

DMP NEWSLETTER

Division of Materials Physics

A Division of The American Physical Society • www.aps.org/units/dmp

Summer 2002

APS March Meeting, Austin, TX; March 3-7, 2003

This Newsletter outlines the Focus Topic program that is being sponsored or co-sponsored by the Division of Materials Physics. There are 25 Focus Topics. Each will include a number of sessions per topic with typically 1 invited speaker per session. The rest of the session consists of contributed presentations. Below is information for suggesting invited speakers and for submitting abstracts for Focus Topics. In addition there will be an invited symposium to honor the recipients of the McGroddy Prize for New Materials and the David Adler Lectureship Award and an invited symposium on the materials realization of qubits for quantum computing.

Please note that the Spring 2002 newsletter, which lists new officers and contains the DMP Chair's post-March-Meeting message and calls for nominations for the McGroddy Prize and the Adler Lectureship Award, was sent out via e-mail and not by postal mail. In addition, it is posted in both html and pdf format on the DMP website. The decision to use electronic rather than hard-copy mailing was made primarily to reduce costs, but it also saves on clutter. To the small minority of members who choose not to make use of e-mail, we apologize for this lack of communication.

DATES TO REMEMBER:

Aug. 30, 2002:
Suggestions for Invited Speakers to organizers

Dec. 6, 2002
Abstract Deadline (submitted via web)

March 3-7, 2003:
March Mtg. in Austin, TX

List of DMP-Sponsored or Co-Sponsored Sessions and Sorting Categories for the 2003 APS March Meeting

- 2.9.1 Applications of Pseudopotentials in Materials and Solid State Physics (DMP/DCOMP)
- 2.9.2 Spin-dependent Phenomena in Semiconductors (DMP/GMAG)
- 2.9.3 Wide Band Gap Semiconductors (DMP)
- 4.14.5 Organic Nano- and Mesosstructures for Electronic & Photonic Applications (DPOLY/DMP)
- 5.9.1 Current Transport in Superconductors (DMP)
- 6.11.1 Theory and Simulation of Magnetism and Spin Dependent Properties (DCOMP/DMP/GMAG)
- 6.11.2 Magnetic Nanostructures and Heterostructures (DMP/GMAG)
- 6.11.3 Magnetoresistive Oxides (DMP/GMAG)
- 6.11.4 Spin Transport and Spin Dynamics in Metal-based Systems (GMAG/DMP)
- 7.9.1 Simulations of Complex Materials (DCOMP/DMP)
- 7.9.2 Theory of Nanotubes (DCOMP/DMP)
- 7.9.3 Novel Thermoelectric Materials and Phenomena (FIAP/DMP)
- 7.9.4 Physics of Silicon in Electronic Materials (FIAP/DMP)
- 7.9.5 Novel and Complex Oxides and Dielectrics (DMP/FIAP)
- 7.9.6 Carbon Nanotubes and Related Nanomaterials (DMP)
- 10.9.3 The Biomembrane/Solid Interface: Mechanisms, Instrumentation, and Measurements (DBP/GIMS/DMP)
- 12.10.8 Nonequilibrium Quantum Dynamics in Electronic and Magnetic Systems (FIAP/DMP)
- 12.10.9 Plastic Deformation and Fracture (DMP)
- 13.9.2 Asymmetrical Nanoparticles: Rods, Disks, and Complex Shapes (DMP)
- 14.9.1 Mechanical Properties of Nanostructured Thin Films and Coatings (FIAP/DMP)
- 14.9.2 Morphological Evolutions of Nanostructures, Interfaces, Surfaces and Thin Films (DMP)
- 14.9.3 Fundamental Challenges in Transport Properties of Nanostructures (DMP)
- 16.9.2 Front-End Materials and Processes for Scaled Silicon CMOS (FIAP/DMP)
- 16.9.3 Progress in Photovoltaic Technology (FIAP/DMP)
- 19.9.1 High Pressure Research (DMP)

In this Issue...

ARTICLES

- **APS March Meeting**
- **List of Sessions and Sorting Categories**
- **DMP 2003 March Mtg. Focused Topic Program - Call for Abstracts**

CALL FOR INVITED SPEAKER SUGGESTIONS and for FOCUS TOPIC SESSION ABSTRACTS

If you would like to make suggestions for invited speakers for a Focus Topic, you may use the web-based form, for which there will be a link on the DMP homepage (www.aps.org/units/dmp/), or contact the appropriate organizers (listed below) by **Friday, Aug. 30, 2002**. The web-based form includes fields for:

- Nominator (affiliation, phone and e-mail)
- Suggested speaker (affiliation, address, phone, fax, e-mail and title of talk)
- Abstract justification (880 character limit)

Once the nominator completes the form, there is a “submit” button at the bottom of the page. The nomination submission is sent by e-mail to the proper focus topic organizer.

