Integrating Nanotechnology with Cell Biology and Neuroscience

INCBN IGERT Seminar

Monday, 17 Sept. 2012, 2:30 pm

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Creating Sharp Plasmon Resonances
Towards Ultrasensitive Biochemical Sensors

Narrow spectral linewidth of plasmon resonances is an essential characteristic for biochemical sensing applications. Multipole plasmon resonances (quadrupole, octupole, etc.), which do not suffer from radiation damping unlike the dipolar mode, have inherently narrow resonances but they do not couple to a plane wave excitation source effectively and remain ‘dark’. In this presentation, first, I will discuss the design, fabrication, and optical characterization of coupled plasmonic nanostructures in which ‘dark’ plasmon modes are excited by conductive coupling but not by capacitive coupling. Experimental evidence will be presented showing that a prominent quadrupole plasmon resonance and a sharp (octupolar) Fano resonance are induced when a gold nanorod and nanoring are conductively coupled in an asymmetric theta-shaped arrangement. Fano-like interferences are observed due to the destructive interference of the octupolar resonance with the overlapping and broadened dipolar resonance. I will further demonstrate that the above sharp resonance features can be smeared out by adverse optical effect of a metallic adhesion layer (e.g. titanium), and discuss the implementation of (3-mercaptopropyl) trimethoxysilane that self-assembles on a silica substrate as a simple and efficient adhesion alternative in lithographic fabrication of noble metal nanostructures. In the end, preliminary results of apertureless near-field scanning optical microscopy will be presented, followed by a brief overview of my future research plan at UNM.