Extending the Photonics Toolbox with Plasmonic Super Absorbers and Active Optical Metamaterials

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Plasmonic nanostructures and metamaterials are poised to revolutionize optical engineering by overcoming fundamental challenges in optical materials. Dr. Aydin will first introduce ultrathin plasmonic super absorbers consisting of reflective metals and transparent dielectric and enabling broadband, polarization-independent resonant light-absorption. Plasmonic super absorbers could find applications for light harvesting and photon management in photovoltaic and thermophotovoltaic cells. Then, Dr. Aydin will present the first experimental demonstration of active infrared metamaterials composed of hybrid metal-vanadium dioxide (VO₂) split-ring resonators. Drastic changes in the optical properties of VO₂ with the phase transition enable control over the transmission and reflection properties of nanophotonic structures. Finally, Dr. Aydin will introduce tunable, stretchable optical metamaterials that enable resonant line-width tuning and amplitude modulation of metamaterial and Fano resonances upon applying mechanical actuation to the polymeric metamaterial. This device is the first mechanically tunable metamaterial in the near infrared, where modifying the distance between coupled resonator elements drastically changes the resonance frequency by a line-width (~400 nm). At the end, Dr. Aydin will propose reconfigurable bio-sensors that relies on the active control of the metamaterial substrates for field-enhanced infrared absorption spectroscopy.

Koray Aydin is currently a postdoctoral research scholar in Applied Physics at California Institute of Technology. Dr. Aydin’s research in the group of Harry Atwater has focused on the experimental and theoretical investigation of active plasmonic nanostructures and metamaterials and their applications in solar energy conversion and bio-sensing. He received his Ph.D. degree in Physics from the Department of Physics at Bilkent University, Ankara, Turkey under the supervision of Ekmel Ozbay. During his PhD, he investigated the novel electromagnetic phenomena, such as negative refraction, superlensing and enhanced transmission, in microwave metamaterials and photonic crystals. Dr. Aydin has authored more than 45 SCI-Index journal publications that are cited more than 1300 times. He is a member of the professional societies of OSA, APS, IEEE, MRS and SPIE and the recipient of 2007 SPIE Educational Scholarship.

Seminar is in EEB 248 at 1 PM on Thursday, Nov. 11.

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