

# Nanophotonics in the Flatland: Engineering Novel Photonic Platforms from 2D Materials to Metadevices and Metamaterials

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## Abstract

Nanophotonic materials and devices facilitate strong light-matter interactions at subwavelength scales, thus providing unique opportunities to control and manipulate photons. In this talk, I will present novel approaches in controlling light-matter interactions at the nanoscale. I will discuss visible frequency metasurfaces broadband phase control and anomalous reflection, spectrum splitting using metallic metasurfaces enabled by phase engineering at the subwavelength scale. I will also present two different approaches for obtaining narrow-band resonant absorption filters at visible wavelengths. First structure is based on the surface lattice resonances in periodic nanowire and nanoring arrays fabricated on a reflecting metallic substrate. Enhanced photoluminescence enhancement from a single monolayer MoS<sub>2</sub> via plasmonic nanostructures will also be discussed. 2D layered materials received great attention due to their unique optical, electrical and mechanical properties however, due to their thickness light-matter interactions is rather weak. We utilize plasmonic nanostructures to strongly enhance electric fields locally at subwavelength scales therefore facilitating increased light emission and absorption in 2D semiconducting materials. Finally, I will present inverse-designed broadband electromagnetic metadevices that can bend and focus light using thin polymeric structured metamaterials at millimeter-wave and optical frequencies.

## Short Biography

Prof. Koray Aydin is an Assistant Professor in the Electrical Engineering and Computer Science Department at Northwestern University and leading the Metamaterials and Nanophotonic Devices Laboratory. He has received his B.S. and Ph.D. degrees in Physics from the Bilkent University in 2002 and 2008, respectively. He worked as a postdoctoral researcher between 2008-2010 and a research scientist between 2010-2011 at the California Institute of Technology under the supervision of Prof. Harry Atwater. His research interests are in the general area of nanophotonics, with a specific focus towards the realization of nanophotonic devices for use in energy conversion, optoelectronic device and sensing applications. Dr. Aydin received the prestigious 2017 ONR Young Investigator Program Award. He is an Associate Member of the Turkish Academy of Sciences and also the recipient of the SPIE Educational Scholarship in 2007.

