DMP NEWSLETTER
Division of Material Physics

A Division of the American Physical Society

Summer 2005

In this Issue ...

July 11, 2005 - Minor update to Focus Topic 6.11.5
July 12, 2005 - Minor updates to Focus Topics 6.11.4 & 6.11.5

Abstract Deadline

All contributed abstracts must be submitted via the official APS web site at http://abstracts.aps.org/ by Wednesday, November 30, 2005. If you intend for your abstract to be part of a Focus Topic, be sure to choose the Sorting Category Code associated with that Focus Topic.

Invited abstracts are due on the same date. Authors of invited abstracts will be instructed where to submit their abstracts in the official APS invitation letter.

Dates to Remember

Aug. 31, 2005 (Wednesday)

- Deadline for submitting invited speaker suggestions for DMP Focus Topics

Nov. 30, 2005 (Wednesday)

- APS Abstract deadline submitted via the web at http://abstracts.aps.org

March 13-17, 2006

- APS March Meeting in Baltimore, Maryland

Call for Invited Speaker Suggestions

With this issue of the Newsletter, the Division of Materials Physics announces the program of DMP Focus Topics for the 2006 APS March Meeting (Baltimore, MD, March 13-17, 2006). A Focus Topic generally consists of a series of sessions, each of which is typically seeded with one invited talk, the remainder of the session being composed of contributed presentations.

DMP members are encouraged to make suggestions for invited speakers for these Focus Topics. The deadline for submitting such suggestions is August 31, 2005. Suggestions can be made in either of two ways: (1) by emailing the suggestion directly to the appropriate session organizers who are listed after the Focus Topic descriptive paragraphs, or (2) by using the web-based form on the APS website at http://www.aps.org/units/dmp/invited.cfm.

If you send your suggestion by direct email, please provide the following information:

- The nominator's name, affiliation, phone number and e-mail address.
- The suggested speaker's name, affiliation, address, phone number, fax, and e-mail.
- The title of the suggested talk.
- A brief justification of the nomination (880 character limit).

The web-based nomination form contains fields for all of these items. If you use the web-based form, your invited speaker nominationwill be sent automatically to the appropriate Focus Topic organizers when you push the "submit" button at the end of the process. However, it is advisable to send an email to the first-listed organizer asking for confirmation that the nomination has been received.

Finally, note that the contents of this Newsletter will be available electronically on the DMP website at http://www.aps.org/units/dmp. In case of any need for corrections or updates, these will also be posted at this location.

List of DMP-Sponsored or Co-Sponsored Focus Topics and Sorting Categories for the 2006 APS March Meeting

DMP 2006 March Meeting Program of Focus Topics and Call for Abstracts

2.8.1 Wide Band Gap Semiconductors (DMP)

Recent advances in the quality of wide band gap semiconductor materials including the nitrides, carbides, and oxides have allowed exploration of fundamental materials parameters, physics, and novel device applications. This session will include topics ranging from characterization, determination and control of fundamental material properties to the implementation of nanostructure designs that introduce new functionality to the wide band gap systems. Areas of interest include, but are not limited to, growth (bulk crystals, heterostructures and nanostructures), polarization effects, ferromagnetism, optical, structural and electrical characterization of materials including local probe techniques, properties of heterostructures, and device physics. Of particular interest are studies of lower dimensional (1D and 0D) nano-wires and quantum dots. New device designs that exploit the unique properties of the wide band gap materials will also be considered.

Organizers:

Michael J. Manfra
Bell Laboratories, Lucent Technologies
Room 1C-368
600 Mountain Ave.
Murray Hill, NJ 07974
Phone: (908) 582-1137
Fax: (908) 582-4868
Email: manfra@lucent.com

Ben V. Shanabrook
Head, Electronic Materials Branch
Code 6870
Naval Research Laboratory
Washington, DC 20375-5000
Phone: (202) 767-3693
Fax: (202) 767-1165
Email: shanabrook@nrl.navy.mil

3.8.1 Dielectric, Ferroelectric, and Piezoelectric Oxides (DMP)

This topic will focus on fundamental advances in the growth, characterization, and theoretical understanding of dielectric, ferroelectric, and piezoelectric oxides in bulk, ultrathin-film, and superlattice form. Functional oxides of all structure types are included, such as perovskites, distorted fluorite high-K dielectrics, ZnO, etc. Topics of interest for bulk materials include structural and ferroelectric phase transitions, lattice dielectric properties, etc. However, a major thrust will be to explore how bulk dielectric, ferroelectric, and piezoelectric properties are modified in thin-film, superlattice, or other nanoscale geometries, as for example in structures grown using atomic-layer controlled techniques (e.g., MBE, PLD, or ALD). In particular, contributions are welcome that explore the effects of strain epitaxy, surfaces, electrical boundary conditions, interfaces, etc.

