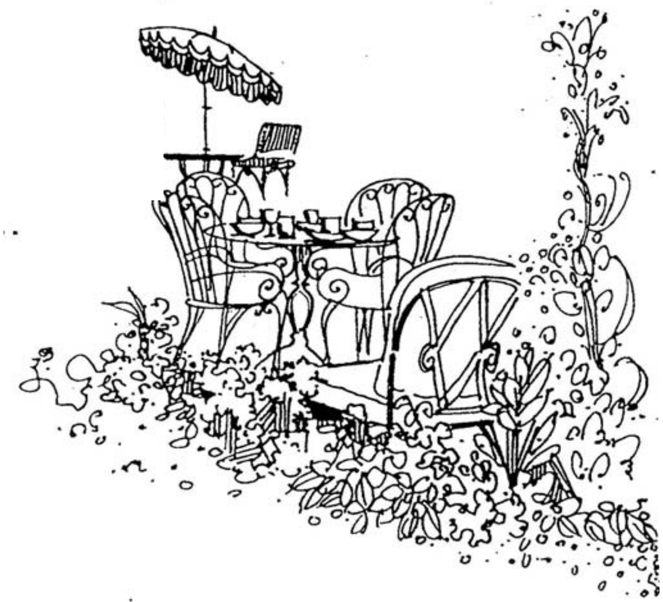
Chez Pierre

Presents ...

Monday, December 15, 2008
12:00pm
MIT Room 4-331



Jun Yan

Columbia University

"Raman Spectroscopy Study of Electron and Phonon Structures in Graphene Thin Films"

Graphene is an isolated carbon atomic layer which hosts bipolar chiral charge carriers. In this 2D crystal, the electronic excitations and lattice vibrations are coupled together. We use the electric field effect and low temperature Raman spectroscopy to study these interaction effects by gate modulation of the long wavelength optical phonon, known as the G-band.

The life time of the G-band phonon is found tunable by turning on and off with a gate electrode a phonon-decay channel, in which the phonon is annihilated by creating an electron-hole pair across the Dirac point. The G-band energy evolution with charge doping reveals a phonon anomaly due to a resonant coupling of electron-hole pair transitions with the phonon mode. The phonon anomaly is expected in both monolayer and bilayer graphene. Experimentally, however, it was observed so far only in the bilayer.

Upon turning on a magnetic field, the G-band phonon interacts with the Landau levels transitions. Our on-going experimental results in graphite show that the G band displays a rich line shape evolution as the magnetic field is finely tuned between 4 and 7 Tesla. Preliminary analysis suggests that the anticrossing of the phonon band with the inter-Landau level transitions results in a mode-splitting of the phonon. The evolution of the energy and spectral weight of the two coupled modes indicates that the phonon may serve as a sensitive probe for the unique Landau level structures in graphene-related materials.