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Evidence of Dispersive Coupling between a Nanomechanical Resonator and a Cooper-Pair Box MATTHEW LAHAYE, JUNHO SUH, California Institute of Technology, PIERRE ECHTERNACH, Jet Propulsion Laboratory, California Institute of Technology, KEITH SCHWAB, Cornell University, MICHAEL ROUKES, California Institute of Technology — Many proposals have been put forth to prepare and observe quantum nano-electromechanical systems (quantum NEMS or QEMS) via coupling to a Cooper-pair box (CPB). A natural first step in the realization of these proposals is to study the dispersive interaction between a NEMS and CPB. In the dispersive limit, the coupling between the NEMS and CPB is a second-order effect that should result in a CPB-state-dependent renormalization of the nanoresonator's frequency. For typical parameters, the relative magnitude of the frequency shift should be a few ppm, resolvable with current NEMS detection capabilities. In fact, using a capacitive nanomechanical transduction scheme, we have been able to observe a red-shift of approximately 150 Hz in the frequency of a 61 MHz silicon nitride nanoresonator while tuning the ground state of a nearby CPB through a charge-degeneracy point. In my talk, I will present our most recent data and discuss the implications for the development of QEMS.

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