TCI SEMINAR

A Taxonomy of the Magneto-Optical Responses of Cyclic Plasmon-Supporting Metal Oligomers

Monday, October 26, 2015
3:00 p.m. Room 8335

Professor David Masiello

Department of Chemistry
University of Washington

In this talk I will explore the optical-frequency magnetic and electric properties of cyclic plasmon-supporting metal nanoparticle oligomers through a combination of scanning transmission electron microscopy (STEM)/electron energy-loss spectroscopy (EELS) simulation and first-principles theory. A tight-binding type model will be introduced to explore the rich hybridization physics in these plasmonic systems and tested with full-wave numerical electrodynamics simulations of the STEM electron probe. Building from a microscopic electric model, connection will be made at the macroscopic level between the hybridization of localized magnetic moments into delocalized magnetic plasmons of controllable magnetic order and the mixing of atomic p_z orbitals into delocalized pi molecular orbitals of varying nodal structure spanning the molecule. It is found that the STEM electrons are uniquely capable of exciting all of the different hybridized eigenmodes of the nanoparticle assembly---including multipolar closed-loop ferromagnetic and antiferromagnetic plasmons, giant electric dipole resonances, and radial breathing modes---by raster scanning the beam to the appropriate position. Comparison to plane-wave light scattering and cathodoluminescence (CL) spectroscopy will be made. The presented work provides a unified understanding of the complete plasmon eigenstructure of such oligomer systems as well as of the excitation conditions necessary to probe each mode.

Theoretical Chemistry Institute Seminar Series