Organizers:

Eric J. Cockayne
MS 8520 Ceramics Div
NIST
100 Bureau Dr
Gaithersburg, MD 20899
Phone: (301) 975-4347
Fax: (301) 975-5334
Email: cockayne@nist.gov

Darrell G. Schlom
Dept of Materials Sci & Engr
Penn State Univ
108 MRI Bldg-Rsch Park
University Park, PA 16803-6602
Phone: (814) 863-8579

Fax: (814) 863-0618
Email: schlom@ems.psu.edu

Yong Liang
Freescale Semiconductor, Inc.,
AZ34, EL 519
Tempe, Arizona 85284
Phone: (480) 413-7118
Fax: (480) 413-3294
Email: yong.liang@freescale.com

4.15.4 Organic Electronics, Photonics, and Magnetics (DMP/POLY)

Small organic molecules and polymer-based materials enable new classes of electronic, photonic and magnetic devices. This focus session considers the latest developments in the physics of these materials. Contributions are solicited in the areas of organic conductors, semiconductors, and magnetic physics. The broad range of topics include: electronic structure, charge transport, morphology, self-assembly, surfaces and interfaces, optics and non-linear optics, photonic crystals, magnetism and spin transport. Contributions of device physics may include electric and magnetic field effects, FETs, LEDs, photovoltaics, lasers, spin valves, and sensors. Electronic systems ranging from large area down to micro- and nanoscale will be addressed. Both theoretical and experimental papers on organic systems ranging from single or small collections of molecules to polycrystalline thin films and bulk single crystals will be included.

Organizers:

Denis Fichou
CEA-Saclay
SPCSI/DRECAM/DSM
91191 Gif-sur-Yvette
France
Phone: 33(0)1 69 08 43 74
Fax: 33(0)1 69 08 84 46
Email: fichou@drecam.cea.fr

John A. Rogers
Univ of Illinois
1304 W Green St
Urbana, IL 61801
Phone: (217) 244-4979
Fax: (217) 294-1190
Email: jrogers@uiuc.edu

David C. Martin
University of Michigan
2022 H. H. Dow Building
Ann Arbor, MI 48109-2136
Phone: (734) 936-3161
Fax: (508) 256-8352
Email: milty@umich.edu

5.11.1 Magnesium Diboride and Related Compounds (DMP)

The two weakly-coupled bands and superconducting gaps of magnesium diboride result in interesting new physics and phenomena not seen in one-gap superconductors. The possibility of modifying interband and intraband scattering offers special opportunities to develop remarkably high upper critical fields. Low flux creep, composite vortex structures and composite phase textures resulting from the internal Josephson effect add additional interest. Alloying and artificial damage of MgB_2 remains an interesting route to modification of the properties and understanding of the multi-band scattering. Four years after the discovery of superconductivity in magnesium diboride, it is possible to think seriously that industry-standard Nb-based superconductors for both high-field and electronic applications may be under challenge. This session addresses the physics and applications of magnesium diboride and related compounds from both theoretical and experimental viewpoints. Topics include various aspects of two-band superconductivity, electronic structure calculations, studies of phonons and electron-phonon coupling, sp^2/sp^3 bonding and optical phonons, doping and alloying, strain and disorder, flux pinning, wires and tapes, and the Josephson effect and devices. Superconductivity in borides, borocarbides, hole-doped diamond, and related compounds is also of interest, as are papers on multifunctional heterostructures involving magnesium diboride.

Organizers:

David C. Larbalestier
909 ERB
University of Wisconsin
1500 Engineering Dr.
Madison, WI 53706
Phone: (608) 263-2194
Fax: (608) 263-1087
Email: larbalestier@engr.wisc.edu

Lance D. Cooley
Materials Science Department
Brookhaven National Lab
Bldg. 480
Upton, NY 11973
Phone: (631) 344-5204
Fax: (631) 344-4071
Email: ldcooley@bnl.gov

Paul C. Canfield
59 Physics
Iowa State University
Ames, IA 50011
Phone: (515) 294-6270
Fax: (515) 294-0689
Email: canfield@ameslab.gov

John M. Rowell
Visiting Professor, Arizona State University
102 Exeter Dr.
Berkeley Heights, NJ 07922
Phone: (908) 464-6994
Email: jmrberkhts@aol.com

