Friday- March 27, 2015

12:00 to 1:00 p.m.

BECTON SEMINAR ROOM

Light lunch will be served at 11:45 a.m.

Ryan Behunin

Department of Applied Physics, Yale University

"Manipulating Disorder-Induced Defect States to Achieve Low Loss Modes”

Disorder induced defect states are virtually impossible to avoid in systems ranging from acoustic wave resonators to superconducting cavities. At cryogenic temperatures, such defect states pose a barrier to the realization ultra-long lived coherent excitations at microwave-frequencies, crucial for classical and quantum information processing. These defects can interact with a variety of fields (e.g. electromagnetic, acoustic, etc.), absorbing and emitting quanta in much the same way that atoms interact with light. Due to thermal occupancy of quantized energy levels, defect-induced attenuation increases sharply at cryogenic temperatures, stifling the ability to achieve ultra low-loss modes with ground state occupancy. In this talk I will describe experimental and theoretical studies of phonon-active defect states in silica, and discuss techniques to mitigate defect-induced losses. We generate intense phonon fields and interrogate their effect on the ensemble of defects within a fiber optic acoustic waveguide using optical methods. We show that defect-induced dissipation can be manipulated using a strong phonon drive field proximal to frequencies of interest. Our observations, combined with a survey of past experimental studies, indicate that phonon lifetime enhancements by many orders of magnitude are possible in silica. Hence, ostensibly lossy amorphous media (which are among the most superb optical materials) can be transformed into low-loss phononic media. While these studies are carried out in the phononic domain, our findings are quite universal, with implications to cavity optomechanics and superconducting resonators.

Xufeng Zhang

Department of Electrical Engineering, Yale University

"Magnon-Photon Hybridization and Gradient Memory"

Despite the dominant role of electrons and photons as information carriers, magnons--the collective spin excitations--have emerged as a very promising candidate and attracted intensive attention recently. Among all the magnon media, yttrium iron garnet (YIG) distinguishes itself for its extremely low spin damping which leads to a very long coherence time for the magnon. In this talk, I will discuss the coherent interaction between magnon and microwave photon in a hybrid system containing a three dimensional microwave cavity and a YIG sphere. The large spin density in YIG, which significantly enhances the magnetic dipolar interaction between the magnon and the microwave photon, allows us to achieve strong and even ultrastrong magnon-photon coupling. Other coherent interactions, such as magnetically induced transparency and Purcell effect, have also been achieved, showing the great flexibility of our system. Such magnon-photon coupling provides us new possibilities of manipulating cavity photons, with which we successfully demonstrated a novel magnon gradient memory that can store information in the magnon dark modes with high efficiency. Our results is a crucial step toward utilizing magnon as a information transducer to interconnect different systems including microwave, optics and mechanics.

HOST: Paul Fleury