



## 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 insufficient

to 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**

IST Austria Campus Heinzl Seminar Room / Office Bldg West (I21.EG.101)



This invitation is valid as a ticket for the IST Shuttle from and to Heiligenstadt Station. Please find a schedule of the IST Shuttle on our webpage: <https://ist.ac.at/en/campus/how-to-get-here/> The IST Shuttle bus is marked IST Shuttle (#142) and has the Institute Logo printed on the side.