6.11.1 Theory and Simulation of Magnetism and Spin-Dependent Properties (DCOMP/DMP/GMAG)

The purpose of this focus topic is to explore recent advances in theory and modeling of magnetic and spin dependent properties of materials. The topic will include methods and materials systems as well as magnetic and spin dependent properties. Of particular concern are magnetic materials in reduced dimension where surface and interface effects become increasing dominant and influence the spin structure, spin dynamics and spin transport. Thus it is expected that a significant part of this focus topic will be devoted to theoretical and computational issues in connection with magnetic nanosystems such as 2D-multilayers, 1D-wires, 0D-particles, molecules, and impurities; including metals, alloys, magnetic semiconductors, magnetic oxides and magnetic molecules in various environments (isolated structures as well as embedded in the bulk and on surfaces). Properties include magnetic structure, mechanisms of exchange coupling, anisotropy, spin-dynamics, damping mechanisms, domain structure, hysteretic phenomena, phase transitions, magneto-optics (including magnetic x-ray scattering), spin transport, spin injection and quantum tunneling. Methods include first-principles density functional theory based methods (LDA, etc) as well as new developments for strongly correlated systems (such as LDA plus dynamical mean field theory), spin models, Monte Carlo and spin dynamics methods, and micromagnetic modeling. Of particular interest are methods for multiscale modeling that bridge length scales and approaches to extend the time scale of simulations.

Organizers:

Wei Cai
Stanford University
Durand Building, Room 259
Stanford, CA 94305-4040
Phone: (650) 736-1671
Fax: (650) 723-1778
Email: caiwei@stanford.edu

Bruce Harmon
Ames Laboratory and Iowa State University
Ames, Iowa 50011
Phone: (515) 294-5772
Email: harmon@ameslab.gov

Renat Sabirianov
Department of Physics (UNO)
University of Nebraska
Omaha, NE 68182-0266
Phone: (402) 554-372
Email: rsabirianov@mail.unomaha.edu

6.11.2 Nanostructured Magnetic Materials (DMP/GMAG)

This session focuses on magnetic materials and phenomena at the nanometer-scale. Magnetic nanostructures include films, multilayers, nanocomposites, hybrid structures, wedges, nanowires, magnetic point contacts, nanoparticles, nanoparticle arrays, and patterned films. This session will cover both experimental and theoretical advances in low dimensional magnetism, proximity effects, interlayer magnetic coupling, exchange spring, exchange bias, magnetic quantum confinement, magnetic anisotropy, effects of structural disorder, hysteresis modeling, and other magnetic phenomena. Of special interest is the fabrication of nanostructures with atomic-scale control, synthesis and assembly of nanoparticles and arrays, high-resolution characterization methods with site and/or element specificity, novel techniques for the creation of nanoscale magnetic features, and other unusual physical phenomena present in these systems.

Organizers:

Sara Majetich
Physics Department
Carnegie Mellon University
Pittsburgh, PA 15213-3890
Phone: (412) 268-3105
Fax: (412) 681-0648
Email: sm70@andrew.cmu.edu

E. Dan Dahlberg
School of Physics and Astronomy
University of Minnesota
116 Church St. S.E.
Minneapolis, MN 55455
Phone: (612) 624-3506
Fax: (612) 624-4578
Email: dand@umn.edu

6.11.3 Complex multifunctional oxides (DMP/GMAG)

The broad range of functionalities associated with solid oxides results in large part from the complexity of their electronic structures, and the close competition they exhibit between multiple magnetic and electronic phases. These factors can lead to large responses to external stimuli and the occurrence of striking phenomena such as colossal magnetoresistance and giant magnetoelectric or magnetocalorimetric effects. This symposium will explore recent advances in the fundamental physics and potential technological applications of such complex and multifunctional oxide materials. Sessions will focus both on phenomena of current interest, such as colossal magnetoresistance, multiferroic behavior, magnetoelectronic phase separation, and orbital and charge ordering, as well as specific materials classes that are receiving increased attention, including manganites, cobalt oxides (perovskites and the sodium cobaltates), and ruthenates. The interplay between bulk and thin film synthesis, characterization of structural, electronic and physical properties, and theory and simulation, will be emphasized.

