18:30
O&S 1

Optical Spectroscopy of Individual Single-Walled Carbon Nanotubes

Tony Heinz
Columbia University

In this talk, we describe recent experimental investigations of optical spectroscopy at the level of an individual nanotube. The principal experimental method has been Rayleigh scattering (elastic scattering) spectroscopy, an approach suitable for probing both semiconducting and metallic nanotubes. Recent measurements include a direct determination of the correlation between optical spectra and nanotube chiral index, as achieved through a combination of Rayleigh scattering measurements and electron diffraction on individual nanotubes; investigation of the influence of the local environment on nanotube electronic spectra, notably the effect of the formation of small nanotube bundles; a determination of the shifts in the electronic transitions induced by controlled axial strain applied to individual nanotubes; investigations of the mechanical properties of individual nanotubes of defined chiral index; and the identification and electrical characterization of nanotubes with spontaneous changes in structure along their length. (These investigations were carried out in collaboration with the groups of Profs. Louis Brus, James Hone, and Stephen O'Brien at Columbia University and the group of Dr. Yimei Zhu at Brookhaven National Lab.)

19:00
O&S 2

Excitons in Carbon Nanotubes: Insights from Model Calculations

Rodrigo Capaz
Instituto de Fisica, Universidade Federal do Rio de Janeiro

We review our recent work on excitons in carbon nanotubes. In particular, we address the usefullness and limitations of model calculations of exciton properties. A We review our recent work on excitons in carbon nanotubes. In particular, we address the usefulness and limitations of model calculations of exciton properties. When parametrized by ab initio calculations and constrained to reproduce the proper exciton symmetries, variational tight-binding schemes can be extremely useful to obtain the diameter and chirality dependences of excitonic properties. Binding energies and spatial extents show a leading dependence on diameter as $1/d$ and d, respectively, with chirality corrections exhibiting strong family behavior. Bright-dark exciton splittings show a $1/d^2$ leading dependence. Such dependences can be described by simple analytical formulas that should be useful to guide future experiments. We also address the limitations of model 1D potentials in describing the ground and excited states of excitons in carbon nanotubes.

19:30
O&S 3

Growth and Optical Properties of Small-Bundled Vertically Aligned Single-Walled Carbon Nanotubes

Shigeo Maruyama
Department of Mechanical Engineering, The University of Tokyo

A new insight is gained on the structure of the vertically aligned single-wall carbon nanotubes (VA-SWNTs) generated by ACCVD technique [1]. Our recent finding of the simple removal method using hot-water enabled us to transfer this film to various flat substrates [2]. Transferring this film on TEM grid made it possible to directly observe the morphology of nanotubes from the top. To our surprise, the average number of nanotubes of a bundle is less than about 10. Electronic properties measured by EELS revealed that nanotubes are virtually electronically isolated. Then, the characteristic resonant Raman features are reconsidered. The high resolution Raman measurements show the sharp features for the RBM peak which have been assigned to cross-polarized resonance [3]. The isolated and cross-polarized absorption resonance in Raman will be discussed based on the recent identification of the excitonic cross-polarized absorption through photoluminescence spectroscopy [4].

[1] S. Maruyama, E. Einarsson, Y. Murakami, T. Edamura, Chem. Phys. Lett. 403 (2005) 320.
[2] Y. Murakami, S. Maruyama, Chem. Phys. Lett. 422 (2006) 575.
[3] Y. Murakami, S. Chiashi, E. Einarsson, S. Maruyama, Phys. Rev. B 71 (2005).
[4] Y. Miyauchi, M. Oba, S. Maruyama, Phys. Rev. B 74 (2006).