Master internship/PhD

Internship Title	**Plasmonic Nanocrystals for Infrared Optics: Synthesis & Application**
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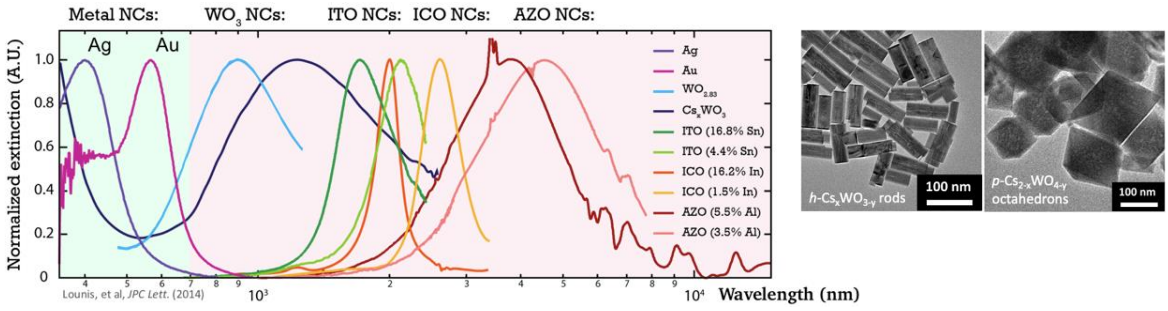
Free electrons in metal nanoparticles host a phenomenon called 'localized surface plasmon resonance' (LSPR), which permits strong light absorption and near-field enhancement within the visible wavelength range. This effect has been extensively studied with the interest in efficient manipulation of light in the nanoscale. Many current technologies for lighting, imaging, health care, and energy harvesting essentially utilize the LSPR phenomena.

Recently, it was found that degenerately doped semiconductor nanocrystals could also exhibit LSPR thanks to their mobile charge careers (electrons or holes). Unlike in metals with fixed free electron density (~10^{23}/cm^3), career density in semiconductor is largely variable (10^{18} ~ 10^{22}/cm^3) by controlling the doping levels. This extends the accessible spectral range of LSPR across the entire infrared region where solar energy is abundant, biological tissues are transparent, and molecular vibrations are resonant[1].



We have been investigating plasmonic doped metal oxide nanocrystals and their unique LSPR natures[2]. As-prepared nanocrystals has been used to make electrochromic smart windows[3]. This internship aims to study 1) the synthesis mechanism of nanocrystals, 2) tuning the LSPR spectrum by controlling the crystal structure and morphology, and 3) application of the nanocrystals as amplifier of fluorescence signals in bio-imaging. Diverse synthesis and characterization techniques will be used: Schlenk line synthesis, Colloid chemistry, Film deposition, Electron microscopy (TEM & SEM), NIR-Spectroscopy, Optical microscopy, NMR, FTIR, etc. *This internship can be continued as a PhD thesis*.

[1] Luther et al, *Nature Materials.* 10, 5, 361-366 (2011) – DOI : 10.1038/nmat3004
[2] Kim et al, *Nano Letters*. 16, 6, 3879-3884 (2016) – DOI : 10.1021/acs.nanolett.6b01390
[3] Kim et al, *Nano Letters*. 15, 8, 5574-5579 (2015) – DOI : 1 10.1021/acs.nanolett.5b02197