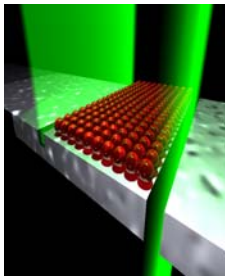


**JOINT INSTITUTE FOR MOLECULAR AND NANOSCALE INNOVATION (IMNI)  
AND DIVISION OF ENGINEERING**

## **“Active Plasmonics for Optical Communication, Photovoltaics and Sensing Applications”**

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Barus & Holley, Room 190  
1:30 PM**

### **Abstract**

Plasmonics is a rapidly emerging subfield of nanophotonics which enables the guiding and manipulation of optical signals in devices with a footprint much smaller than the wavelength of light. By using individual sub-wavelength scatterers, such as holes, grooves and slits milled in a metal film, light at optical frequencies can be efficiently coupled to electron density fluctuations in the metal. These propagating waves, named surface plasmon polaritons (SPPs), are characterized by maximum field amplitudes at the metal-dielectric interface, and by wavelengths that can be much shorter than the free-space wavelength. Therefore, SPPs have the potential to encode a huge amount of information, indeed larger than in conventional microchips, in devices with dimensions comparable to modern microelectronic transistors.

In this talk, I will present novel approaches to the generation and manipulation of SPPs in various devices ranging from all-optical modulators to solar cells and sensors. Active manipulation of the SPP is achieved by coating the arms of planar plasmonic interferometers with an active medium, consisting of CdSe semiconductor quantum dots or of thin perovskites oxide dielectric layers. Thanks to the highly confined nature of the SPP field and to the interference effects in the plasmonic cavity, all-optical and electro-optical modulation can be achieved at low power densities in micrometer-scale planar devices. A design study for plasmonic vias and interconnects will also be presented. I will further demonstrate that highly confined SPPs can enable bulk-like absorption properties in monolayer-thick semiconductor quantum dot layers, thus opening new opportunities for the implementation of more efficient ways to harvest solar energy in thin-film solar cells.

In conclusion, I will propose a new type of nanofabricated bio-chemical sensor consisting of a compact, dense, and planar array of submicron-scale plasmonic interferometers which can enable detection of a single monolayer of analyte adsorbed on the metal surface.