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Western Australia Section

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Mesoscopic Modeling of Ferroic and Multiferroic Materials

A Seminar of the IEEE WA joint EDS/SSCS/IPS Chapter

Dr Avadh Saxena
Los Alamos National Lab, USA

Friday, 22 February 2019 @ 1.00 PM

Venue: **Billings Room 3.04, 3rd floor. Electrical & Electronic Engineering Building**
University of Western Australia, Crawley

This seminar is open to the public and admission is free to all IEEE members and non-members

Abstract:

Materials exhibiting ferroic phase transitions are ubiquitous in nature. Ferroic materials are those which possess two or more orientation states (domains) that can be switched by an external field and show hysteresis. Typical examples include ferromagnets, ferroelectrics and ferroelastics which occur as a result of a phase transition with the onset of spontaneous magnetization (M), polarization (P) and strain (e), respectively. A material that displays two or more ferroic properties simultaneously is called a multiferroic, e.g. magnetoelectrics (simultaneous P and M). Another novel class of ferroic materials called ferrotoroidics has been recently found. These materials find widespread applications as actuators, transducers, memory devices and shape memory elements in biomedical technology. First I will provide a historical perspective on this technologically important class of materials and then briefly illustrate the relevant concepts. I will discuss their properties, model the transitions at mesoscale and describe their microstructure. I will emphasize the role of long-range, anisotropic forces that arise from either the elastic compatibility constraints or the (polar and magnetic) dipolar interactions in determining the microstructure. Finally, I will discuss the role of color symmetry in multiferroic transitions and consider the effect of disorder on ferroic transitions. Much of the excitement in the field of multiferroics stems from the unusual optical, spin and lattice properties of these materials which renders them as truly viable candidates for future metamaterials.

Biography:

Avadh Saxena is Group Leader of the Condensed Matter and Complex Systems group (T-4) at Los Alamos National Lab, New Mexico, USA, where he has been since 1990. He is also an affiliate of the Center for Nonlinear Studies at Los Alamos. His main research interests include phase transitions, optical, electronic, vibrational, transport and magnetic properties of functional materials, device physics, soft condensed matter, geometry, topology and nonlinear phenomena. He is an Affiliate Professor at the Royal Institute of Technology (KTH), Stockholm, Sweden, and holds adjunct professor positions at the University of Barcelona, Spain, Virginia Tech and the University of Arizona, Tucson. He is Scientific Advisor to National Institute for Materials Science (NIMS), Tsukuba, Japan. He is a Fellow of Los Alamos National Lab, a Fellow of the American Physical Society (APS), and a member of the Sigma Xi Scientific Research Society and APS.
Contact him at: avadh@lanl.gov