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Light at the nanoscale: morphology-dependent optical properties of nanoparticles

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ABSTRACT

Metal nanoparticles (NPs) exhibit remarkable physical and chemical properties which are morphology-dependent. Particular interest has been paid in their surface plasmon excitations that play an important role in fluctuation-induced interactions. At the nanoscale, this physical property conducts to new phenomena because these surface plasmon resonances are localized and consequently they enhance the near electromagnetic field. This latter can be important for controlling the interaction among diverse nanostructures. Nowadays, nested nanoparticles (NNP) can be reproducibly synthesized in various geometries of increasing complexity. NNP exhibit versatile plasmonic properties such as size- and geometry-dependent resonance tuning and near field enhancement, thus exploring these properties is of considerable interest for sensors.
In this presentation, we discuss surface plasmon in metal NPs, their localization and the electromagnetic field enhancement of such plasmons. We present an exhaustive study of NNP of different sizes and shapes and the geometry-dependence of important factors such as light scattering and absorption, near field enhancement and radiative effects. Our calculations are based on a numerical implementation of the Finite-Difference Time Domain method and include finite size corrections of the dielectric functions of the materials involved.