INSTITUTE SEMINAR

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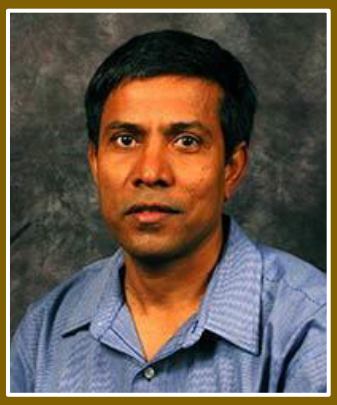

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TITLE

Nanoscale Investigation of Multiferroic Domain Switching in Ferromagnetic / Ferroelectric Hetero-structures using Scanning Probe Microscopy

ABSTRACT

Recently, simultaneous ferromagnetic and ferroelectric orderings have been observed in a single phase perovskite oxides as well as nanocomposite materials with perovskite oxides. These materials are called multiferroics. It has also been found that in some multiferroic materials ferroelectric and magnetic orderings not only coexist in the same material but also couple strongly that the magnetic degree of freedom can be manipulated by an electric field and the electric degree of freedom can be manipulated by a magnetic field. These unique properties promise potential multifunctional devices such as tunnel magneto resistance sensors, non-volatile ferroelectric random access memories, and tunable microwave devices. The magnetoelectric effects depend on the microscopic domain structure of multiferroics. Thus direct imaging of domain structures and investigation of their behavior under both electric and magnetic field can provide a microscopic origin of switching phenomena and the role domains play in magnetoelectric effect in multiferroics. Scanning probe microscopy (SPM) is a useful technique for investigation of multiferroic materials, providing high-resolution visualization of ferroelectric as well as ferromagnetic domains. This talk will explain how a SPM can be used to read, write, and erase data in both ferroelectric and ferromagnetic materials. Also I will discuss how SPM can be used to investigate magnetoelectric coupling in multiferroics. A better understanding of the multiferroics will lead us to make advanced logic and memory devices and tunable microwave filters that can be used in many electronic devices such as computers, digital cameras, and cell phones.