Organizers:

Chris Leighton
Department of Chemical Engineering and Materials Science
University of Minnesota
Minneapolis, MN 55455
Phone: (612) 625 4018
Fax: (612) 626 7246
Email: leighton@umn.edu

Nicola A. Spaldin
Materials Department
University of California

Santa Barbara, CA 93106-5050
Phone:(805) 893-7920
Fax: (805) 893-7221
Email: nicola@mrl.ucsb.edu

6.11.4 Spin Transport and Magnetization Dynamics in Metal-Based Systems (GMAG/DMP/FIAP)

This session will focus on experimental and theoretical investigations that elucidate and/or utilize the transport and transfer of spin in metal-based magnetic systems. Topics of interest include all aspects of spin-dependent transport and scattering, in the diffusive, ballistic, tunneling and hot electron transport regimes as evidenced, for example, in giant magnetoresistance (GMR), tunneling magnetoresistance (TMR), tunneling spectroscopy of spin states, spin filtering and related effects. Also of particular interest are studies of the interplay between non-equilibrium carriers and magnetization dynamics in point contacts, magnetic pillar structures and magnetic nanowires. Additional topics include, but are not limited to, interfacial spin transport, spin injection and detection, spin relaxation time, damping mechanisms in ferromagnets, spin-current-driven domain wall dynamics, and studies in ferromagnetic — normal metal and ferromagnetic — superconductor systems. Studies that emphasize spin phenomena in semiconductor systems will be covered in a separate focus session.

Organizers:

Mark Stiles
Stop 8412
NIST
100 Bureau Drive
Gaithersburg, MD 20899-8412
Phone: (301) 975-3745
Fax: (301) 926-2746
Email: mark.stiles@nist.gov

John Q. Xiao
Department of Physics and Astronomy
University of Delaware
Newark, DE 19716
Phone: (302) 831-6547
Fax: (302) 831-1637
Email: jqx@udel.edu

Allan MacDonald
Physics Department
University of Texas
Austin, TX 78712
Phone: (512) 232-9113
Fax: (512) 471-9637
Email: macd@physics.utexas.edu

6.11.5 Spin Dependent Phenomena in Semiconductors (DMP/GMAG)

Recent advances in understanding the physics of spin-dependent phenomena in semiconductors have come from the mutual influence of research on fundamental optical and transport properties, materials physics, and devices. This focused session solicits abstracts that explore a fundamental understanding of spin-dependent processes in magnetic and non-magnetic structures incorporating semiconductors. Topics include 1) spin dynamics and transport in nonmagnetic semiconductors, including spin transport in mesoscopic systems, electrical or optical spin injection, manipulation, and detection, optical and electronic control of spin coherence, and hyperfine effects; 2) growth, characterization, electrical, optical and magnetic properties, and control of magnetic properties in ferromagnetic semiconductors and hybrid ferromagnet-semiconductor structures and devices; and 3) developments in related fields, such as organic semiconductors and quantum computing, that relate to spin-dependent phenomena in semiconductors.

Organizers:

Peter E. Schiffer
Department of Physics
Penn State University
104 Davey Lab, Box 135
University Park, PA 16802
Phone: (814) 865-5982
Fax: (814) 865-3604
Email: schiffer@phys.psu.edu

Michael E. Flatté
Department of Physics and Astronomy
University of Iowa
Iowa City, IA 52242
Phone: (319) 335-0201
Fax: (319) 353-1115
Email: michael_flatte@mailaps.org

Allan MacDonald
University of Texas
Austin, TX 78712
Phone: (512) 232-9113
Fax: (512) 471-9637
Email: macd@physics.utexas.edu

7.8.1 Simulation and Theory of Complex Materials (DCOMP/DMP)

Advances in computational methods to address materials and condensed matter problems continue to develop in producing exceedingly realistic simulations of physical phenomena as well as providing predictions and enhancement of various properties for length and time scales that span from the subatomic, to atomic, to mesoscopic and even to the continuum limit. In this focused topic the recent progress in such simulations will be demonstrated for a wide spectrum of applications. Here complex systems signify those systems with spatial complexity, systems with a large number of structural units (atoms or molecules) and/or systems of multidimensional and multi-component character. The computational approaches may include implementation of large scale density functional calculations, model Hamiltonians in many-body theory, simulations based on empirical potentials, as well as Monte Carlo, coarse graining, accelerated dynamics and kinetic theory techniques. Applications of these methods are suitable to simulate the behavior of periodic, disordered and defect-containing systems including metallic, semiconducting, insulating and magnetic states of matter. Abstracts with applications to biological systems and those that directly link computational findings to experimental data are also encouraged.

