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Driven Dissipative Stabilization of a Photonic Mott-insulator BRENDAN SAXBERG, RUICHAO MA, CLAI OWENS, DAVID SCHUSTER, JONATHAN SIMON, University of Chicago — The rich physics of stronglycorrelated quantum materials can be explored in synthetic systems built with microwave photons in superconducting circuits in the circuit QED paradigm. However, even the minimal intrinsic loss present in photonic platforms makes many-body quantum state preparation a unique challenge. We build a 1D Bose-Hubbard lattice for photons where capacitively coupled transmon qubits serve as lattice sites, and the transmon anharmonicity corresponds to strong photon-photon interaction. We employ reservoir engineering to dissipatively stabilize a n=1 Mott insulator. Siteresolved microscopy allow detailed studies of the thermalization process through the dynamics of defect propagation and removal in the Mott phase. Recent improvements to our experiment will allow us to probe multi-site correlations - potentially revealing the intricate interplay of correlations, entanglement and thermalization in these driven-dissipative systems. We explore prospects for employing this platform to stabilize topological quantum phases of light and probe their thermodynamics.

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