FACOLTÀ DI SCIENZE MATEMATICHE, FISICHE E NATURALI
DIPARTIMENTO DI MATEMATICA E FISICA "NICCOLÒ TARTAGLIA"
INTERNATIONAL DOCTORAL PROGRAM IN SCIENCE

Martedì 22 ottobre 2019, ore 14.30-17.30

Ultrafast Measurements of Single Nanostructures

The ability to study single particles has revolutionized nanoscience. The advantage of single particle spectroscopy measurements compared to conventional ensemble studies is that they remove averaging effects from the different sizes and shapes that are present in the samples. In time-resolved experiments this is important for unraveling homogeneous and inhomogeneous broadening effects in lifetime measurements. In this talk, recent progress in the development of ultrafast time-resolved spectroscopic techniques for interrogating single nanostructures will be discussed. The techniques include far-field experiments that utilize high numerical aperture (NA) microscope objectives, near-field scanning optical microscopy (NSOM) measurements, ultrafast electron microscopy (UEM), and time-resolved x-ray diffraction experiments. Examples will be given of the application of these techniques to studying energy relaxation processes in nanoparticles, and the motion of plasmons, excitons and/or charge carriers in different types of nanostructures.

Mercoledì 23 ottobre, ore 14:30 – 17:30

Making Waves: Radiation damping in Metallic Nanostructures

Metal nanostructures display several types of resonances. In the visible and near-IR spectral regions, there are localized surface plasmon resonances (LSPRs) that involve the coherent oscillation of the conduction electrons. Extended metal nanostructures, such as nanowires or nanoplates, also exhibit propagating surface plasmon polaritons (PSPPs), which are motions of the electrons at the surface of the structure that have a well-defined momentum. In addition, the vibrational normal modes of metal nanostructures give rise to low frequency resonances in the gigahertz to terahertz range. These different types of motions/resonances suffer energy losses from internal effects and from interactions with the environment. The goal of this talk is to describe the part of the energy relaxation process due to the environment. Even though the plasmon resonances and acoustic vibrational modes arise from very different physics, it turns out that environmental damping is dominated by radiation of waves. The way the rates for radiation damping depend on the size of the nanostructure and the properties of the environment will be discussed for the different processes. For example, it is well known that for LSPRs, the rate of radiation damping increases with particle size. However, the radiation damping rate decreases with increasing dimensions for PSPPs and for the acoustic vibrational modes. Examples of applications enabled by the control of radiation damping will also be discussed.

Introduce:
Prof. LUCA GAVIOLI, Università Cattolica del Sacro Cuore

Interviene:
Prof. GREG HARTLAND, University of Notre Dame, USA

Workshop

Martedì 22 e mercoledì 23 ottobre 2019
Sala Riunioni, ore 14.30-17.30
Via dei Musei 41 - Brescia

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