THE MATERIALS SCIENCE AND ENGINEERING DEPARTMENT
WINTER COLLOQUIUM SERIES PRESENTS:

Vivian Ferry

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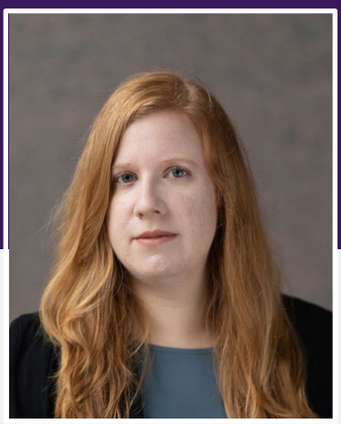

Tunable chiral optical properties in semiconductor nanocrystals and metamaterials

Optical nanomaterials offer the ability to bend, twist, guide, and confine light in nanoscale dimensions. Among these materials, chiral nanostructures particularly show promise for applications ranging from polarization manipulation to 3D displays, sensing, and spin-selective transport. Compared to their molecular counterparts, chiral nanomaterials exhibit orders of magnitude stronger dissymmetry factors, but have only been realized in a limited set of materials systems. We have recently demonstrated different strategies to tune and manipulate the polarization response of chiral metamaterials that combine metallic nanostructures, dielectric materials, and semiconductor nanocrystals. By controlling the refractive index of the dielectric components in different architectures, we show that the sign of the circular dichroism can be reversed, and the polarization and directionality of the outcoupled luminescence from nearby nanocrystals can be controlled. To create light-emitting metamaterials, it is additionally useful to create nanostructured elements comprised entirely of photoluminescent materials. We have recently developed patterning methods to transform semiconductor nanocrystals into patterned nanocrystal solids, realizing lateral feature sizes as small as 30 nm and heights in excess of 100 nm without degradation of the photoluminescence. We show that by designing the shape of the nanocrystal solid at this length scale and controlling connectivity between the nanocrystals, the refractive index and nanostructure absorptivity can be tailored. This work points to new strategies to design dynamically tunable metamaterials and control nanoscale light-matter interactions.

Vivian Ferry is an associate professor at the University of Minnesota in the Department of Chemical Engineering and Materials Science. She received her S. B. in Chemistry from the University of Chicago in 2006, and her Ph.D. in Chemistry from the California Institute of Technology in 2011, working with Prof. Harry Atwater. She was a postdoctoral fellow with Prof. Paul Alivisatos at Lawrence Berkeley National Laboratory from 2011 to 2014. Her research focuses on light-matter interactions in nanoscale materials, and her specific research interests include light management in solar energy conversion, switchable metamaterials, and nanoscale chirality. She is the recipient of an NSF CAREER award, an Air Force Office of Scientific Research Young Investigator Award, the Marion Milligan Mason Award for women in the chemical sciences, the Ovshinsky fellowship in sustainable energy from APS, and was named as one of Technology Review's 35 Innovators under 35 in 2016.

Tuesday, January 12 • 4 pm CT • Zoom

Registration is required. RSVP link.

Questions? Contact Kristina.lugo@northwestern.edu.

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