北京大学量子材料科学中心
International Center for Quantum Materials, PKU

Seminar
Classical and Quantum Effects in Cavity Optomechanics

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Time: 10:30am, Feb. 20, 2014 (Thursday)
时间：2014年2月20日（周四）上午10:30
Venue: Room 607, Science Building 5
地点：理科五号楼607会议室

Abstract

The field of cavity optomechanics studies interaction between laser light inside a high quality optical resonator (e.g. optical cavity) and the motion of a highly compliant mechanical oscillator (e.g. a millimeter-sized cantilever). It is a rapidly emerging field, as it can be a test bed for fundamental quantum mechanics, particularly the boundary between classical and quantum mechanics. In this talk, I will present our recent results measured with a state-of-the-art cavity optomechanics device operating at 500 mK. This device has unique advantages over conventional optomechanical devices, as it can provide nonlinear optomechanical coupling in addition to the more typical linear interaction. In cavity optomechanics, linear optomechanical interaction has been used to laser-cool the motion of mechanical oscillators. On the other hand, nonlinear interaction has been proposed to study more striking quantum effects in mechanical oscillators such as measuring its quantized energy states and observing quantum jumps between them. The linear coupling combined with cryogenics and resolved-sideband laser cooling enables us to cool the mechanical motion close to its quantum ground state. Upon this cool down procedure, we have observed a strong asymmetry in the mechanical sidebands which is a signature of quantum phenomena in mechanical oscillators. Furthermore, we have demonstrated a nonlinear optomechanical interaction with a thorough characterization of its dynamics and full comparison with a theoretical model. As an intermediate step for realizing the aforementioned proposals, we have also demonstrated a classical analog of a quantum nondemolition measurement of photons.

About the Speaker

-Born in South Korea
-Undergraduate study at Pohang University of Science and Technology (POSTECH), South Korea
-Graduate study at Ohio State University, USA, low temperature scanning tunneling microscopy on single magnetic dopants in semiconductors
-Postdoctoral research at Yale University, USA, cryogenic cavity optomechanics