Nanophotonics and plasmonics are essential for bridging nanoelectronics and diffraction-limited optics. One central objective of plasmonics research is modifying the propagation of surface plasmon polaritons (SPPs) in order to implement diverse functionalities in the context of two-dimensional optics. First, I will discuss an effective approach to manipulate SPPs by adiabatically tailoring the topology of a dielectric layer adjacent to a metal surface using grey-scale lithography. In such a way, we are able to continuously modify the propagation constant of SPPs, analogous to traditional gradient index optics. Applying this method, we design and experimentally demonstrate two different devices: a plasmonic Luneburg lens to focus SPPs and a plasmonic Eaton lens to bend SPPs. Second, an alternative route for sub-wavelength light confinement will be discussed. Here, an all-dielectric slot-waveguide architecture is employed for deep sub-wavelength light confinement in a material with a low refractive index surrounded by high-index barriers. Individual colloidal quantum dots are controllably coupled to this waveguide mode using an AFM-tip. Large Purcell enhancements are observed from lifetime measurements of the spontaneous emission rate of individual quantum dots before and after coupling to the waveguide mode. The demonstrated system is a promising broadband and low-loss platform for quantum information applications.

Friday, February 8, 2013
2:00 PM
DeLoach Hall, Room 212