Tuning the Electronic Properties of Carbon and BN Nanotubes - S.G. Louie (University of California at Berkeley)

Theoretical studies of the electronic structure and related properties, such as the quantum conductance, of different nanotubes and nanotube structures are presented. Systems examined include carbon and BN nanotubes, tubes with defects, junctions, and hybrid structures (e.g., the nano-peapods). The transport properties of various carbon nanotube systems are investigated in terms of the electronic structure of the underlying geometric structures. A rich interplay between their structural and electronic properties gives rise to new phenomena and potential for device applications. The effects of structural deformation and external field (e.g., that from a gate voltage) on the electronic properties of the insulating B-C-N nanotubes are also explored. Theory predicts that a large mechanical deformation or strong static electric field perpendicular to the axis of the BN nanotubes can induce a large reduction in the value of the band gap, changing these tubes from large-gap insulators to semiconductors to metals. Also, with the report of observation of superconductivity, there is now considerable interest in the structure and electronic properties of the very small diameter carbon nanotubes.