The remarkable progress in the coherence properties of superconducting qubits over the last decade makes them a prime candidate for both universal quantum computing and near-term quantum simulation. Indeed, systems consisting of either a single qubit or a small number of coupled qubits have already realized a variety of quantum simulation experiments. Implementing more sophisticated simulations, in fields ranging from quantum chemistry to quantum chromodynamics, requires scaling up the number of qubits on a single chip. In this work, we present initial progress on the design, fabrication, and characterization of such a multi-qubit device.

Our chip is designed within the circuit quantum electrodynamics paradigm, in which a superconducting qubit is coupled to a linear resonator to facilitate measuring its state. It features ten transmon qubits, which have become one of the staples of the community in recent years due to their insensitivity to charge noise. Each of these is coupled to individual coplanar waveguide resonators, which in turn are coupled to a single, common microwave bus for qubit state manipulation and readout.

Several versions of this chip have been fabricated and tested. We will detail the fabrication process, qubit coherence measurements, and multiplexed readout capability in this talk.