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Perturbative scanning probe microscopy on a Kagome lattice of superconducting microwave resonators DEVIN UNDERWOOD, Princeton University, WILL SHANKS, IBM, ANDY C.Y. LI, JENS KOCH, Northwester University, ANDREW HOUCK, Princeton University — Microwave photons confined to a lattice of coupled resonators, each coupled to its own superconducting qubit have been predicted to exhibit matter like quantum phases. Realizing such a lattice-based quantum simulator presents a daunting experimental challenge; as such, new tools and measurement techniques are a necessary precursor. Here, we present measurements of the internal mode structure of microwave photons on a 49-site Kagome lattice of capacitively coupled coplanar waveguide resonators without qubits. By scanning a probe with a sapphire tip over the surface of a single lattice site, the resonant frequency was detuned, thus forming a local defect in the lattice. This perturbation resulted in measurable shifts in the lattice spectrum, which were used to extract the mode weights at the perturbed site. By perturbing each lattice site it was possible to reconstruct a complete map of different normal mode weights within the entire lattice. Additionally we present experimental evidence of a frustrated flat band that arises from the Kagome lattice geometry.

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