIONE, University of KwaZulu-Natal and National Institute for Theoretical Physics, JENS KOCH, Northwestern University — Quantum simulation realized in the circuit QED architecture is an emerging direction to study many-body physics in open lattice systems. Among several models of interacting photons, the driven-dissipative Jaynes-Cummings (JC) lattice is commonly employed to investigate the steady-state and dynamical behavior. While there is a wealth of analytical and numerical tools applicable to closed lattice systems in thermal equilibrium, the number of methods to treat open lattice systems is rather limited. Hence, many properties of open lattices remain an open question. Here, we formulate a general perturbation theory and an infinite-order resummation scheme applicable to open lattices. We then apply this theory to the driven-dissipative JC lattices to predict steady-state expectation values. This allows us to explore the rich features due to photon-qubit interaction and compare results obtained for finite chains and infinite lattices.

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Date submitted: 14 Nov 2014 Electronic form version 1.4