



# Rensselaer

The HOWARD P. ISERMANN  
DEPARTMENT OF CHEMICAL AND  
BIOLOGICAL ENGINEERING

## CBE Seminar Series – Spring 2023

**Dr. Ji-Young Kim**

Research Investigator  
University of Michigan

**Seminar: Wednesday, April 5, 2023**

**9:30 a.m. (Ricketts 203)**

### **“Exploiting Symmetry Breaking Factors in Optical Nanostructures: toward functional materials for analytical chemistry and their biomedical applications”**

#### **Abstract:**

In many cases, the symmetry of the nanomaterials plays a crucial role in determining the system's electronic structure, optical activity, and physical dynamics. Matured synthesis of inorganic nanocolloids today has allowed the production of diverse asymmetric nanoparticles (NP) and even more complex assemblies, introducing a variety of nanomaterials with unique properties. Full control of assembly pathways primarily dependent on NP symmetry can allow us to design new functional materials and open enormous opportunities in renewable energy, health care, environmental monitoring, and beyond. However, precise symmetry assignment and regulating the symmetry-breaking factors in nanoscale materials is a challenging task due to their multicomponent nature and multiscale dynamics. Several important examples and approaches to overcome these challenges will be discussed in this talk. The first part will highlight some initiatives and efforts to discover symmetry-breaking factors of optical NPs to understand previously puzzling nonlinear optics phenomena and experimentally control NP assembly pathways to build complex superstructures with chirality. The second part will be focused on the practical application of chiral nanomaterials in extended fields - photonic and biomedical applications to overcome the current limitation of (bio)analytical chemistry and establish a new paradigm of diagnostics and therapeutics.

#### **Biography:**



Dr. Ji-Young Kim is currently a Research Investigator in the Chemical Engineering Department (CHE) at the University of Michigan (UM), where she completed her postdoctoral training. Ji-Young earned her B.S. and M.S. in Materials Science and Engineering (MSE) from Korea University and a Ph.D. in MSE from UM under the guidance of Prof. Nicholas A. Kotov. For her doctorate studies about symmetry-breaking factors in optical nanostructures, she honed special techniques in the physics aspect –advanced electron microscopies and electromagnetic modeling - under the guidance of physicists at Brookhaven National Laboratory, which allowed her to understand previously puzzling nonlinear optics phenomena. In the chemistry aspect, she also extends her synthesis knowledge and skills to achieve complex and asymmetric NP assemblies including chiral nanostructures. During postdoctoral training, her commitment to the practical application of chiral nanomaterials in extended fields - photonic metamaterials, nonlinear optics, diagnostics, and nanomedicine- led her to publish sixteen articles in prestigious journals within recent three years, rewarding her with the Women Interactive Materials Award 2022. Her current research

interests include the development of high-throughput experimental platforms and modeling methods for metamaterial synthesis and bio-chiral nanomaterial interface analysis.

**Refreshments will be available at 9:00 a.m. in the Ricketts Coonley Lounge (RI 120).**

For more information, please contact Lisa Martin ([swishl@rpi.edu](mailto:swishl@rpi.edu))