MRSEC SEMINAR SERIES

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Hosted by MRSEC IRG 3

Tuesday November 27, 2012

2:15pm Reception, Ryan Hall 4003
2:30pm Seminar, Ryan Hall 4003

Nano-Optics of Plasmonic Optical Tweezers, SERS Substrates, and Multi-Colored Silicon Nanowires

Field enhancement from surface plasmon structures presents new opportunities for optical manipulation and surface enhanced Raman spectroscopy (SERS). We demonstrate three configurations for manipulating nanoparticles using the optical forces from surface plasmons. In the first, we propel nanoparticles using surface plasmon polaritons (SPPs) on a thin gold film (NanoLett 2009). In the second, we trap microparticles with counter-propagating SPPs on a gold stripe (NanoLett 2010). In the third, we demonstrate a gold nanopillar plasmonic tweezer (Nature Communications 2011). The substrate acts as a heat sink, and simulations predict a ~100-fold reduction in heating compared to previous designs. We describe our work on metal nanoparticle substrates for SERS. We demonstrate that periodic metal nanoparticle arrays can exhibit spectrally narrow surface plasmon resonances, with numerical simulations predicting considerably enhanced optical near-fields (APL 2008). We describe a novel SERS substrate with double plasmon resonances, which enables field enhancement at both pump and Stokes frequencies (ACS Nano 2010). We describe a method by which we lithographically fabricate pairs of nanoparticles with gaps as small as 3 nm, producing SERS enhancements almost two orders of magnitude larger than those with 18 nm gaps (Small 2011). Lastly, we demonstrate that vertical silicon nanowires take on a surprising variety of (diameter-dependent) colors covering the entire visible spectrum, in marked contrast to the gray color of bulk silicon. This effect is readily observable by bright-field microscopy, and arises from the guided mode properties of the individual nanowires (NanoLett 2011).

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