

Title: Magnetic Nanocrystals: Synthesis and Study of ZnO and GaN Diluted Magnetic Semiconductors

Type: Student

Awardee: Nick Norberg

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Description: I propose to continue the study of ferromagnetism in diluted magnetic semiconductor (DMS) nanocrystals. Continuing from my previous research on Co^{2+}ZnO , I will determine the effects of altering the chemical conditions of Co^{2+}ZnO nanocrystals on its ferromagnetic properties. Exhibiting control over its ferromagnetism will provide clues to understanding this behavior. I will expand this study to III-V DMSs, where I aim to develop solution synthetic routes to various $\text{TM}^{2+}:\text{GaN}$ nanocrystals. Electronic absorption, magnetic circular dichroism (MCD), and electron paramagnetic resonance (EPR) spectroscopies will be used to analyze the quality of these materials, obtaining valuable information about the transition metal dopant geometries, electronic structure, spin states, oxidation states, and magnetic behavior. By correlating the electronic structure with magnetic behavior of these materials, I will analyze the electronic exchange coupling between the doped transition metal cations and the semiconductors. These interactions are thought to induce ferromagnetism, making DMSs important materials for the development of spintronics technologies. Strong emphasis will be placed on developing homogeneous, high quality samples of nanocrystalline GaN DMSs, allowing in depth study of their physical and magnetic properties in the nanocrystalline size regime.