DMP 2003 March Meeting Focus Topic Program Call for Abstracts

2.9.1 Applications of Pseudopotentials in Materials and Solid State Physics (DMP/DCOMP)

A central goal of materials and solid state physics is the prediction of properties using only information about the constituent species. The realization of this goal would allow workers to predict the existence of new materials with useful properties such as high temperature alloys and superconductors, superhard matter, low dielectric materials, spintronic materials and so on. The pseudopotential description of matter has led the way in providing a viable model for this goal, and modern computer platforms have provided the means for its implementation. Pseudopotentials have made it possible to predict accurately the electronic and structural properties of complex systems with hundreds, if not thousands of atoms. This focus session will center on pseudopotential applications for problems in materials and solid state physics. Examples of applications will include predicting the electronic and structural properties of complex solids, defects, surfaces, interfaces, clusters, quantum dots, amorphous solids, glasses, and nanostructured matter. The emphasis of this session will be electronic materials.

Organizers: Jim Chelikowsky, Department of Chemical Engineering and Materials Science; University of Minnesota Minneapolis, MN 55455; Phone: (612) 625-4837; Fax: (612) 626-7246; e-mail: jrc@msi.umn.edu

Jerry Bernholc, Department of Physics; North Carolina State University, Raleigh, NC 27695-8202, Phone (919) 515-3126, Fax (919) 515-7331, e-mail: bernholc@ncsu.edu.

2.9.2 Spin-Dependent Phenomena in Semiconductors (DMP/GMAG)

The field of spin-dependent phenomena in semiconductors has developed rapidly in the past several years. Considerable progress has already been made in the understanding and control of ferromagnetism

If you contact the organizers directly, then the format for your suggestions is free-style, but please include a title, a brief descriptive paragraph, and the name, address, telephone number, fax number, and e-mail address of both the proposed speaker and the nominator.

Contributed (and invited-speaker) abstracts are **due Dec. 6, 2002 at APS (submitted via the web at <http://abstracts.aps.org/> [starting August 1])**; contributors are welcome to send a duplicate copy to the organizers listed below, but please be sure to send the original to APS, on time, being careful that the abstract conforms to APS regulations.

in III-Mn-V alloys, of spin-polarization of electrons in semiconductors near ferromagnet/semiconductor interfaces and in spin-polarized LED's. Optical manipulation of spin memory of electrons in GaAs and polarization/imprinting of the nuclear spin system in GaAs by an adjacent ferromagnet has also been demonstrated. A range of novel semiconducting materials, exhibiting ferromagnetism at relatively high temperatures (in some cases in excess of 300K), has been reported (although many of these materials remain to be fully characterized and the origin of their ferromagnetism clarified). These materials advances not only include new systems per se but novel schemes of materials processing (such as annealing and co-doping), as well as control of ferromagnetism by materials design by fabricating digital ferromagnetic alloys. In addition, room temperature magnetoelectronic devices such as magnetic tunnel junctions and magnetic tunneling transistors continue to develop rapidly. For example, giant magnetocurrents (>3400%) with large output currents, have recently been reported for GaAs magnetic tunneling transistors. This focused session solicits abstracts in each of these fields. Topics of particular interest include fabrication, design, characterization and theory of novel magnetic semiconductors, including clarification of the origin of high temperature ferromagnetism; measurements of spin injection into semiconductors across interfaces to ferromagnetic metals and dilute magnetic semiconductors; studies of magnetoelectronic devices including spin LED's, magnetic tunnel junctions (particularly those involving semiconducting barriers or functional integration with semiconductors) and magnetic tunneling transistors.

