SPECIAL SEMINAR

MONDAY, DEC. 6 AT 3:30 P.M. IN 1315

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Photons, Ions and Defects on the Nanoscale

I will present inorganic nanostructures as model systems for studying nanoscale phenomena, especially the fundamental question of how photons, ions, and defects behave when confined to the nanoscale.

PHOTONS: Metal nanostructures allow one to confine and sculpt photons on the nanoscale by means of collective resonant oscillations of their free electrons. Such "confined photons", also known as plasmons, depict interesting properties such as super-enhanced electric fields, amplified light-matter interactions, and electromagnetic hybridization – properties that have potential utility in practical applications, like chemical sensing with extremely low detection limits and selective photothermal cancer therapy.

IONS: The high surface area of nanostructures makes them interesting from the standpoint of chemical transformations. For instance, in ionic nanocrystals, the cationic sub-lattice can be replaced with a different metal via a fast, simple, and reversible ion exchange. During such an exchange, the anionic framework of the crystal is preserved, which ensures that the nanocrystal size, shape, and compositional interfaces within the nanocrystal are conserved. This enables chemical access to a wider range of nanostructures beyond those available by conventional colloidal synthesis.

DEFECTS: While typically viewed as ultrapure single crystals, semiconductor nanocrystals can support defects in special cases. These may range from grain boundaries that deteriorate nanocrystal emission to self-vacancies that result in optical resonances conventionally seen only in nanostructures of metals.