Organizers:

Jeff Grossman
Center for Integrated Nanomechanical Systems
Berkeley Nanosciences and Nanoengineering Institute
University of California
Berkeley, CA 94720-1726
Phone: (510) 642-8358
Fax: (510) 642-9879
Email: jgrossman@berkeley.edu

Alberto G. Franceschetti
National Renewable Energy Laboratory
1617 Cole Boulevard
Golden, CO 80401
Phone: (303) 384-6645
Fax: (303) 384-6432
Email: alberto_franceschetti@nrel.gov

7.8.3 Carbon Nanotubes and Related Materials (DMP)

Broad interest in the fundamental properties of carbon nanotubes and their exploitation in a wide range of applications continue at an increasing pace, due in large part to their unique chemical, mechanical, thermal, optical and electrical properties. This focus topic concerns recent developments in (1) the fundamental understanding of nanotube properties, including synthesis, processing, purification, electrical, optical, thermal, mechanical, and chemical properties and (2) on potential applications, such as nanosensors, nanoprobes, field emitters, display devices, field-effect devices, composite materials, and high surface area storage media. Experimental and theoretical contributions are solicited in the following areas: 1) synthesis and characterization of doped and pure carbon nanotubes and nanohorns, 2) optical spectroscopy of carbon nanotubes, 3) electrical transport in carbon nanotubes, 4) thermal and magnetic properties of carbon nanotubes, 5) mechanical properties of nanotubes and their composites, 6) chemical functionalization, properties, and separation techniques 7) electronic properties and devices, 8) gas adsorption and storage, 9) field emission, 10) structure and properties of filled carbon nanotubes, and nanotube peapods 11) multifunctional nanotube composites and 12) other experimental and theoretical results from quasi-one dimensional systems which relate to carbon nanotubes.

Organizers:

Vasili Perebeinos
IBM Research Division
T.J. Watson Research Center
P.O. Box 218
Yorktown Heights, NY 10598
Phone: (914) 945-3567
Fax: (914) 945-4531
Email: vperebe@us.ibm.com

Tobias Hertel
Department of Physics and Astronomy
Vanderbilt University
6301 Stevenson Center Lane

Nashville, TN 37235
Phone: (615) 322-2864
Fax: (615) 343-7263
Email: tobias.hertel@vanderbilt.edu

Junichiro Kono
ECE Department, MS 366
PO Box 1892
Rice University
Houston, TX 77251-1892
Phone: (713) 348-2209
Fax: (713) 348-5686
Email: kono@rice.edu

7.8.4 Computational Nanoscience (DCOMP/DMP)

When the size of the physical systems is reduced to the nanometer scale, many novel physical phenomena emerge. Computational studies can be used to interpret experimental observations of these phenomena, provide much-needed insight into their underlying physical origin, and thus design nanomaterials with desired properties. Recent advances in computational methodologies for studying nanoscale materials have made it possible to reliably predict many physical and chemical properties of nanostructures that span multiple time and length scales. This session will provide a comprehensive overview of recent computational work in the field of nanoscale materials with particular emphasis on techniques that allow an efficient multi-scale integration from the micro- to the nanoscale. Subjects to be covered include, but are not limited to, computational studies of the growth, structural, mechanical, vibrational, electronic, opto-electronic and reactivity properties of nanofeatured structures and materials and the interplay between functionality and local structural environment.

Organizers:

Lin-Wang Wang
Mail Stop 50F
Lawrence Berkeley National Laboratory
1 Cyclotron Road
Berkeley, CA 94720
Phone: (510) 486-5571
Fax: (510) 486-5812
Email: lwwang@lbl.gov

Marco Buongiorno Nardelli
Center for High Performance Simulation and Department of Physics
North Carolina State University
Raleigh. NC 27695-7518
and
CCS-CSM - Oak Ridge National Laboratory
Oak Ridge, TN 37831
Phone: (919) 513-0514
Fax: (919) 5134804
Email: mbnardelli@ncsu.edu

12.7.1 Friction, Fracture and Deformation (DMP/GSNP)

This session will explore recent developments in the areas of friction, fracture, and deformation in materials-research areas that have recently drawn renewed interest within the physics community. This session covers all length scales from the nanoscale to tectonic scales. Topics of interest include tribochemistry, nanoscale mechanics including AFM indentation phenomena, dislocation patterns, grain boundary and interface effects, fracture initiation, crack propagation, the tribology of smooth and rough surfaces including fractal interfaces, and material deformation under applied stress including cutting. The session welcomes experimental, computational, and analytical studies of atomistic, mesoscopic, continuum, statistical, and multiscale aspects of deformation, friction, and fracture instabilities in various classes of solids, including granular, crystalline, amorphous, micro-fabricated, and nano-structured solid systems of metallic, silicon-based, ceramic, glassy, or polymeric type.