Organizers: Robin F.C. Farrow, Mail Stop K11/D1, IBM Research Division, 650 Harry Road, San Jose, CA 95120-6099, Phone (408) 927 2389, Fax (408) 927 2510, E-mail farrow@almaden.ibm.com

Jacek Furdyna, Department of Physics; University of Notre Dame, 225 Nieuwland, Notre Dame, IN 46556, Phone (219) 631-6741, Fax (219) 631-5952, E-mail furdyna.1@nd.edu

Thomas C Schulthess, Computer Sci & Math Division; Oak Ridge National Laboratory, 1 Bethel Valley Rd MS 6114, Oak Ridge, TN 37831-6114, Phone (865) 574-4344, Fax (865) 574-7659, E-mail schulthess@ornl.gov

2.9.3 Wide Band Gap Semiconductors (DMP)

Research and development of wide band gap (WBG) semiconductor materials continues to draw much interest in academia, government, and industry based on their current and projected use in a variety of electronic (e.g., RF and high power systems) and opto-electronic (e.g., short-wavelength sources and sensors) systems. These materials include (Ga,In,Al)-based Nitrides, II-VI compounds such as ZnO, ZnSe, and ZnTe, and group-IV WBG semiconductors such as SiC (of all polytypes) and diamond. This session solicits experimental and theoretical papers that address issues related to growth (including bulk and epitaxial techniques), structural, electronic, and optical properties, and emerging device technologies. Abstracts are encouraged for work performed that advances the state-of-the-art from either fundamental or technological standpoints. Topics to be covered include materials growth, physical, electronic, and optical properties, materials theory, and device characterization and modeling.

Organizers: Evan R. Glaser, Naval Research Laboratory, Code 6877 4555 Overlook Ave. SW; Washington, DC 20375-5347, Phone: (202) 404-4521, Fax: (202) 767-1165, e-mail: glaser@bloch.nrl.navy.mil

Mary Ellen Zvanut, Physics Department, University of Alabama at Birmingham, Birmingham, Alabama 35294-1170, Phone: (937) 255-4474, ext. 3232, Fax: (937) 255-4913, e-mail: maryzvanut@wpafb.mil

4.14.5 Organic Nano- and Mesostructures for Electronic & Photonic Applications (DMP/DPOLY)

With the physical limits of silicon-based technology discernable on the near horizon, organic-based structures are strongly being pursued for the development of smaller and faster circuits and devices. This DMP/DPOLY jointly sponsored focus topic considers the latest developments in electronic and photonic materials and structures comprising organics. As one direction, molecule-based electronic structures ranging broadly from single crystals and films to nanoscopic molecular tunnel junctions are considered. Contributions are solicited in the areas of organic semiconductor device physics (e.g., FETs, LEDs, photovoltaics), low temperature transport phenomena, theories and measurement of transport in molecular junctions, as well as novel device structures and measurement schemes. This session will also serve as a forum for reporting efforts to fabricate and characterize single crystal organic semiconductor FETs, which have been the focus of much recent attention. Complementary to such efforts, photonic nano- and mesostructures incorporating organics are considered in applications ranging from waveguides and dielectric mirrors to optical filters and switches. Contributions pertaining to the fabrication of photonic band-gap structures by self-assembly routes, holographic lithography and other novel schemes are sought, as well as papers concerning modeling and characterization of such structures, control of defects and approaches to achieve dielectric contrast.

Organizers: C. Daniel Frisbie, Chemical Engineering & Materials Science, University of Minnesota, Minneapolis, MN 55455, Phone: (612) 625-0779, Fax: (612) 626-7246, e-mail: frisbie@cems.umn.edu

George G. Malliaras, Materials Science & Engineering, Cornell University, Ithaca, NY 14853, Phone: (607) 255-1956, Fax: (607) 255-2365, e-mail: george@ccmr.cornell.edu

5.9.1 Current Transport in Superconductors (DMP)

This session focuses on the delineation of the physical nature of current transport and the factors which influence its behavior in superconductors, such as cuprates, MgB₂, NbTi, Nb₃Sn, etc. One of the important areas in superconductivity, where sufficient scientific understanding is not yet developed, is the mechanisms which control current transport in different superconductors. For example, the interactions of magnetic vortices with defects and/or the role of fluctuations on the interaction in superconductors lack understanding, except for the cases where artificial pinning centers such as amorphous columns are introduced. Neither is a consistent picture(s) available for the relationship between current transport across grain boundaries and the defect and electronic structures of the boundaries in cuprates, nor even in A15 compounds. Thus, this session is organized to bring together investigators, who are working on different aspects of the current transport phenomena, experimental and theoretical including simulations, and/or on different materials, to seek the possible commonality or dissimilarity in the observed phenomena, in order to promote further scientific understanding of this important area of superconductivity.

