Metamaterials beyond common multipoles

Alexey Basharin
Institute of Photonics, University of Eastern Finland, Joensuu, Finland
Alexey.basharin@uef.fi

Multipole decomposition is a promising method for study of radiating or scattering response of electromagnetic sources or particles, even in the case of relatively complicated and compound scatterers like multilayer particles, clusters or asymmetrical systems. Indeed, the radiation fields of point electric or magnetic sources are decomposed only into electric or magnetic dipole moments, while real sources can be described by series of multipoles, including higher multipoles, toroidal moments and moments of mean-square radii. In this talk, we discuss the concept of modified multipoles describing the real sources of electric, magnetic and more complicated toroidal types. We discuss the secondary multipole decomposition for explanation of light interaction with compound particles, asymmetrical particles. We discuss high Q-factor resonances in metamaterials and meta-particles due to interference effects, like anapole mode, Kerker effects and Bound state in the continuum. Our approach will be useful for multipole analysis of complex systems in photonics such as nanoparticle clusters, metamaterials and nanoantennas and hybrid systems based on plasmonic/all-dielectric/carbon structures.

Acknowledgement.

This work was supported by H2020 RISE 734164 Graphene 3D