Plasmonic Properties of Metallic and Hybrid Nanostructures

from Fundamental Physics to Applications

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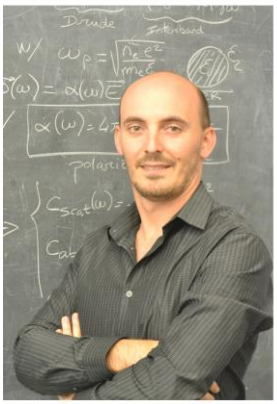
Abstract

Nanophotonics has become a very active interdisciplinary research field during the past decades. With the development of new advent technologies, a deep understanding of the optical, electronic, thermal, and chemical properties of materials at the nanoscale became crucial. Furthermore, recent advances in the control of bottom-up and top-down nanofabrication techniques allow for the synthesis of novel materials, geometries, and devices at the nanoscale, thus revealing new physical effects and pushing away the limits of the *Terra Incognita* in nanosciences. The development of theoretical models, and the use of advanced numerical simulations and modeling, is necessary not only to correctly understand these new properties but also to guide experimentalists in the design of the future nanostructures and in the tailoring of new physical properties. Here, I will present some recent work on plasmonic nanosystems and their use for localized surface plasmon resonance sensing, electron-based and surface-enhanced spectroscopies (EELS, CL, SERS, TERS, SHG), plasmon-enhanced chemistry, control of light, optoelectronic and photovoltaic applications. Along the way, I will present some state-of-the-art studies of fundamental physical processes in hybrid nanostructures such as plasmon-vibration and plexcitonic couplings and novel computational and theoretical models and methods (EELS-FDTD and SHG.



Bio

Nicolas Large is an Assistant Professor of Physics at The University of Texas at San Antonio. After obtaining his B.S. and M.S. in Physics at the Paul Sabatier University of Toulouse, France, he obtained a dual Ph.D. degree in 2011 in Nanophysics from Paul Sabatier University of Toulouse and in Physics of Nanostructures and Advanced Materials from the University of the Basque Country in San Sebastián, Spain. He worked jointly in the Center of Materials Physics (CSIC) and Donostia International Physics Center (DIPC) in San Sebastián, and at the Center for Materials Elaboration and Structural Studies (CNRS, Toulouse) where he was supervised by Profs. Javier Aizpurua and Adnen Mlayah. Later, Dr. Large worked as a postdoctoral researcher in the group of Prof. Peter Nordlander at Rice University in Houston (2012-2014), and in the group of Prof. George Schatz at Northwestern University in Chicago area (2014-2016). During his doctoral and postdoctoral work, Dr. Large developed novel several approaches and numerical methods for the calculations of optical properties of semiconductor and plasmonic systems, including new models for the description of acoustic Raman scattering, and electron-based spectroscopies. He also conducted fundamental and applied studies for a large variety of plasmonic-based systems. He is currently conducting research in the field of theoretical nanophotonics and focuses on the modeling of the optical response of semiconductor (excitonic), metallic (plasmonic), and hybrid (plexcitonic, plasphonic, magneto-plasmonic) nanosystems.