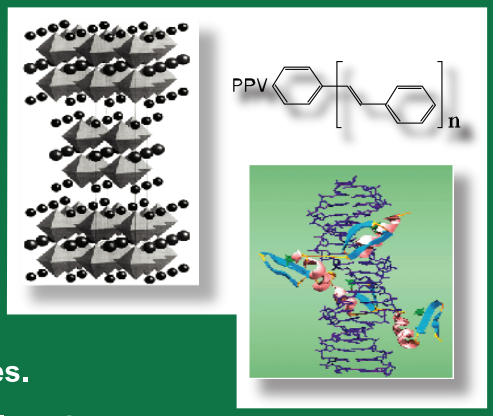
Argonne NATIONAL LABORATORY

Alan R. Bishop

"Functional Complexity in Hard, Soft, and Biological Matter"

Alan R. Bishop is Associate Laboratory Director for Theory, Simulation, and Computation at Los Alamos National Laboratory. His research interests include non-equilibrium electronic and structural phenomena in condensed matter physics, and chaos and complexity. He is the 1993 recipient of the Department of Energy's E. O. Lawrence Award in Materials Science in recognition of his contributions to the development and application of nonlinear concepts and techniques to a broad range of problems in materials science.



A substantial change is presently taking place in experimental and theoretical approaches to large classes of "strongly correlated" materials. The change reflects growing evidence that multiscale complexity (in space and time) is frequently both intrinsic and functional, and further, that intimate relationships between hierarchies of functional scales constitute essential "Systems" or "Networks." This complexity provides qualitatively new avenues for predictive design of technological materials, including intrinsically nanoscale structures.

In the search for underpinning concepts and principles, the prevalence of local constraints and coexisting short- and long-range forces have become apparent as keys to some major class of materials with emergent "landscapes" of spatio-temporal patterns and associated glassy dynamics and statistics. This talk reviews our recent work in these directions in the context of elastically-driven textures in (a) directionally-bonded electronic materials, including superconducting, magnetoresistant, and ferroelectric oxides; and (b) bubble opening patterns in DNA. Underscored is the importance of suites of experimental probes being applied to establish the networks of functional scales: microscopic to mesoscopic to macroscopic. Recent advances in angle-resolved photoemission and inelastic neutron scattering experimental techniques are particularly valuable in this regard.

Note day change: Friday, August 4, 2006

3:00 p.m.

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