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Title of the lecture:
Quantum dynamics of driven mesoscopic vibrational systems

Format:
TBA

Contents & Summary
Mesoscopic vibrational systems are studied in quantum cavity and circuit electrodynamics, quantum optomechanics, nanomechanics, and cold atom physics. The black-board lectures are intended to provide an introduction to some features of the dynamics of such systems in a moderately strong periodic field.

Lecture 1. The Floquet dynamics of an isolated nonlinear vibrational system for resonant and parametric driving. Symmetry, geometric phase, exact and approximate eigenstates. Dissipation in the Floquet world: old and new channels and what causes transitions between the Floquet eigenstates.

Lecture 2. Squeezing in the classical and quantum domain and how to detect it. Quantum heating and quantum activation phenomena, including switching of driven quantum vibrational systems between metastable vibrational states. Scaling of the switching rates.

Lecture 3. A brief overview of quantum optomechanics: heating, cooling, and excitation of vibrational systems by a field that creates new dissipation channels. Beyond conventional processes: the resonantly induced friction force. Onset of a frequency comb in a single-mode system.

Lecture 4. Nonlinear resonant phenomena in coupled vibrational modes. The limits of weak dissipation and of significantly different dissipation rates. Spectral manifestations. The ringdown dynamics.

Lecture 5. Quantum phase transition in dissipative and conservative coupled vibrational systems. The time crystal effect: what is old and what is new.