Physics Department Candidate Colloquium

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Exploring Functionality in Complex Oxide Thin Films

Complex oxides are ideal systems for studying condensed matter physics due to the wide variety of functionalities that they exhibit, such as high-temperature superconductivity, colossal magneto-resistance, and multiferroicity. Synthesizing thin films of these materials opens up new avenues for manipulating their properties through small changes in elemental composition, epitaxial strain, and film thickness. This deterministic control of physical properties makes complex oxides promising for use in next-generation device applications, such as electrically controlled magnetic memories. In this talk, I will explore three different complex oxide systems to demonstrate their wide range of functionalities and technological potential. I will begin by discussing the growth of thin-film $SrVO_3$, in which we use a novel thin-film growth technique to synthesize nearly defect-free films that are more conductive than any other metallic oxide and ideal for use as bottom electrodes in all-oxide devices. Second, I will examine the magnetically frustrated spinel ferrites, focusing on the difference in the magnetic structure between thin-film Fe_3O_4 and $CoFe_2O_4$. In bulk, $CoFe_2O_4$ has a magnetic moment that is 75% of that of Fe_3O_4, but as a thin film, it decreases to ~25% of that of Fe_3O_4. I will discuss the mechanisms behind this dramatic decrease in magnetization and the potential for using these mechanisms to dynamically control its magnetic moment. Finally, I will discuss the lutetium-iron-oxygen system, which contains multiple multiferroic materials. I will focus on our recent work on the synthesis of superlattices composed of $LuFeO_3$ and $LuFe_2O_4$ in an attempt to fabricate a room-temperature multiferroic.

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Time: 12:30 PM SCP 317