Taming light at the nanoscale with metamaterials

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Abstract:

Structured materials with unusual electromagnetic properties have received much attention after some influential works demonstrated that by introducing a new length scale in conventional metals and dielectrics – by tailoring the microstructure – it is possible to radically modify the electromagnetic response.

In this talk, I will present an overview of our research work on electromagnetic metamaterials and plasmonics, and discuss the unusual potentials of media with near zero permittivity, materials with a chiral response, and materials with anomalous dispersion. In particular, I will explain how low loss plasmonic materials may offer the opportunity to have light localization in open bounded systems with infinitely long oscillation lifetimes and no radiation loss [1]-[2]. Moreover, I will show how chiral light may be used to harness the sign of optical forces, forcing a material body to be pulled towards a direction opposite to the photon flow (optical tractor beam). Finally, time permitting, I will discuss how by controlling the topology of a metamaterial it is possible to engineer the material dispersion and create reverse rainbows [3]-[5]. It is envisioned that these materials may useful for the design of improved optical instruments insensitive to chromatic aberrations.

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