

Title: Magneto-Optical Spectroscopy of Nanocrystalline Ferromagnetic Oxide Semiconductors

Type: Student

Awardee: J. Daniel Bryan

Mentors: Daniel Gamelin– UW; Scott Chambers - PNNL

Description: Continued JIN support is requested for research into the synthesis, optical, magneto-optical, and magnetic properties of oxide diluted magnetic semiconductor (DMS) nanocrystals and epitaxially grown thin films of direct relevance to spin-based electronics technologies. We will apply electronic absorption and magnetic circular dichroism spectroscopies to evaluate the dopant geometries, oxidation states, spin states, and electronic exchange interactions with semiconductor band electrons in nanoscale ferromagnetic oxide semiconductor materials. Our studies will focus on transition-metal doped TiO_2 and ZnO semiconductors prepared as epitaxially-grown thin films (thickness = 10-100nm) and as nanocrystalline (dia. = 1.5-100nm) colloid solutions or spin-cast thin films. Our experiments will address changes in electronics structure, magnetic, and magneto-optical properties of these materials as the nanoscale dimensionality is changed from 2D single crystals to zero-and one-dimensional nanocrystals, and subsequently to 2D ordered nanoparticle arrays.