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Non-Equilibrium Quantum Phases In The Jaynes-Cummings Lattice MARIUS CONSTANTIN, DEVIN UNDERWOOD, ANDREW HOUCK, Princeton University — With the ability to control disorder in microwave cavity lattices (Underwood2012), superconducting circuits provide a feasible platform to conduct on-chip strongly correlated many-body experiments (Houck2012). We aim to fabricate a lattice of dispersive Jaynes-Cummings models by strongly coupling a microwave resonator to a superconducting qubit at each site. The high Q lattice will allow us to investigate the non-equilibrium steady state regime of an open quantum system driven continuously. It was theoretically shown that the lattice's hybrid elementary excitations exhibit distinct quantum phases (Koch2009), including the Mott insulator and the superfluid phases. Experimentally, we intend to perform quantum non-demolition measurements of photon statistics by coupling a measurement qubit to the central lattice site (Johnson2010). In the Mott insulator phase, the statistics of the photon number in the center resonator exhibit the characteristic absence of quantum fluctuations while the superfluid phase is consistent with poissonian statistics of the photon number. The superfluid phase is also characterized by the high correlation between two non-adjacent edge lattice sites, signaling the presence of long-range off-diagonal order (Bozyigit2011, Angelakis2007).

Marius Constantin
Princeton University

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