The National Academies of
SCIENCES • ENGINEERING • MEDICINE

Division on Engineering and Physical Sciences
Committee on NIST Technical Programs

Panel on Review of the Center for Neutron Research at the National Institute of Standards and Technology

Biographical Sketches

Chair

TOM C. LUBENSKY, NAS, is the Christopher H. Browne Distinguished Professor Emeritus in the Department of Physics and Astronomy at the University of Pennsylvania. Dr. Lubensky is a physicist who has made striking advances in understanding "soft" materials, such as liquid crystals, membranes, vesicles, and microemulsions. He has applied the theoretical methods of many-body physics to complex fluids and solids. For instance, he has elucidated the properties of the twist-grain-boundary phase in emulsions and lipid phases intercalated with deoxyribonucleic acid (DNA). His research focuses on soft materials, such as liquid crystals, membranes, vesicles, Langmuir films, and the many realizations of such complex fluids as microemulsions. His approach is phenomenological: properties of an equilibrium phase at length scales several times molecular lengths can be described by effective free energies and by hydrodynamical equations, which depend only on the conservation laws and the symmetry of the phase. Associated with each thermodynamic phase are elastic rigidities, low-frequency hydrodynamics modes, and topological defects that are collectively responsible for most of the remarkable properties of soft materials. Thermal fluctuations are almost by definition strong in soft systems, and they can lead to significant modifications of naive harmonics theories. In the recent past he has developed and applied these ideas to elucidate the properties of the twist-grain-boundary phase in liquid crystals, liquid crystalline emulsions, lamellar lipid phases intercalated with DNA, liquid crystalline elastomers, tethered membranes, and interacting arrays of one-dimensional Luttinger liquids. He has also worked on a variety of other problems, including the theoretical underpinnings of microrheology, flow of granular material under shear, and the origins of macroscopic chirality. Dr. Lubensky received his B.A. in physics from the California Institute of Technology and his M.A. and Ph.D. degrees in physics from Harvard University.

Members

SIMON J. L. BILLINGE is a professor of materials science and applied physics at Columbia University and also conducts research at Brookhaven National Laboratory. Dr. Billinge has more than 20 years of experience developing and applying techniques to study local structure in materials using x-ray, neutron, and electron diffraction. He was previously a faculty member at Michigan State University. Dr. Billinge has published more than 200 papers in scholarly journals. He is a fellow of the American Physical Society and the Neutron Scattering Society of America, and a former Fulbright and Sloane Fellow. He is section editor of *Acta Crystalographica Section A: Advances and Foundations*. He regularly chairs and participates in reviews of major facilities and federally funded programs. He earned his Ph.D in materials science and engineering from the University of Pennsylvania.

SUSAN N. COPPERSMITH, NAS, is the Robert E. Fassnacht and Vilas Research Professor of Physics in the Department of Physics at the University of Wisconsin, Madison. Her expertise is in theoretical and condensed matter physics. Her research has addressed nonequilibrium properties of disordered materials, especially granular materials, glasses, and random magnets. Her main research focus is on the fundamental nature of systems that are far from thermal equilibrium, which is the state that systems eventually reach if they are undisturbed for long enough. Dr. Coppersmith has elucidated specific new features that arise in some systems driven far from thermal equilibrium and has demonstrated that some of these properties are robust in that they do not depend on microscopic details. She showed how nonlinear dynamics leads to self-organization in the context of a specific complex system, and others have shown subsequently that the phenomenon occurs in a broad variety of dynamical systems. She has identified concepts and developed theories that unify phenomena that are observed in areas as diverse as population biology, biomineralization, granular materials, and superfluidity. She has previously been professor of physics at the University of Chicago, a distinguished member of the technical staff at AT&T Bell Laboratories, and a visiting lecturer at Princeton University. Dr. Coppersmith received her M.S. and Ph.D. degrees in physics from Cornell University and her B.S. in physics from the Massachusetts Institute of Technology.

