SEMINARY NOTICE

Preston M. Green Department of Electrical and Systems Engineering

Engineering Nanoscale Photonic Functionalities with Active Metamaterials and Plasmonic Absorbers

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Abstract: Nanophotonics, the emerging field of photon-material interactions at the nanoscale, poses many challenges and opportunities for researchers engineering materials with subwavelength features. Plasmonic nanostructures and metamaterials exhibit optical properties not seen in conventional photonic materials and enable focusing, guiding, bending, and absorbing photons at the nanoscale. They are poised to revolutionize a broad range of applications including energy, communications, defense and sensing.

In this seminar, I will describe the design, nanofabrication and optical characterization of engineered nanophotonic materials that enable controlled and enhanced photonic functionalities. First, I will introduce frequency-tunable, hybrid infrared metamaterials, in which a dynamic optical response is achieved via a thermally induced phase transition in vanadium dioxide (VO$_2$) nanostructures. I will also present how the mechanical actuation of flexible polymers can be used to control the nanoscale distances between coupled metallic resonators, in turn enabling frequency-tunable, compliant optical metamaterials. Such reconfigurable nanophotonic materials significantly enhance the infrared reflection signal from a C-H vibrational mode, and could find use in bio-chemical sensing and environmental screening applications. Finally, ultrathin, polarization-insensitive, broadband plasmonic super absorbers capable of absorbing light over the entire visible spectrum will be demonstrated. These uniquely shaped plasmonic nanostructures could be utilized in solar energy conversion applications for efficient light-trapping and photon management in photovoltaic and thermophotovoltaic cells.

Monday, February 28, 2011
11:00 a.m.
Bryan Hall, Room 305
Host: Dr. Arye Nehorai

Short Bio: Koray Aydin is currently a research scientist in Applied Physics and Materials Science, and the Assistant Director of DOE Light-Material Interactions Energy Frontier Research Center at the California Institute of Technology. Dr. Aydin’s research in the group of Prof. Harry Atwater has focused on the experimental and theoretical investigation of active optical metamaterials and functional plasmonic nanostructures, and motivated towards applications of such nanophotonic materials in solar energy conversion, optical communications, defense and environmental screening. He received his Ph.D. degree in 2008 from the Department of Physics at Bilkent University, Turkey under the supervision of Prof. Ekmel Ozbay. During his PhD, he studied novel electromagnetic phenomena, such as negative refraction, subwavelength imaging, and enhanced transmission, in microwave metamaterials and photonic crystals. Koray Aydin is a member of the professional societies of MRS, APS, SPIE, and OSA and the recipient of 2007 SPIE Educational Scholarship.