Organizers: M. Suenaga, Materials Science Department, Brookhaven National Laboratory, 76 Cornell St. Upton, NY 11973, Phone: (631) 344-3518, Fax: (631) 344-4071, e-mail: mas@bnl.gov

David Larbalestier, Materials Science and Engineering, 915 Engineering Research Building, 1500 Engineering Drive, Madison, WI 53706, Phone: (608) 263-2194, Fax: (608) 262-8353, e-mail: larbales@enr.wisc.edu

M. Beasley, Applied Physics, Rm. 213, Stanford University, Stanford, CA, 94305-4090, Phone: (650) 723-1196, Fax: (650) 725-2189, e-mail: beasley@ee.stanford.edu

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

The purpose of this session is to focus on recent advances in theory and modeling of magnetic and spin dependent properties of materials. The session 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 session 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 semi-conductors, 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, 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 extending the time scale of simulations.

Organizers: G. Malcolm Stocks, Metals and Ceramics Division, Oak Ridge National Laboratory, P.O. Box 2008-6114, Bethel Valley Road, Oak Ridge, TN 37831-6114, Phone: (423) 574-5163, Fax: (423) 574-7659, e-mail: gms@ornl.gov.

Steven Erwin, Code 6690, Naval Research Laboratory, 4555 Overlook Ave. Washington, DC 20375 Phone: (202) 404-8630, Fax: (202) 404-7546, e-mail: erwin@dave.nrl.navy.mil

Bruce Harmon, Department of Physics and Astronomy, Iowa State University, Ames, IA 50011, Phone: (515) 294-7712, Fax: (515) 294-0689, e-mail: harmon@ameslab.gov

6.11.2 Magnetic Nanostructures and Heterostructures (DMP/GMAG)

This session will focus on the properties of artificial magnetic structures characterized by nanometer dimensions. Structures include films, multilayers, nanocomposites, hybrid structures, wedges, nanowires, magnetic point contacts, nanoparticles, self-organized and ordered nanoparticle arrays, and patterned films. This session will cover 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 are 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: J. Samuel Jiang, Materials Science Division, MSD223, Argonne National Laboratory, 9700 S. Cass Ave. Argonne, IL 60439, Phone: (630) 252-7738, Fax: (630) 252-9595, e-mail: jiang@anl.gov

Diandra Leslie-Pelecky, Department of Physics and Astronomy, University of Nebraska, Lincoln NE 68588-0111, Phone: 402-472-9178, Fax: (402) 472-2879, e-mail: diandra2@unl.edu

Kurt W. Wierman, Seagate Technology, River Park Commons, Suite 550, 2403 Sidney, Street, Pittsburgh, PA 15203-2116, Phone: (412) 918-7050, Fax: (412) 918-7010, e-mail: kurt.w.wierman@notes.seagate.com

6.11.3 Magnetoresistive Oxides (DMP/GMAG)

A great richness of phenomena, including Colossal Magnetoresistance (CMR), half-metallicity, ferro and antiferromagnetism, charge- and orbital ordering, and micro- and mesoscopic phase mixtures is exhibited by transition metal oxides such as manganites, cobaltates, ruthenates and ferrites, to name a few. This session concerns experimental, theoretical, and computational explorations of both a fundamental and applied nature, aiming at developing understandings of magnetism and its relationship to other physical properties such as magneto-transport, lattice and magnetic excitations, surface and interface behavior, electronic structure, and electron correlation effects.

Organizers: Dan Dessau, Condensed Matter Labs, Physics Department, Campus Box 390, University of Colorado, Boulder, CO 80309-0390, Phone: (303) 492-1607, Fax: (303) 492-2998, e-mail: dessau@colorado.edu

Andrew J. Millis, Physics Department, Department of Physics, Columbia University, 538 West 120th Street, New York, NY 10027, Phone: (212) 854-3336, Fax: (212) 854-3379, e-mail: ajm2010@columbia.edu

Jonathan Z. Sun, IBM Research, Rm 24-154, 1101 Kitchawan Rd, Rt 134, Yorktown Heights, NY 10598, Phone: (914) 945-1372, Fax: (914) 945-2141, e-mail: jonsun@us.ibm.com

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

This session will focus on experimental and theoretical investigations that elucidate and/or utilize the transport and transfer of spin, at the nanoscale, in metal-based magnetic systems. Studies that emphasize spin phenomena in semiconductor systems will be covered in a separate focused session. 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), ballistic magnetoresistance, tunneling spectroscopy of spin states, spin filtering and related effects. Also of particular interest are studies of the transfer of spin between charge carriers and magnetic elements resulting in either the excitation or damping of the magnetic element, and the use of magnetoresistance and spin-transfer phenomena to investigate nanomagnetic behavior and dynamics. Additional topics include, but are not limited to, interfacial spin transport, spin injection and spin lifetime studies in ferromagnetic - normal metal and ferromagnetic-superconductor systems, as well as the use of such systems to study spin polarization.

