Nano Carbon: From Solar Cells to Atomic Drums

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Abstract:
Graphene is the world’s first atomic membrane, a robust, one-atom thick freestanding layer of sp2-bonded carbon. Graphene membranes are strong but highly flexible, with bending stiffness comparable to a lipid bilayer but stretching stiffness similar to diamond. Meter-scale polycrystalline graphene films can now be produced cheaply and easily, opening the door to applications in both science and technology. Equally fascinating are carbon nanotubes -- nanometer-diameter cylinders of graphene. These make great 1D transistors, diodes, and even nanoguitar strings.

In this talk we will present new results on the structural, optoelectronic, and physical properties of nanotubes and graphene. Topics include the first STEM images of graphene grain boundaries and the patchwork-quilt-like structure of graphene grains. We also discuss experiments on graphene atomic drums that can be “played” either electrically or optically. Finally, we will present ultrafast measurements of photocurrent in both nanotube and graphene p-n junctions. These experiments probe the fundamental excitation, relaxation, and transport processes that are key to applications ranging from graphene photodetectors to ultra-efficient nanotube solar cells.