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New Frontiers in Plasmonics: Embedded Eigenstates and Topological Effects

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The field of plasmonics, or metal optics, has enabled great advances in our ability to control electromagnetic fields at the subwavelength scale, and in realizing anomalous and extreme electromagnetic effects, including, for instance, transparency and invisibility, sub-diffractive resonances and light guiding, as well as enhanced absorption, nonlinearities, and quantum effects.

In this talk, we will present our recent efforts on two particularly exciting research directions in the field of plasmonics: (i) Extreme light confinement and trapping based on the concept of *embedded eigenstates*, or bound states in the continuum, in open plasmonic cavities and waveguides. In this context, we will discuss our recent work on unveiling the properties of these non-radiating eigenmodes, which exist in engineered open resonant structures based on plasmonic layers operating in their epsilon-near-zero regime (F. Monticone, et al., "Trapping Light in Plain Sight: Embedded Photonic Eigenstates in Zero-Index Metamaterials", in press, 2018). (ii) *Topologically-protected leaky surface plasmons* on magnetized plasmonic structures. We will discuss the possibility of controlling the radiation, scattering, and guiding properties of plasmonic-based photonic topological insulators, with the goal to provide seamless bridging between free-space propagating waves and one-way topological surface waves on complex bodies (A. Hassani and F. Monticone, "Topologically-Protected One-Way Leaky Waves in Nonreciprocal Plasmonic Structures", *Journal of Physics: Condensed Matter*, in press, 2018). If time permits, we will also highlight some surprising connections between embedded eigenstates and topological properties.

We believe that these findings may open new intriguing scenarios in the field of plasmonics, and may stimulate further theoretical studies and experimental efforts in this exciting area of science and technology.