Physical Sciences Seminar

Phonon-number squeezing beyond the classical limit

Jeremie Viennot
CNRS Paris

Host: Andrew Higginbotham

Low frequency massive mechanical oscillators are extremely sensitive detectors of force and strain, and their performances could now be pushed further by preparing them into quantum states. However, the linear parametric coupling of these oscillators to microwave and optical light has been so far insufficientto prepare them into quantum states. To go beyond the limitations of such linear coupling schemes, we quadratically couple the displacement of a 25 MHz oscillator to a superconducting qubit with a 4 GHz transition frequency [1]. This quadratic interaction enables direct control over the oscillator's energy distribution. We squeeze this distribution by adiabatically adjusting dissipative reservoirs corresponding to driven qubit-oscillator sideband transitions. The large coupling strength between the qubit and the oscillator places the system in a dispersive ultra-strong coupling limit at large phonon numbers. We explore this new limit and we demonstrate the preparation and detection of non-classical states, characterized by a large mean phonon number and a comparatively small variance in phonon distribution [2]. These sub-Poissonian states could potentially be used to enhance the sensitivity of force detection. [1] J. J. Viennot et al., Phys. Rev. Lett 121 (18), 183601 (2018)[2] X. Ma et al. (in preparation)

Tuesday, November 19, 2019 11:00am - 12:00pm
Heinzel Seminar Room / Office Bldg West (I21.EG.101)

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