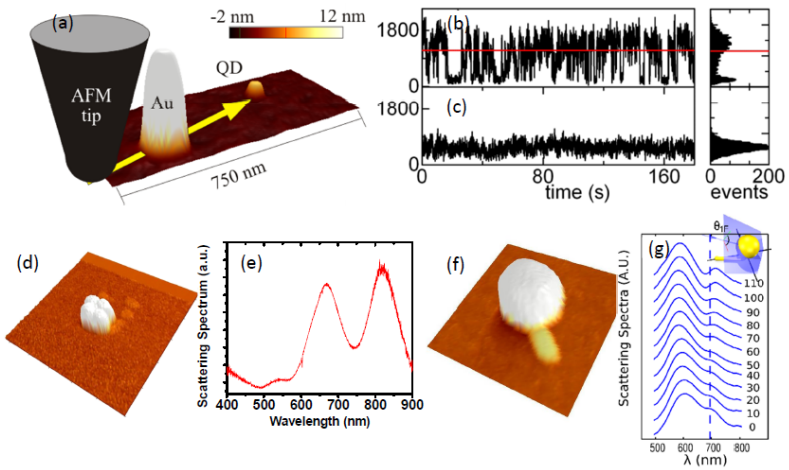
Dr. Xiaoqin (Elaine) LI obtained her Master degree in Electrical Engineering in 2002 and her PhD in physics in 2003 from the University of Michigan when she demonstrated a quantum gates based on optically driven quantum dots. She worked as a postdoctoral fellow between 2003 and 2006 at JILA Colorado, where she developed a new ultrafast spectroscopic tool for investing electron dynamics in semiconductors known as the optical Fourier transform spectroscopy. She joined the physics department at University of Texas-Austin in 2007. Her group is currently exploring unique properties of metallic and hybrid nanostructures, semiconductor quantum dots and quantum wells, spin waves in micromagnetic devices using a variety of light scattering techniques and advanced nonlinear spectroscopy methods such multidimensional Fourier transform spectroscopy. In recent years, Dr. Li has received a number of awards which include the Sloan fellowship, the NSF CAREER award, and the Presidential Early Career Award for Scientists and Engineers (PECASE).

Plasmonic Nanostructures by Design

The properties of individual semiconductor and metallic nanoparticles have been extensively investigated. When these nanoparticles are controllably arranged in a particular geometry, new and fascinating properties emerge. I will present a few recent experiments in which we assemble semiconductor/metallic nanoparticles into a particular geometry using AFM nanomanipulation method. I will present a local orientation sensor called “plasmonic protractor, a subwavelength metamolecule with overlapping electric and magnetic response in the visible wavelength range, and a coupled quantum- dot—gold-nanoparticle hybrid structure.

If time permits, I will also share our recent results on characterizing fundamental optical properties of epitaxial silver. Our work reveals that loss in silver as characterized by optical permittivity reported by Johnson and Christy does not represent the intrinsic material limit in the visible frequency range.



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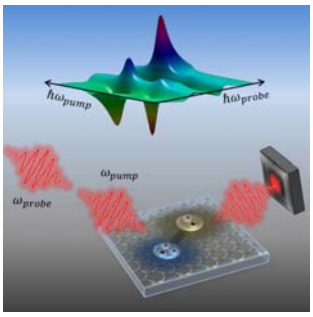
Coherent Electronic Coupling and Dynamics in Atomically Thin Semiconductors (MoSe2 and WSe2)

Monolayer transition metal dichalcogenides (TMDs) have recently emerged as promising materials for novel electronic and photonic device applications. The fundamental optical excitations of semiconductors are excitons (or electron-hole pairs) and trions (i.e. exciton bounded with one extra charge). Remarkably, the exciton and trion binding energies in monolayer TMDs are at least an order of magnitude larger than those in quasi-2D systems (e.g. GaAs quantum wells), making these quasiparticles stable at room temperature and relevant for opto-electronic devices. We demonstrate that monolayer TMDs exhibit strong exciton-trion coupling by performing two-color ultrafast pump-probe spectroscopy of monolayer MoSe2. The existence of coupling between these two distinct quasiparticles would indicate that their response to applied electrical and optical fields cannot be treated independently. Instead, the interactions between them need to be considered in the design of efficient opto-electronic devices, including photovoltaics.



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