A piezo-optomechanical transducer for quantum entanglement between light and microwaves

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Superconducting qubits and optical photons are leading platforms for quantum computation and communication, respectively. We demonstrate a chip-scale source of quantum entanglement to interconnect these platforms. Our device features an aluminum nitride-on-silicon acoustic transducer as an intermediary between quantum signals at microwave and optical frequencies. The transducer is engineered to simultaneously realize strong piezoelectric coupling to a thin film superconducting microwave resonator and optomechanical coupling in a silicon nanophotonic cavity. Recently, we used such a device to generate entangled states of single microwave and optical photons. Further advances in device performance can enable applications of such transducers in distributed quantum computing and quantum communication. This talk will discuss the design and fabrication of piezo-optomechanical quantum transducers, current challenges, and a few near-term routes to address them.

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