Organizers: Jack Bass, Physics and Astronomy Dept., Michigan State University, East Lansing, MI 48824-1116, Phone: (517) 432-1146, Fax: (517) 353-4500, Email: bass@pa.msu.edu

Robert A. Buhrman, School of Applied and Engineering Physics, Cornell University, Ithaca NY 14853-2501, Phone: (607) 255-3732, Fax: (607) 255-7658, e-mail: rab8@cornell.edu

Roger Koch, IBM TJ Watson Res Center 2-004, Yorktown Heights NY 10598, Phone (914) 945-2393, Fax (914) 945-442, e-mail coke@watson.ibm.com,

Steve Russek, NIST, MC 814.05, 325 Broadway, Boulder CO 80303, Phone (303) 497-5097, Fax (303) 497-5316, e-mail: russek@boulder.nist.gov

7.9.1 Simulations of Complex Materials (DCOMP/DMP)

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 of enhancing various properties. In this focused session the recent progress in such simulations will be demonstrated for a wide spectrum of applications. 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 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.

Organizers: E. Blaisten-Barojas, School of Computational Sciences, George Mason University, MS 5C3, Fairfax, Virginia 22030, Phone: (703) 993-1988, Fax: (703) 993-1269, e-mail: blaisten@gmu.edu

D. Papaconstantopoulos, Code 6390, NRL, 4555 Overlook Ave SW, Washington DC 20375, Phone: (202) 767-6886, Fax: (202) 404-7546, e-mail: papacon@dave.nrl.navy.mil

7.9.2 Theory of Nanotubes (DCOMP/DMP)

The discovery of carbon nanotubes a little more than ten years ago has created a plethora of opportunities in the science and technology of novel materials and devices. Nanotubular structures are characterized by extraordinary structural, mechanical and electrical properties, which derive from their unique quasi-one-dimensional nature and peculiar symmetry. They have become a prototypical system to study physics at the nanoscale and have provided the theoretical community with exciting new opportunities and challenges in the description of novel physical phenomena. This focus session is designed to provide an updated and comprehensive overview of the recent theoretical work in the field of nanotubular structures. Theoretical papers are solicited to address all issues related to nanotubular materials and composites. Subjects to be covered include: growth, structural, mechanical, electronic, transport and optical properties, electronic excitations and correlation effects, phenomenology, device development, functionalization and energy storage.

Organizers: Marco Buongiorno Nardelli, Department of Physics, North Carolina State University, Box 8202, Raleigh, NC 27695 and Center for Computational Sciences (CCS) and Computational Science and Mathematics Division, Oak Ridge National Laboratory, Oak Ridge, TN 37830, Phone: (919) 513-0514, Fax (919) 513-4804, e-mail: mbnardelli@ncsu.edu

Jean-Christophe Charlier, Unité de Physico-Chimie et de Physique des Matériaux, Université Catholique de Louvain Place Croix du Sud 1 (Boltzmann) B-1348 Louvain-la-Neuve, BELGIUM, Phone: (32) 10 47 33 59, Fax: (32) 10 47 34 52, e-mail: charlier@pcpm.ucl.ac.be

M. P. Anantram, Center for Nanotechnology, NASA Ames Research Center, Mail Stop: 229-1, Moffett Field, CA 94035-1000, Phone: (650) 604-1852, Fax: (650) 604-437, e-mail: ananant@nas.nasa.gov

7.9.3 Novel Thermoelectric Materials and Phenomena (FIAP DMP)

The focus session will examine the current state of the art in materials for solid-state thermoelectric and thermionic refrigeration and power generation applications. In addition, the session will solicit abstracts on novel thermoelectric related phenomena, nano-materials and other new materials as well as structure-property relationships of novel materials as applied to thermoelectrics and thermionics. These technologies offer unique opportunities in environmental issues, from CFC reduction to waste heat recovery. The research into these technologies offers a unique

insight into the investigation of the basic properties of matter. New materials research on novel semiconductors, self-assembled nano-structures and engineered materials will be a key focus. Examples include, but are not limited to, materials with the skutterudite and clathrate crystal lattice structure, half-Heuslers alloys, complex chalcogenides, superlattice structures and nanowires. A main goal will be to focus on the scientific and theoretical capabilities required to provide new classes of materials to investigate and their subsequent properties. It will emphasize the combination of experiment with theory needed to advance the science and technology of the field of thermoelectric-related research.

