

## Qubit-Coupled Nanomechanics

Matt LaHaye  
Assistant Professor  
Department of Physics  
Syracuse University, USA

In this talk, I will report on our measurements of a novel nanoelectromechanical system in which the flexural motion of a nanomechanical structure is coupled to the charge degree of freedom of a superconducting charge qubit. I will discuss how the interaction with the charge qubit produces a shift in the frequency of a flexural mode of the mechanics that depends on the state of the qubit and is similar to the single-atom phase shifts experienced by electromagnetic resonators in the dispersive limit of cavity quantum electrodynamics (CQED). Results will be shown that demonstrate the use of this dispersive shift for performing spectroscopy and read-out of quantum interference effects in the qubit. I will also present recent results in which we utilize the dispersive interaction to provide phase-sensitive amplification of the nanomechanical resonator's motion. In the end, I will discuss the prospects for implementing this qubit-coupled system in more advanced measurement protocols to manipulate and probe quantum states of nanomechanical devices.