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Development of a dispersive read-out technique for quantum measurements of nanomechanical resonators[1] FRANCISCO ROUXINOL, MATTHEW LAHAYE, HUGO HAO, Syracuse University, SEUNG-BO SHIM, Korean Research Institute for Science and Standards — Over the last decade, there has been an active effort to prepare and measure mechanical structures in the quantum regime for the purpose of sensing weak forces and for studying fundamental topics in quantum mechanics such as quantum measurement, entanglement and decoherence in new macroscopic limits. One promsing tool for such studies is the qubit-coupled mechanical resonator. In this work we discuss some of our first results towards the development of a nanoelectromechanical system that integrates a charge-type superconducting qubit as a detector to probe the number-states of a nanomechanical mode. In our system the qubit-coupled nanoresonator is embedded in a superconducting microwave resonator (SMR); the SMR then serves to perform spectroscopic measurements of the qubit to infer the number-state statistics of the nanoresonator in a manner analogous to dispersive measurement techniques used in circuit and cavity QED to probe the number-states of electromagnetic cavities. We will discuss the design and measurement of our latest generation devices and the prospects for achieving single-phonon measurement resolution with this system.

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