Organizers:

H. G. E. Hentschel
Math. & Sci. Ctr., Phys. Dept.
Emory University
400 Dowman Drive
Atlanta, GA 30322
Phone: (404) 727-0764
Fax: (404) 727-0873
Email: phshgeh@physics.emory.edu

Yue Qi
MC 480-106-224
GM Research and Development Center
30500 Mound Rd
Warren, MI 48090-9055
Phone: (586) 947-0751
Fax: (586) 986-8697
Email: yue.qi@gm.com

Udo D. Schwarz
Department of Mechanical Engineering
Yale University
P.O. Box 208284
New Haven, CT 06520
Phone: (203) 432-7525
Fax: (203) 432-6775
Email: udo.schwarz@yale.edu

13.6.1 Optical Properties of Nanostructures (DMP)

This focused session will be devoted to techniques to predict and understand the optical, photoemission, x-ray absorption, and other spectroscopic properties of materials at the nanoscale. The emphasis will be on current topics and applications. Contributions from both theory and experiment are encouraged. Topics of interest will include, but are not limited to: (1) optical and dielectric (including nonlinear response) properties of semiconductors, insulators and oxides; (2) electron and x-ray spectroscopies via x-ray absorption, emission, and scattering; applications to metals, surfaces, and complex systems; (3) electronic excitations in confined systems, e.g., polymers, clusters, nanocrystals, quantum dots, and nanostructured materials.

Organizers:

James R. Chelikowsky
ACES Bldg. Rm 4.102
Inst. Comp. Eng. & Sci. (C0200)
1 University Station
Austin, TX 78712
Phone: (512) 471-3312
Email: jrc@ices.utexas.edu

John Rehr
Department of Physics
University of Washington
P.O. Box 351560
Seattle, WA 98195-1560
Phone: (206) 543-8593
Fax: (206) 685-0635
Email: jjr@phys.washington.edu

Steven G. Louie
University of California
Physics Department #7300
Berkeley, CA 94720-7300
Phone: (510) 642-1709
Fax: (510) 643-9473
Email: sglouie@uclink.berkeley.edu

13.6.2 Fundamental Challenges in Transport Properties of Nanostructures (DMP)

This focus topic will address issues which are critical to the understanding, characterization and control of electrical transport phenomena in nanostructures including single-molecule devices, self-assembled monolayers, point contacts, semiconductor nanowires, quantum dots, and other novel structures. Contributions are solicited in the following areas: 1) controlled fabrication of nanoscale devices including synthesis, self assembly and other bottom-up approaches, novel lithographic and other top-down techniques, and integration with contacts; 2) experimental studies of structural properties and electrical transport characteristics of nanoscale structures and devices; and 3) theoretical advances in modeling structural properties and electrical transport characteristics of nanoscale systems. Note that other focus topics are organized more specifically on: (1) carbon nanotubes; (2) organic electronics, photonics, and magnetics; and (3) thermal, thermoelectric, and mass transport at the nanoscale.

Organizers:

Mark S. Hybertsen
Applied Physics and Applied Math
Columbia University
500 W. 120th St.
New York, NY 10027
Phone: (212) 854-8420
Fax: (212) 854-1909
Email: msh2102@columbia.edu

Daniel C. Ralph
Department of Physics
Cornell University

Clark Hall
Ithaca, NY 14853
Phone: (607) 255-9644
Fax: (607) 255-6428
Email: ralph@ccmr.cornell.edu

Mark C. Hersam
Materials Science and Engineering
Northwestern University
2220 Campus Drive
Evanston, IL 60208-3108
Phone: (847) 491-2696
Fax: (847) 491-7820
Email: m-hersam@northwestern.edu

13.6.3 Materials Issues for Quantum Computing and Quantum Engineering (DMP)

Many experiments aimed at engineering the quantum behavior of objects have important underlying materials issues. These arise in wide ranging systems such as qubits based on Josephson junctions, quantum dots, spins in semiconductors and quantum behavior of small mechanical resonators, to name just a few. This focus session is aimed at materials issues in quantum computing and quantum engineering, discussing what has been learned about how materials properties influence the coherent quantum behavior of such systems, views on what is possible, and new ideas for obtaining and studying controlled quantum behavior of materials-based qubits. Abstracts in any of these areas are encouraged. For further information please contact one of the co-organizers listed below.

