Gate-tunable Conducting Oxide Epsilon-near-zero Metasurfaces with Active Nonlinear and Quantum Responses

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Abstract

The optical response of epsilon-near-zero (ENZ) materials has been a topic of significant interest in the last few years as the electromagnetic field inside media with near-zero permittivity has been shown to exhibit unique optical properties, including strong electromagnetic wave confinement, non-reciprocal magneto-optical effects, and abnormal nonlinearity. These ultrathin ENZ materials are promising for the enhancement of quantum emission for optical sensing and enhanced absorption/emittivity for energy harvesting.

This talk will review our recent development on a gate-tunable conducting oxide epsilon-near-zero metasurfaces [1-5]. I will present our recent development on the use of gate-tunable materials, transparent conducting oxides, to demonstrate an electrically tunable ultrathin ENZ perfect absorber enabled by the excitation of ENZ modes. In addition, I will present the active control of emissive properties of quantum emitters and enhanced optical nonlinearity in hybrid ENZ-plasmonic heterostructures.

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