QPhysics AT QUEENS COLLEGE

Colloquium Notice

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The Fascinating Physics and Applications of Plasmonic Materials and Metamaterials

Plasmonics has opened the possibility to strongly enhance light-matter interaction at the nanoscale, opening new opportunities to manipulate and confine light at dimensions unthinkable only a few years ago. Plasmonic nanostructures can enhance weak optical responses and nonlinear optical effects, and can serve as information carriers for the next-generation of heavily integrated nanophotonic systems. Optical metamaterials formed by large arrays of subwavelength plasmonic nanostructures can open even more exciting scenarios, by exploiting the collective coupling interaction among many nanoinclusions to realize bulk optical properties that cannot be found in nature, such as a negative optical index of refraction. In my talk,I will describe our recent research efforts on optical nanoantenna arrays and optical metamaterials, studying their exciting physics and their practical use and application in highly-efficient thermoelectric and thermophotovoltaic solar cells, photothermal therapy and nanoscale nonlinear optical processes, including wave mixing, harmonic generation, phase conjugation and optical bistable effects. In addition, I will discuss how the extreme local field enhancement around nanoantennas can benefit ultrafast photon-assisted field emission processes, optical heterodyne terahertz (THz) generation and multiple-photon photoemission from nano-emitters, enabling compact, low-cost, low-power THz generation, free-electron lasers and X-ray sources. I will also discuss how the anti-phase polarization of a plasmonic coating may be used to realize invisibility and transparency effects. As an extreme case of light manipulation at the "atomic" scale, I will discuss the collective oscillation of massless Dirac fermions inside grapheme monolayers, in which surface plasmon polaritons may be controlled by the graphene's tunable surface conductivity using electrostatic gating. I will conclude my talk discussing active and tunable THz nanodevices and nanocircuits, and graphene-based THz metamaterials.

Wednesday
February 13, 2013
Starts at 12:15 PM
Coffee at 12:00 PM
Physics Conference Room, SB B326