Organizers:

James N. Eckstein
Department of Physics
University of Illinois
1110 West Green Street
Urbana, IL 61801
Phone: (217) 244-7709
Fax: (217) 244-2278
Email: eckstein@uiuc.edu

Keith Schwab
Laboratory for Physical Sciences
National Security Agency
8050 Green Mead Drive
College Park, MD 20740
Phone: (301) 935-6542
Fax: (301) 935-6723
Email: schwab@lps.umd.edu

13.6.4 Thermal, Thermoelectric, and Mass Transport at the Nanoscale (DMP)

The influential role of quantum effects and correlations in nanoscale structures often leads to unexpected and fundamentally interesting behavior. The ability to harness such effects for device applications, however, depends crucially on the thermal and mechanical stability of the constituent nanostructures. In particular, for materials with characteristic dimensions below the electron and phonon mean free paths, thermal and electrical transport may differ dramatically from bulk semi-classical behavior, and the interplay between electrons and phonons will significantly impact device properties and performance. This focus topic centers on fundamental questions related to understanding and controlling thermal, electrical, thermoelectrical, and mass transport in nanostructures. We encourage submission of abstracts in the areas of synthesis, fabrication, characterization, and theory of nanostructures in the context of novel thermal, thermoelectric, and mechanical properties. Nanoscale phenomena of interest include phonon dynamics, thermal conductance, thermoelectric power, specific heat; mass transport, diffusion, and nanofluidics; and local heating, nanoscale friction, dissipation, and elasticity. Relevant systems include nanostructured interfaces and superlattices; embedded nanostructures and nanocomposites; biological and organic complexes; quantum dots, nanowires and nanotubes, organic self-assembled monolayers, and single molecule devices. We encourage experimental, theoretical, and computational contributions, in particular those reporting on interdisciplinary and collaborative research efforts.

Organizers:

Jeffrey B. Neaton
The Molecular Foundry
Lawrence Berkeley National Laboratory
Berkeley, CA 94720
Phone: (510) 642-1031
Fax: (510) 642-9345
Email: jbneaton@lbl.gov

Philip Kim
Department of Physics
Columbia University
538 West 120th Street
New York, NY 10027
Phone: (212) 854-0102
Fax: (212) 854-3379
Email: pk2015@columbia.edu

David Tomanek
Department of Physics and Astronomy
Michigan State University
East Lansing, MI 48824-2320
Phone: (517) 355-9702
Fax: (517) 353-4500
Email: tomanek@pa.msu.edu

13.6.5 Nanoscale Materials Physics of Phase Transitions (DMP)

There has been substantial recent progress in the synthesis and characterization of nanoscale materials, as well as in theoretical and computational methods for describing these phase transitions. It is thus now becoming possible to correlate the effects of size, dimensionality and electronic structure with the dynamics and physical properties arising from these phase transitions. This focused topic session aims to bring together theorists and experimentalists working in this area to discuss materials physics questions relating to nanoscale phase transitions. Topics of interest include, but are not limited to relevant experimental, theoretical and computational studies of: 1) model materials: semiconductors, strongly correlated materials, metals and semi-metals; 2) effects of dimensionality: nanoparticles and nanocrystals, nanowires, ultrathin films and surfaces; 3) phase transformations: structure, dynamics, order-disorder and coherence effects; 4) effects of nanoscale phase transformations on optical, magnetic, conducting and thermal properties. Questions about the suitability of proposed contributions can be addressed to any of the organizers listed below.

Organizers:

Richard Haglund
Department of Physics and Astronomy
Vanderbilt University
6301 Stevenson Center
Nashville TN 37235-1807
Phone: (615) 322-7964
Fax: (615) 343-7263
Email: richard.haglund@vanderbilt.edu

David Singh
Condensed Matter Sciences Division
Oak Ridge National Laboratory
P. O. Box 2008, MS 6032
Oak Ridge TN 38731-6032
Phone: (865) 241-3716
Fax: (865) 574-4143
Email: singhdj@ornl.gov

Eric Mazur
Div. of Engineering and Applied Sciences
Harvard University
Cambridge MA 02138
Phone: (617) 495-8729
Fax: (240) 255-4622
Email: mazur@physics.harvard.edu

14.9.1 Morphology and Composition Evolution in Thin Films and Surfaces (DMP)

Exploiting growth and kinetic instabilities to form surface nanostructures and patterns with desirable functionality has emerged as a key element in strategies for nanoscale fabrication. The success of this approach depends on fundamental understanding of the evolution of thin-film morphology, electronic structure, and composition. This focus session will highlight recent experimental and theoretical developments associated with the formation and stability of nanostructures, surfaces, thin films, and interfaces. Novel hard/soft hybrid systems with potential biological relevance, such as water and biomolecule interaction with solid surfaces, will also be addressed.