STEVEN B. DIERKER is a professor of physics at Texas A&M University. Prior to Texas A&M University, he was the associate laboratory director of the Light Sources Directorate and the director of the National Synchrotron Light Source II (NSLS-II) Project at Brookhaven National Laboratory (BNL). As NSLS-II Project director, he had overall line management responsibility and authority for carrying out the NSLS-II Project, including the design, construction, and transition to operations of the NSLS-II facility to ensure all mission requirements were fulfilled in a safe, cost-efficient, and environmentally responsible manner. In addition to the NSLS-II Project, the Light Sources Directorate also includes the National Synchrotron Light Source (NSLS), which reported to Dr. Dierker. His research involved the first observation of Raman scattering from superconducting gap excitations, which has now become a widespread and powerful technique for investigating the physics of superconductors. He was previously in the Semiconductor and Chemical Physics Research Department at AT&T Bell Laboratories and carried out research using light scattering and neutron scattering to study problems in soft condensed matter, most notably the hexatic phase of freely suspended liquid crystal films and activated dynamics of binary fluids in porous media. He was also a professor of physics and applied physics at the University of Michigan where he pioneered the development of the new technique of X-ray Photon Correlation Spectroscopy (XPCS) and carried out the first convincing demonstration of the feasibility of this technique in a study of Brownian motion of gold colloids. Dr. Dierker has been an active member of the Advanced Photon Source (APS) Users Organization at Argonne National Laboratory, chairing that organization from 1998-2000. He also helped to plan the construction, design, and operation of beam lines at the American Physical Society (APS), with funding from the U.S. Department of Energy and the National Science Foundation. After earning B.S. degrees in both physics and electrical engineering from Washington University, Dierker earned both an M.S. and Ph.D. in physics from the University of Illinois, Urbana-Champaign.

AARON P.R. EBERLE is Global Oxy Fluids Marketing Manager and a senior research scientist at ExxonMobil Chemical Company. His research interests include polymer physics, rheology, scattering physics, collidal physics, polymer processing, and inorganic porous materials. Nanoparticle and colloidal gels are of fundamental scientific interest and pose challenges to industrial formulation and application because of the hierarchy of structures that connect particle properties to bulk material properties. Three specific examples are paints, inks, and uncured concrete. In many cases the processing of these materials relies on the fact that the underlying structure may be reversibly broken down by flow. As a result, their rheological behavior is of technological relevance and can exhibit complex behaviors such as yielding, shear localization, and aging. To study these phenomena, Dr. Eberle utilizes a model nanoparticle system in which the strength of attraction can be tuned with temperature. The system consists of silica spheres (~ 30 nm) coated with a short oligomeric brush (C18). He and his team show the temperature dependence of the interparticle potential is related to a surface molecular phase transition of the brush layer using neutron reflectivity (NR) and small-angle neutron scattering (SANS). They establish the temperature dependence of the interparticle potential using SANS, dynamic light scattering (DLS), and rheology. The potential parameters extracted from SANS suggest that, for this system, gelation is an extension of the Mode Coupling Theory (MCT) attractive driven glass line (ADG) to lower volume fractions and can form without competition for phase separation. Finally, they use two complimentary techniques Rheo-SANS and Flow-SANS to study the effect of shear flow on the structural reorientation. They connect shear induced phenomena such as densification and structural anisotropy to the bulk rheology and the interparticle potential. Dr. Eberle earned a B.S. in chemical engineering from the University of Rochester and a Ph.D. in chemical engineering from Virginia Polytechnic Institute and State University.

PAUL A. FLEURY, NAS/NAE, is the Frederick William Beinecke Professor of Engineering and Applied Physics, and Professor of Physics at Yale University. He has made numerous seminal contributions to the field of Raman and Brillouin scattering in condensed matter. These include his pioneering work on soft phonon modes near phase transitions, spin flip Raman scattering in semiconductors, and scattering from magnetic excitations in classical and quantum systems. Dr. Fleury has been recognized for discoveries related to ferroelectric, acoustic, and nonlinear performance of materials, and for management leadership in materials. Dr. Fleury's research interest has been in the microscopic origin of physical phenomena in condensed matter systems with emphasis on collective behaviors underlying magnetic, optical, electronic, acoustic, and structural properties of materials. These properties include the linear and nonlinear responses of materials to external drivers such as stress, electric, magnetic, and optical fields. Dr. Fleury earned a B.S. and M.S. from John Carroll University and his Ph.D. in physics from the Massachusetts Institute of Technology.

