Plasmon Resonances in Photonic Chiral Metamaterials

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Abstract: We report on the development of photonic 2D- and 3D-chiral meta-materials with intriguing properties including giant rotary power and asymmetric transmission which are due to the excitation of chiral and enantiomeric sensitive plasmons.

OCIS codes: (999.9999) Chirality and optical activity; (999.9999) Metamaterials

The ability to rotate the polarization state of light (gyrotropy) by chiral molecules is one of the most fundamental phenomena of electrodynamics. The recent explosive increase in interest in gyrotropic media is driven by an opportunity for the development of negative index metamaterials, where simultaneous electric and magnetic responses of gyrotropic structures are required to achieve negative refraction.

The concept of chirality also exists in two dimensions and is essentially different in symmetry from three-dimensional chirality. For 3D-chiral structures the sense of perceived rotation remains unchanged for opposing directions of observation, while planar chiral structures possess a sense of twist that is reversed when they are observed from opposite sides. This leads to some interesting electromagnetic properties asymmetric with respect to the direction of light propagation.

This paper reports first results on the development of low-dimensional (planar and layered) photonic 2D- and 3D-chiral meta-materials and to the study of enantiomeric sensitive and chiral plasmon excitations it these structures.

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