

Jeffrey Peterson

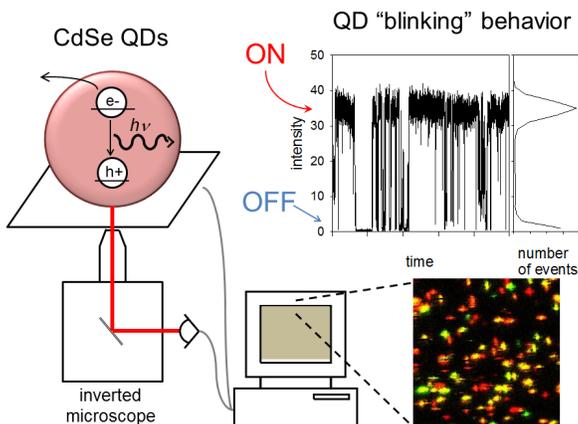
SUNY Geneseo, Department of Chemistry

Single Quantum Dot Photophysics: Insights from Novel Multiparameter Measurements

Abstract

The broad absorption spectra, size-tunable emission, and enhanced photostability of colloidal semiconductor nanocrystals, also known as quantum dots (QDs), render them attractive candidates for diverse technologies, including biological imaging, photovoltaics, and display applications. However, one significant limitation of QDs is the presence of fluorescence intermittency in these materials. Fluorescence intermittency describes the phenomenon in which the fluorescence from a single emitter randomly fluctuates between extended periods of bright, laser-induced fluorescence cycling (known as ON periods), and dark non-emission (known as OFF periods), all while under continuous excitation. Fluorescence intermittency, more commonly known as “blinking,” limits the brightness of ensemble samples and important questions remain regarding its microscopic origin, despite over 15 years of active investigation.

This seminar will present new insights into QD blinking from novel multiparameter studies. Multiparameter studies seek to simultaneously measure multiple quantities and can enable a detailed understanding of QD photophysics. For example, simultaneous measurements of the fluorescence intensity, emission energy, and fluorescence lifetime from single CdSe/ZnS QDs in the presence of an externally modulated electric field will be discussed. The results highlight a new source of fluctuations in QDs’ radiative and nonradiative recombination rates that has not been previously identified. In addition, recent attempts to simultaneously measure the electric charge and fluorescence from a single QD using a combination of gel electrophoresis and fluorescence imaging will be presented. Such measurements have not been reported and could provide key data to help evaluate alternative theoretical models of QD blinking.



Bio

Jeff Peterson received his B.S. in Chemistry from Wheaton College (Chicago, IL) in 1999. After working 3 years as a microelectronic engineer for various start-up companies in the Rochester, NY area, he began graduate studies in the Chemistry Department at the University of Rochester. He completed his Ph.D. in Chemistry in 2007, working with Prof. Todd Krauss in the area nanomaterials optical spectroscopy. Jeff was a National Institute of Standards and Technology Postdoctoral Fellow, working with Prof. David Nesbitt at JILA/University of Colorado. He joined the Chemistry Department at the State University of New York, Geneseo in 2009. His research at Geneseo focuses on novel approaches to single molecule fluorescence spectroscopy.