Title: Magneto-Optical Spectroscopy of Nanocrystalline Ferromagnetic Oxide Semiconductors

Type: Postdoc

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Description: We propose to apply electronic absorption and magnetic circular dichroism spectoscopies to evaluate the dopant geometries, oxidation states, spin states, and electronic exchange interactions with semiconductor band electrons in nanoscale ferromagnetic oxide semiconductor materials of direct relevance to spintronics applications. Our studies will focus on transition-metal doped Fe_3O_4 and TiO_2 oxide semiconductors prepared as epitaxially-grown crystalline films (thickness ≈ 10-100nm), as nanocrystalline (dia. ≈ 1.5-10nm) colloid solutions, and as thin-film 2D arrays of nanocrystals. Our experiments will address the change in electronic structure, magnetic, and magneto-optical properties of these materials as the nanoscale dimensionally is changed form 2D single crystal to zero-dimensional nanocrystals, and subsequently to 2D ordered nanoparticle arrays. Particular attention will be paid to the potential influence of quantum confinement on the observed physical properties.