DALE E. KLEIN is associate vice chancellor for research in the Office of Academic Affairs at the University of Texas at Austin, where he also served as the associate director of The Energy Institute, associate vice president for research, and a professor of mechanical engineering in the University’s nuclear program. Dr. Klein was sworn into the U.S. Nuclear Regulatory Commission (NRC) in 2006, and was appointed chairman of the NRC by President George W. Bush, serving in that role from July 2006 to May 2009. As chairman, Dr. Klein was the principal executive officer and official spokesman for the NRC, responsible for conducting the administrative, organizational, long-range planning, budgetary, and certain personnel functions of the agency. Additionally, he had the ultimate authority for all NRC functions pertaining to an emergency involving an NRC licensee. The remainder of this term was as commissioner of the NRC from May 2009 to March 2010. Before joining the NRC, Dr. Klein served as the assistant to the Secretary of Defense for Nuclear, Chemical, and Biological Defense Programs. Previously, Dr. Klein served as the vice-chancellor for special engineering programs at The University of Texas System. During his tenure at the university, Dr. Klein was director of the Nuclear Engineering Teaching Laboratory, deputy director of the Center for Energy Studies, and associate dean for research and administration in the College of Engineering. He has published more than 100 technical papers and reports, and co-edited one book. He has made more than 400 presentations on energy and has written numerous technical editorials on energy issues that have been published in major newspapers throughout the United States. Dr. Klein holds a Ph.D. in nuclear engineering from the University of Missouri-Columbia.

TONYA L. KUHL is a professor of chemical engineering, materials science and biomedical engineering, and a faculty member of the Biophysics Graduate Group at the University of California, Davis. Her research interests are in the general area of intermolecular and intersurface forces in complex fluid systems. She uses the Surface Forces Apparatus for directly measuring the forces between surfaces in liquids and vapors, and for studying other interfacial phenomena, providing information at the molecular level not always available by other techniques. These interaction force studies are complemented by structural characterization via x-ray and neutron scattering measurements at National Laboratories such as the Advanced Photon Source at Argonne and the Los Alamos Neutron Scattering Center. Currently, her research is primarily focused on membrane biophysics, membrane fusion, self-assembly, polymer brushes, ligand-receptor binding and adhesion, and the properties of polymer thin-films. She received her B.S. in chemical engineering from the University of Arizona and Ph.D. in chemical engineering from the University of California, Santa Barbara (UCSB).

PETER B. MOORE, NAS, is the Sterling Professor of Chemistry (Emeritus) at Yale University. His research interests include: biophysical chemistry, the structure and function of macromolecular assemblies, ribonucleic acid (RNA) structure and function, ribosomes, nuclear magnetic resonance (NRM) spectroscopy, X-ray crystallography, X-ray, and neutron scattering. He was formerly a Guggenheim Fellow at the University of Oxford, U.K., and a guest biophysicist at Brookhaven National Laboratory. He is a member of the following professional organizations: the Biophysical Society, American Society of Biochemistry and Molecular Biology, American Association for the Advancement of Science, Connecticut Academy of Science and Engineering, and the American Academy of Arts and Sciences. He earned a B.S. from Yale University and Ph.D. from Harvard University.

THOMAS P. RUSSELL, NAE, is the Silvio O. Conte Distinguished Professor of Polymer Science and Engineering at the University of Massachusetts at Amherst. He currently is director of the Materials Research Science and Engineering Center at the University of Massachusetts and associate director of the MassNanoTech facility at the University. Dr. Russell's interests span research in surface and interfacial properties of polymers and polymer nanostructures, polymer morphology, kinetics of phase transitions, and confinement effects on polymers. Formerly of IBM Almaden Research Center, Dr. Russell conducted pioneering studies on measuring fundamental properties of block copolymers and the use of an electric field to orient block copolymers for microelectronic applications. He has more than 300 peer reviewed scientific publications. He is a fellow of the American Physical Society, a fellow of the American Association for the Advancement of Science, associate editor for *Macromolecules*, and former member of the board of directors of the Materials Research Society. He received his Ph.D. in polymer science from the University of Massachusetts at Amherst.

HELMUT SCHOBER is director of the Institut Laue-Langevin in Grenoble, France. His research interests include: spectroscopy of fullerenes and carbon nanotubes; dynamics of water ice and clathrates; quantum fluids in connement; glass transition; phonon-mediated superconductivity; thermal and ionic transport; experimental techniques (including neutron scattering, inelastic x-ray scattering, optical spectroscopy); calculation techniques (lattice dynamical calculations and classical molecular dynamics); and methodological interest (neutron sources as well as neutron and time-of-flight instrumentation). Dr. Schober earned his undergraduate degree in physics and a Ph.D. in physics from the University of Regensburg in Regensburg, Germany.