Organizers:

Zhenyu Zhang
Condensed Matter Sciences Division
Oak Ridge National Laboratory
Oak Ridge, TN 37831
Phone: (865) 576-5346
Fax: (865) 574-4143
Email: zhangz@ornl.gov

Shirley Chiang

Department of Physics
University of California at Davis
Davis, CA 95616-8677
Phone: (530) 752-5989
Fax: (530) 752-4717
Email: chiang@physics.ucdavis.edu

Efthimios Kaxiras
Department of Physics
Harvard University
Cambridge, MA 02138
Phone: (617) 495-7977
Fax: (617) 496-2545
Email: kaxiras@cmt.harvard.edu

19.3.1 Earth and Planetary Materials (DMP/DCOMP)

This focus session on Earth and Planetary Materials will highlight new experimental, computational, and theoretical approaches for understanding a variety of materials existent in planetary environments, from core to surface, from solar to exosolar planets. The main interest lies in the exploration of ices, fluids, minerals as well as complex/imperfect materials over the appropriate range of thermodynamics conditions. Recent advances in theoretical and experimental techniques have led to breakthroughs in our understanding of the physical and chemical properties of Earth materials that were deemed inconceivable only a few years ago. For example, progress in laser-based spectroscopy, the second- and third-generation synchrotron sources, static and dynamic compression techniques, and advanced theoretical methods combined with rapidly increasing computer power has fundamentally altered how we investigate Earth materials and their interaction with the environment. Of particular importance is that we now have *in situ* methods capable of determining the properties and behavior of materials under conditions ranging from deep-earth temperatures and pressures to ambient conditions. The goal of these sessions will be to explore the science and the technological advances that inspire research in this area.

Organizers:

Renata M. Wentzcovitch
Dept of Chem Engr & Mater Sci
Univ of Minnesota
421 Washington Ave SE Rm 151
Minneapolis, MN 55455
Phone: (612) 625-6345
Fax: (612) 626-7246
Email: wentzcov@cems.umn.edu

Hokwang Mao
Geophysical Lab, CIW
5251 Broad Branch Rd, NW
Washington, DC 20015
Phone: (202) 321-8899
Email: mao@gl.ciw.edu

Eric R. Schwegler
Lawrence Livermore National Laboratory
PO Box 808, MS L-415

Livermore, CA 94550
Phone: (925) 424-3098
Fax: (925) 373-3542
Email: schwegler@llnl.gov

19.3.2 Simulations of Matter at Extreme Conditions (DCOMP/GSCCM/DMP)

A wide variety of phenomena, such a solid compressed by a shock wave, planetary interiors, a nanoparticle subjected to an intense radiation field, or a cell membrane under large strain, all represent matter under extreme conditions. Matter at extreme conditions is characterized by a strong perturbation of structure and dynamics far from ambient equilibrium by environmental factors. Despite the diversity of applications, strong commonality exists among the methods employed in the description of strongly perturbed matter. This focus session concerns recent advances in theoretical and computational methodologies applied to metallic, organic, inorganic, and biological materials, as well as liquids, plasmas, and atomic or molecular clusters exposed to high pressures, strain rates (including shock loading), temperature extremes, or intense external fields. Presentations will include such diverse computational approaches as atomistic (quantum, semi-classical, and classical), mesoscopic (grain-scale), continuum, and multi-scale techniques. Representative scientific areas of interest are: (1) equations of state; (2) dynamical response of materials; (3) inelastic deformation, fracture, and spall; (4) high-pressure phase transitions; (5) electrical, optical, and other properties of shocked materials; (6) energetic materials; (7) shock-induced chemistry; (8) high energy density conditions; (9) intense external field interactions; and (10) biological or geophysical applications.

Organizers:

Timothy C. Germann
X-7, MS-F699
Los Alamos National Laboratory
Los Alamos, NM 87545
Phone: (505) 665-9772
Fax: (505) 665-6722
Email: tcg@lanl.gov

Laurence E. Fried
L-282
Lawrence Livermore National Laboratory
7000 East Avenue
Livermore, CA 94550
Phone: (925) 422-7796
Fax: (925) 424-3281
Email: fried1@llnl.gov

Sandro Scandolo
The Abdus Salam International Center for Theoretical Physics
Strada Costiera 11
34014 Trieste (Italy)
Phone: +39 040 2240 209
Fax: +39 040 224163
Email: scandolo@ictp.it