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A Dynamically Reconfigurable Quantum Processor

SpiderNet, a novel quantum processor unit (QPU) that allows users to dynamically reconfigure the connectivity between eight tunable superconducting transmon qubits by programming room temperature controls was fabricated and tested in a dilution refrigerator. In this talk, we will present the experimental apparatus as well as the various experimental results that showcase the SpiderNet architecture's unique capabilities. In particular, we benchmark our device's performance in terms of qubit coherence times, readout fidelity, and single and two-qubit gate fidelities. The SQUID tunable bus resonator which acts as the central coupling component for multi-qubit interactions is characterized over its full tuning range. Lastly, we explore how effectively we can generate different forms of multi-qubit couplings with an eye towards using this architecture as a versatile platform for quantum simulation.