“Plasmonics at the Interface of Hard and Soft Materials”

ABSTRACT

Surface plasmon resonances are notable for their ability to concentrate light into nanoscale volumes, known as hot spots, at the interface between a metal nanostructure and the surrounding dielectric. In this talk, I will discuss the case where the dielectric is a soft material, such as a polymer or a protein.

I will focus on four different experiments we have performed in our lab in this area. First, I will detail how we were able to create a thin film with high effective second order nonlinear susceptibility by combining a nonlinear optical thin film with silver nanoparticles with strong plasmon resonances. The second topic will deal with optically induced nanoassembly, where we use photochemical effects to create patches on metal particles with properties different from the rest of the particle, making it possible to induce the particles to self-assemble into well-defined structures. Next, I will discuss the role of hot electron injection from decayed surface plasmons, illustrated with a recent result that show how ligand photocleavage can be induced on silver using excitation wavelengths that would not normally cleave the same ligand in a solution phase. Finally, I will present results from a series of experiments involving stimulus-responsive polymers that swell and shrink predictably in response to ambient pH. By using films of such polymers as tunable dielectric spacers, we have been able to create plasmonic structures whose properties can be reversibly tuned over a wide range by adjusting an external parameter.

Hans Robinson received his Ph.D. in 2000 from Boston University, where he worked with Bennett Goldberg on near-field scanning optical microscopy of individual self-assembled quantum dots. He then went on to a post-doctoral position at UCLA, where he worked with Eli Yablonovitch on quantum-information processing devices, where the goal was to transfer quantum information from photons to electron spins and back. Since 2005, he is a faculty member in the Physics Department at Virginia Tech, where his research interest is mainly directed at nano-optics, particularly as it pertains to plasmonics and nonlinear optics.