

Exploring the world at the nanoscale: an all-optical investigation

Introduce:

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Interviene:

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Abstract

Nanosized materials, as compared to their bulk counterparts, exhibit characteristic optical, electrical and magnetic properties. This new class of materials allows to amplify, concentrate and manipulate light at the nanoscale, thus opening the way to several application in fields such as biomedicine, catalysis, energy, sensing and information technology.

With advances in their fabrication, optical response of metal nanoparticles and nanostructures has been extensively experimentally and theoretically investigated during the past decade. Though many studies have been performed in the past on ensemble of metal nanoparticles, optical investigation of "individual" nanoparticles is still a recent field.

In this talk, I will present a set of experimental optical studies aiming to characterize the linear and ultrafast optical response of single nanoparticles. Spatial modulation spectroscopy (SMS) is exploited to quantitatively investigate the optical properties of elongated metal (nanorods, nanobipyramids) and bimetallic (gold-silver heterodimers) particles, with particular attention to their dependence on the nano-object size, shape, local environment, composition and inter-particle coupling. Quantitative interpretation of optical measurements is made possible by finite elements numerical simulations, complemented by electron microscopy and 3D tomography on the same nanoparticle. By combining SMS microscopy with a high sensitivity femtosecond two-color pump-probe setup, the ultrafast dynamics of single nano-objects have also been investigated.

Among the numerous potential applications of coupled metal nanoparticles, I will focus on high-sensitivity molecular sensing. I will introduce the "nanoparticle on mirror" (NPoM) geometry as a robust and versatile platform for sensing, and I will present the first broadly tuneable SERS study realized on a single nanostructure. This technique allowed us to probe the near-field resonances within individual NPoMs, and to directly compare them with the corresponding far-field responses, giving new fundamental insights into the optical response of coupled nanostructures.

Seminario

Venerdì 4 novembre 2016

Sala Riunioni, ore 12.00

Via dei Musei 41 - Brescia



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