

Coupling a Superconducting Qubit to an Aluminum Drumhead Mechanical Resonator

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The preparation and readout of arbitrary non-classical states of motion is an important goal in the field of quantum optomechanics or electromechanics. One strategy is to couple a mechanical system directly to a strong non-linearity such as a two level system, or qubit. I will present our recent work on the realization of a hybrid system consisting of an aluminum drumhead and a Cooper pair box. We use a DC-biased capacitive coupling scheme in which coupling strength scales with DC voltage. The maximum DC voltage that can be applied is limited by an electrostatic instability, which we mitigate using a capacitance bridge geometry. This allows us to reach a regime in which the single phonon Stark shift becomes comparable to the qubit linewidth. With this system, we should be able to cool and prepare the mechanical oscillator in a non-classical state using qubit control.