Organizer: George S. Nolas, Department of Physics, University of South Florida, Tampa, FL 33620, Phone: (813) 974-2233, e-mail: gnolas@chuma1.cas.usf.edu

Terry M. Tritt, Dept. of Physics & Astronomy, Clemson University, Clemson, SC 26934; Phone: (864) 656-5319, e-mail: ttritt@clemson.edu

7.9.4 Physics of Silicon in Electronic Materials (FIAP/DMP)

The formation of silicon-containing electronic materials such as silicon carbide and the various metal (particularly rare earth) silicides and their assembly into nanowires or contacts for sub-0.1 micron ULSI fabrication has attracted attention recently for novel device designs. The properties of these materials depend on bond formation of the different constituent atoms with silicon, and the characteristics of the silicon bond with other atoms is essential for their understanding. This concept extends to the bonds between atomic impurities such as Si-N in semiconductors as well as to the dielectrics silicon nitride and silica where for the latter its formation by biomineralization has become very interesting. The Si-C bond in organosilicon compounds and its effect on polarizability (for example in low-k dielectrics for the semiconductor industry) and the electronic transitions in chromophores are other areas of interest in this session. Researchers from industry, government, and academia are invited to report on their experimental and theoretical results in this wide-ranging area.

Organizer: Udo Pernisz, Dow Corning Corporation, Physics Group, mailstop C043B1, Midland MI 48686, Phone: (989) 496-6087, Fax: (989) 496-5121, e-mail: udo.pernisz@dowcorning.com

7.9.5 Novel and Complex Oxides (DMP/FIAP)

Oxides continue to be of great interest both because of their remarkable range of fascinating fundamental properties and their consequent technological applications. Following the oxide renaissance launched by the advent of high Tc superconductors, many novel oxide phenomena have been observed. This session will focus on novel oxide phenomena (outside of superconductivity and magnetoresistance) such as ferroelectrics, ferroelastics, transparent conducting oxides and dielectric materials. The complexity of oxide behavior lends itself to a multidisciplinary research approach, therefore this focused session aims to foster dialogue among experimentalists and theorists, and to bring scientists together from academia and industry.

Organizers: Nicola A. Hill, Materials Department, University of California, Santa Barbara, CA 93106, Phone: (805) 893-7920, Fax: (805) 893-7221, e-mail: nahill@mrl.ucsb.edu

Joseph Woicik, Department: Ceramics Division (852), NIST, Materials (223), Room B164, NIST, MATLS A163, Gaithersburg, MD 20899, Phone: (301) 975-5972, e-mail: joseph.woicik@nist.gov

Darrell G. Schlom, Materials Science and Engineering, Penn State University, 108 Materials Research Institute Building, University Park, PA 16803-6602, Phone: (814) 863-8579, Fax: (814) 863-0618, e-mail: schlom@ems.psu.edu

Bruce White, Motorola Inc., Mail Drop K20, 35010 Ed Bluestein Blvd., Austin, TX 78721, Phone: 512-933-2621

7.9.6 Carbon Nanotubes and Related Nanomaterials (DMP)

Broad interest in the fundamental properties of carbon nanotubes and their exploitation in a wide range of applications continue apace, due in large part to their unique chemical, mechanical, optical and electrical properties. This session is focused on recent developments in (i) the fundamental understanding of nanotube synthesis, processing, purification, electrical, optical, thermal, mechanical, and chemical properties, and (ii) on potential applications, including but not limited to, nanoelectronic devices, nanosensors, nanopores, field emitters, display devices, composite materials, and high surface area storage media. Experimental and theoretical contributions are solicited in the following topical areas: a) synthesis and characterization of carbon nanotubes and nanotube peapods, b) optical spectroscopy of carbon nanotubes, c) electrical transport in carbon nanotubes, d) thermal and magnetic properties of carbon nanotubes, e) mechanical properties of nanotubes and their composites, f) chemical functionalization and properties, g) electronic properties and devices, h) gas adsorption and storage, i) field emission, j) structure and properties of filled carbon nanotubes, k) other nanotubes, nanowires and nanostructures.

