

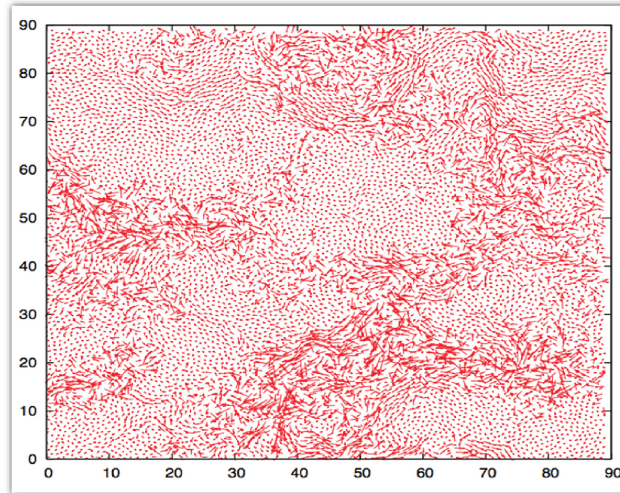
# Sunil K. Sinha

## Complexity and Dynamics in Condensed Matter Systems

Over the last few years, attempts have been made to unify many aspects of the freezing behavior of glasses, granular materials, gels, supercooled liquids, etc., into a general conceptual framework of what is called jamming behavior. This occurs when particles reach packing densities high enough that their motions become highly restricted. A general phase diagram has been proposed onto which various materials systems, e.g., glasses or granular materials, can be mapped.

We will discuss some recent applications of resonant and non-resonant soft x-ray grazing incidence scattering to mesoscopic science, for example the study of magnetic domain wall fluctuations in thin films. For these studies, we use resonant magnetic x-ray scattering with a coherent photon beam and the technique of x-ray photon correlation spectroscopy.

We find that at the ordering temperature, the domains of an antiferromagnetic system, namely Dysprosium metal, also behave very much like a jammed system, and their associated fluctuations exhibit behavior that displays some of the universal characteristics of jammed systems, such as non-exponential relaxation and Vogel-Fulcher-type freezing. We will also discuss studies of other systems in this class, such as the dynamics of nanoparticles in entangled polymer networks.



**SUNIL K. SINHA** received his Ph.D. in physics from Cambridge University. He is currently Distinguished Professor of Physics in the Department of Physics at the University of California, San Diego. He also has served as Group Leader in Neutron Scattering at Argonne National Laboratory, Group Leader of X-ray Scattering at Brookhaven National Laboratory, Senior Research Associate at Exxon Corporate Research Laboratories, and Associate Division Director at

Argonne's Advanced Photon Source. He was the recipient of a Guggenheim Fellowship, the Ernest O. Lawrence Award of the Department of Energy, the MRS Medal, the Barrett Award of the Denver X-ray Conference, and the Arthur H. Compton Prize of the Advanced Photon Source. He is a Fellow of the American Physical Society and the AAAS, and has published over 350 papers. His group's research is concerned with studying the structure and dynamics of condensed matter using the techniques of x-ray and neutron scattering. He has served on several national and international panels, including the Department of Energy's Basic Energy Sciences (BES) Advisory Committee, the BES Council on Materials, the Linac Coherent Light Source Science Advisory Committee, the Advanced Light Source Science Advisory Committee, and the Spallation Neutron Source Advisory Board.

Wednesday, November 13, 2013/3:00 P.M.

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