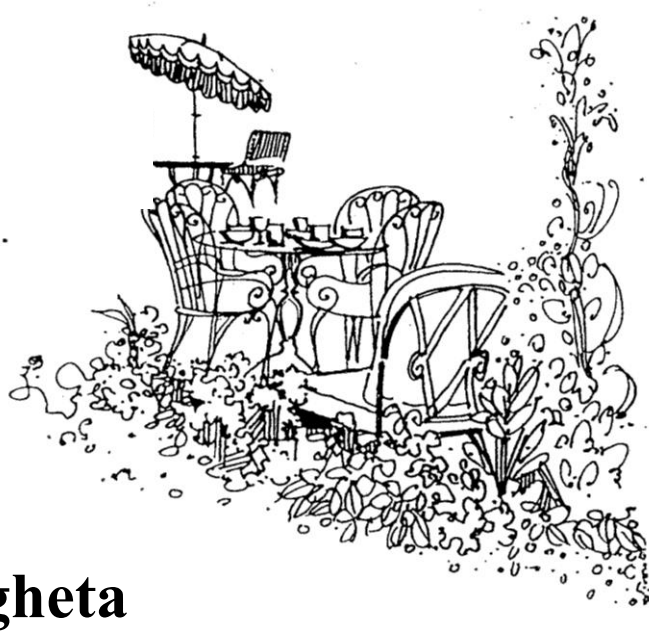
Chez Pierre

Presents ...

Monday, May 14, 2012
12:00pm
MIT Room 4-331



Nader Engheta
University of Pennsylvania

"Of Light, Electrons, and Metastructures"

Metamaterials and Plasmonic optics provide mechanisms for controlling and taming light and electrons in unprecedented ways. In my group we are exploring various features and characteristics of these concepts and investigate new classes of applications such paradigms may provide. Some of the features of interest include nonlinearity, anisotropy, chirality, non-reciprocity, and non-locality. We have been developing the concept of "optical metatronics", i.e. metamaterial-inspired optical nanocircuitry, in which the three fields of "electronics", "photonics" and "magnetics" can be merged together. In such a paradigm, the concept of metamaterials and plasmonics optics can be exploited to bridge the gaps among these fields, to modularize, standardize, and parameterize some of the optical and electronic phenomena, and to transplant concepts from one field into another. In this unified platform of optical metatronics, the nanostructures with specific values of permittivity and permeability may act as the optical lumped circuit elements at the nanoscale, analogous to the circuit elements in RF electronics. Nonlinearity in metatronics can also provide us with novel optical nonlinear lumped elements. Optical nanoantennas can link the "macroworld" with such optical metatronics. We have been investigating the concept of metatronics through extensive analytical and numerical studies, computer simulations, and a set of experiments at the IR wavelengths. We have also been exploring how metamaterials can be exploited to control the flow of photons, analogous to what semiconductors do for electrons, providing the possibility of one-way flow of photons. We are now extending the concept of metatronics to other platforms such as graphene as a new paradigm for metatronic circuitry and also as one-atom-thick metamaterials and one-atom-thick transformation optical devices. I will present an overview of our most recent results from a sample of these topics and discuss future directions and potentials.