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***Programing multi-component nanocrystal assembly:  
Building with Artificial Atoms***

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**Tuesday May 11, 2010 1:00pm**  
**Otto Maass room 10**

The synthesis of colloidal nanocrystals with controlled crystal shape, structure and surface passivation provides a rich family of nanoscale building blocks for the assembly of new solid thin films and novel devices. The tunability of the electronic, magnetic, and optical properties of the nanocrystals has led to them being compared to a set of "artificial atoms". This talk will provide key insights into the development of "best practices" in preparation, isolation and characterization of semiconducting quantum dots, nanocrystal phosphors and magnetic nanoparticles. A very brief discussion of the organization of monodisperse nanocrystals into single component superlattices that retain and enhance many of the desirable mesoscopic properties of individual nanocrystals will transition into a discussion of multicomponent assembly. The potential to design new materials expands dramatically with the creation of binary nanocrystal superlattices (BNSLs). I will show how we synthesized differently sized PbS, PbSe, CoPt<sub>3</sub>, Fe<sub>2</sub>O<sub>3</sub>, Au, Ag and Pd nanocrystals and then assembled these nanoscale building blocks into a rich array of multi-functional nanocomposites (metamaterials). Binary superlattices with AB, AB<sub>2</sub>, AB<sub>3</sub>, AB<sub>4</sub>, AB<sub>5</sub>, AB<sub>6</sub> and AB<sub>13</sub> stoichiometry and with cubic, hexagonal, tetragonal and orthorhombic packing symmetries have been grown. The opportunity to optimize materials for applications in solution processable photovoltaic systems and phosphor based luminescent concentrators will be highlighted. We have also identified a novel method to direct superlattice formation by control of nanoparticle charging. Although modular nanoassembly approach has already been extended to a wide range of nanoparticle systems, we are confident that we have produced only a tiny fraction of the materials that will soon be accessible. Recent progress in the extension to the formation of quasicrystalline colloidal phases will be shared. Progress toward large area (~1cm<sup>2</sup>) processing and integration and device fabrication.