Organizers: Apparao M. Rao, Department of Physics and Astronomy, Clemson University, Clemson, SC 29634, Phone : (864) 656 6758, Fax : (864) 656 0805, e-mail: arao@clemson.edu

Andrew G. Rinzler, Department of Physics, University of Florida, P.O. Box 118440, Gainesville, FL 32611-8440, Phone: (352) 392-5656, Fax: (352) 392-3591, e-mail: rinzler@phys.ufl.edu

Saroj K Nayak, Department of Physics, Applied Physics and Astronomy, Rensselaer Polytechnic Institute 110th 8th Street, Science Center, 1C25, Troy, NY 12180-3590, Phone: (518) 276-2932, Fax: (518) 276-6680, e-mail: nayaks@rpi.edu

10.9.3 The Biomembrane/Solid Interface: Mechanisms, Instrumentation, and Measurements (DBP/GIMS/DMP)

This focus session intends to address the issues of fabricating materials, such as silicon, silicon nitride, glass, PDMS, etc, for the purpose of providing platforms/containment/interfaces for biological molecules and cells, and the use of these interfaces in biophysical instruments. The reason for examining the materials aspect of the problem is that there are a number of issues that need to be addressed, including the requirement for adding bioactive surfaces to promote/inhibit cell adhesion, the porosity of PDMS to gases, requirement for sub-micron patterning, and how mechanical properties of the materials might be used to address issues of cell adhesion and cytoskeletal forces. The instrumentation is limited not only by interfaces, but issues such as biological

complexity. The session will begin with talks on the nature of the solid/liquid/biological interface (Sachs) and the gigaohm seal between silicon and lipid and cellular membranes (Schmidt). Researchers from industry and academic groups are invited to report on these and other recent biointerface/instrumentation results.

Organizer: John P. Wikswo, Vanderbilt Institute for Integrative Biosystems Research and Education, Vanderbilt University, VU Station B Box 351807; Nashville, TN 37235-1807 USA, Phone: (615) 343-4124, Fax: (615) 322-4977, e-mail: john.wikswo@vanderbilt.edu

12.10.8 Nonequilibrium Quantum Dynamics in Electronic and Magnetic Systems (FIAP/DMP)

Glassy states of matter appear in a wide variety of materials including amorphous solids, spin systems, flux lattices, disordered semiconductors, and macromolecular networks. Since glassy systems do not reach thermal equilibrium on experimentally accessible time scales, their characterization remains a challenge. The concepts and techniques developed for studying such complex problems have also been applied to issues as diverse as high-density chip design, coding theory, protein folding, and neural computation. The field of nonequilibrium quantum systems is a rapidly growing one. Thanks to recent experimental advances, there are now several nonequilibrium quantum systems that are accessible to both experiment and theory. They include quantum glasses in both electronic and magnetic systems, which allow studies of a variety of problems, from the effects of disorder and correlations to the strategies for the design of actual quantum computers. Papers are solicited on topics that include insulating phases and region around the metal-insulator transition in disordered two- and three-dimensional electronic systems, Coulomb glass phenomena, quantum effects in spin glasses and highly disordered magnets, aging and glassy dynamics. Experimental techniques may include a variety of standard and novel probes (electrical, magnetic, mesoscopic, etc.).

Organizer: Snezana Bogdanovich, GE Global Research Center, Niskayuna, NY, Phone: (518) 387-6424, Fax: (518) 387-6030, e-mail: s1bogdano@aol.com

12.10.9 Plastic Deformation and Fracture (DMP)

This session will explore recent developments in studies of plastic deformation and fracture, research areas that have recently drawn renewed interest within the physics community. Materials of interest include crystalline, polycrystalline, amorphous, and nanostructured solids. Topics of interest include:

- Dislocation patterning, strain localization, and scaling behavior
- Size effects in plasticity
- Atomistic and multiscale models of plastic deformation and fracture
- Coupled atomistic-mesoscale-continuum models
- High strain rate effects
- Mechanical properties of metallic glass
- Fracture—quasi-static, dynamic, intersonic
- Plastic zone formation and structure
- Brittle/ductile transition
- Microstructure effects, including nanostructured solids and grain boundary effects
- Statistical physics approaches
- Applications

Contributions are welcomed describing experiment, theory, and simulation studies.

