Resonant Bright and Dark modes on Plasmonic Nanoscatterers: Characteristic Modes for Platonic Solids

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Extented Abstract

The optical properties of nanoscatterers have generated increasing research interest due to the recent advances in nanotechnology. A particularly interesting case of nanoscatterers are the plasmonic nanostructures, i.e., particles that support localized charge oscillations, referred also as surface plasmons [1]. Strongly coupled resonances with the incident field are often characterized as *bright*, while their weakly coupled counterparts as *dark* plasmonic modes, respectively [2, 3]. Therefore, it is of great importance to understand the underlying, non-trivial, physical mechanisms and their scattering characteristics. At the same time the modeling and optimization of such structures require the development of accurate and reliable numerical methods.

In this presentation we describe how the theory of characteristic modes (TCM) will be implemented for the theoretical study of the supported eigenstates by resonant plasmonic nanostructures [4]. Specifically, the shape family of regular Platonic solids will be investigated [5]. A conventional surface integral equation (SIE) method will be used as a way to verify and explore the bright–dark scattering features of the particles.

Briefly, TCM provides excitation-independent eigenmodes, affected by the material and morphological characteristics, and describe the possible physical eigenstates supported by the structure [6]. On the complementary side, SIE provides results about the scattering spectrum for a given excitation. Proper usage of both TCM and SIE enable the study of more realistic structures such as the tetrahedra, hexahedra, octahedra, dodecahedra and icosahedra, i.e., Platonic solids. In this way the necessary intuition is obtained towards their implementation for application oriented purposes.

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