QPhysics
AT QUEENS COLLEGE

Colloquium Notice

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Metamaterials: Shrinking Circuit Elements and Nano-optics

Metamaterials are engineered composite media with unconventional electromagnetic and optical properties. They can be formed by embedding sub-wavelength inclusions as "artificial molecules" in host media in order to exhibit specific desired response functions that are not readily available in nature, but physically realizable. These metamaterials have exciting characteristics in manipulating and processing RF, microwave, IR and optical signal information. In my group, we have been investigating various features of these media and have been developing some of the fundamental concepts and theories and modeling of wave interaction with a variety of structures and systems involving these material media. From our analyses and simulations, we have found that the devices and components formed by these media may be ultracompact and subwavelength, while supporting resonant and propagating modes. This implies that in such structures RF, microwave, IR and optical signals can be controlled and reshaped beyond the diffraction limits, leading to the possibility of miniaturization of optical interconnects and design and control of near-field devices and processors for the next generation of information technology. This may also lead to nano-architectures capable of signal processing in the near-field optics, which has the potential for significant size reduction in information processing and storage. Furthermore, the nanostructures made by pairing these media can be compact resonant components, resulting in either enhanced wave signatures and higher directivity or in transparency and scattering reduction. We are also interested in nano-optics of metamaterial structures that effectively act as "lumped nano-circuit-elements". These may provide nano-inductors, nano-capacitors, nano-resistors, and nanodiodes as part of "field nanocircuits" in the optical regimes or optical-field nanoelectronics--, and can provide roadmaps to more complex nanocircuits and systems formed by collection of such nanostructures. All these characteristics may offer various potential applications in high-resolution near-field imaging and microscopy, enhancement or reduction of wave interaction with nano-particles and nano-apertures, nanoantennas and arrays, far-field sub-diffraction optical microscopy (FSOM), nano-circuit-filters, optical data storage, nano-beam patterning and spectroscopy, optical-molecular signaling and optical coupling and interfacing with cells, to name a few

Notes: *Wednesday talk*

Wednesday
October 25, 2006
Starts at 12:15 PM
Coffee at 12:00 PM
Physics Conference Room, SB B326