The MARCO FENA Center is proud to present its student-hosted tutorial series featuring

PHONON ENGINEERING IN HETEROGENEOUSLY INTEGRATED SILICON/CARBON-BASED NANOSTRUCTURES

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THURSDAY, OCTOBER 26TH - 12:00PM
BOELTER PENTHOUSE- 8500 BOELTER HALL
LUNCH SERVED

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Phonons, i.e. quanta of lattice vibrations, manifest themselves practically in all electrical, thermal, optical and noise phenomena in semiconductors and other material systems. Reduction of the feature size of electronic devices to the nanometer scale creates a new situation for the phonons propagation and interaction. From one side, it may complicate heat removal from the downscaled electronic and optoelectronic devices. From the other side, it opens up an exciting opportunity for engineering phonon spectrum in nanostructures and achieving enhanced operation of nanodevices.

In this talk I will review our recent results pertinent to the acoustic and optical phonons in nanostructures and nanodevices. Specifically, I will focus on the methods of the room-temperature electron mobility enhancement in silicon nanowires embedded within the acoustically hard material such as diamond. The electron mobility in the silicon/diamond hetero-nanowires can be made two orders of magnitude higher at 10 K and a factor of two higher at room temperature than the mobility in a free-standing silicon nanowire. The importance of this result for the downscaled architectures and possible silicon-carbon nanoelectronic devices is augmented by an extra benefit of diamond, a superior heat conductor, for thermal management. Experimental thermal data for the electrically conducting and insulating nanodiamond films on silicon and silicon/diamond-like carbon heterostructures will also be discussed.