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Imaging the mode structure of a kagome lattice of superconducting resonators with a scanning defect[1] DEVIN UNDERWOOD, WILL SHANKS, Princeton University, ANDY C.Y. LI, JENS KOCH, Northwestern University, ANDREW HOUCK, Princeton University — It has been theoretically shown that a lattice of coupled electromagnetic cavities each strongly coupled to a two-level system exhibit quantum phase transitions of polaritons. Such a system consists of a lattice of coupled sites each described by the Jaynes-Cummings Hamiltonian. The circuit quantum electrodynamics architecture is a natural choice for such experiments because of the ease of fabrication, and the easily obtainable strong coupling limit. In these systems an important first step is to build and understand a large photonic lattice of microwave resonators without qubits. Here we present measurements of the mode structure of microwave photons in an array of 49 niobium CPW resonators that are capacitively coupled to form a kagome lattice. Our method for extracting the mode structure is a piece of sapphire mounted to a three-axis positioning stage that we bring into contact with each resonator. This scanning defect locally perturbs each lattice site and the shifted transmission spectrum can then be used as a metric to extract the internal mode structure. When compared to calculations from a tight binding Hamiltonian, measured modes show good agreement. These results demonstrate our ability to fabricate and understand large lattices of microwave resonators.

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