Organizers: Robin Selinger, Physics Department, Catholic University, Hannan 200, Washington, DC 20064, Phone: (202) 319-6740, Fax: (202) 319-4448, e-mail: selinger@cua.edu

James Belak, Lawrence Livermore National Laboratory L-45 UCL, PO Box 808, Livermore CA 94551 Phone: (925) 422-6061, Fax: (925) 422-2851, e-mail: belak@llnl.gov

Darcy A. Hughes, MS-9405, Sandia National Laboratory, Livermore, CA 94551, Phone: (925) 294-2686, Fax: (925) 294-3410, e-mail: darcyhu@sandia.gov

13.9.2 Asymmetrical Nanoparticles: Rods, Disks and Complex Shapes (DMP)

Recent work on nanometer scale particles has uncovered a wealth of quantum effects such as confinement, finite size effects, enhanced electron phonon coupling, and changes in electronic band structure. The vast majority of these studies concern spherical, or nearly spherical, nanoparticles of one component. In this Focus Topic session, we invite submissions on nanoparticle research. Metals, semiconductors, and insulators are all of interest, including cases of more than one component. Spherical, and especially non-spherical, nanoparticles are of interest, such as rods, disks and more complicated shapes. The reduced symmetry creates opportunities ranging from magnetic interactions and coupling to mechanical control and assembly. Non spherical particles, and libraries of them, can be made by colloidal chemistry as well as by micro, and nano lithography techniques. These particles may exhibit “easy” and “hard” directions of magnetization, alignment in electromagnetic fields, self-assembly and phase transitions, and anisotropic transport properties (spin, electron, phonon, or photon). Papers are sought in modeling (bandstructure calculations, spin transport, mechanical motion in a fluid) and in experiment (synthesis, characterization, self-assembly, and applications).

Organizers: Thomas E. Felter, Lawrence Livermore National Laboratory, PO Box 808, L – 356, Livermore, CA, 94550 Phone: (925) 422-8012, Fax: (925) 424-4737, e-mail: felter1@llnl.gov

Robert A. Weller, Department of Electrical Engineering and Computer Science, Vanderbilt University, VU Station B 351821, Nashville, TN 37235-1821, Phone: (615) 322-2828, Fax: (615) 343-6614, e-mail: robert.a.weller@vanderbilt.edu

Naomi Halas, Department of Electrical and Computer Engineering, MS-366, Rice University, 6100 Main Street, Houston, TX 77005-1892, Phone: (713) 348-5611, Fax: (713) 348-5686, e-mail: halas@rice.edu

Kai Liu, Physics Department, University of California at Davis, Davis, CA 95616, Phone: (530) 752-4109, Fax: (530) 752-4717, e-mail: kailiu@ucdavis.edu

14.9.1 Mechanical Properties of Nanostructured Thin Films and Coatings (FIAP/DMP)

Mechanical properties of thin films and coatings play an increasingly important role in many industries, ranging from microelectronics, MEMS, to automobile manufacturing. This focus session provides an

opportunity to bring people from academia, government labs, and diverse industrial backgrounds together to discuss the materials physics underlying the mechanical properties of nanostructured thin films and coatings. General principles governing mechanical properties, properties of particular classes of materials, and experimental and theoretical techniques to understand those, will all be appropriate for this session. Topics of interest include, but are not limited to: Computational design of thin films and coatings with desired mechanical properties (i.e., elastic modulus, yield strength, hardness, thermal expansion coefficient, etc); modeling and measurements of interface strength and adhesion; modeling and measurements of stress in thin films and coatings; stress induced effects and methods for controlling stress; mechanical behavior of solids in small dimensions; nanostructured thin film materials, including smart materials and nanocomposites; tribological applications of thin films and coatings; relationship between crystal structure (grain size, texture, twinning) and mechanical properties; copper interconnects, barrier layers, and low-k interlayer dielectrics (adhesion, porosity, hardness); impact of mechanical properties on reliability in microelectronics (electromigration, stress migration).

Organizers Yang-Tse Cheng, Materials and Processes Laboratory, General Motors Research and Development Center, Mailstop: 480-106-224, 30500 Mound Road, Warren, Michigan 48090, Phone: (586) 986-0939, Fax: (586) 986-8697, e-mail: yang.t.cheng@gm.com

Paul Ho, Laboratory for Interconnect and Packaging, University of Texas at Austin, Austin, TX 78712-1100, Phone: (512) 471-8961, Fax: (512) 471-8969, e-mail: paulho@mail.utexas.edu

14.9.2 Morphological Evolution of Nanostructures, Interfaces, Surfaces, and Thin Films (DMP)

This session will explore diffusion, growth, decay, etching, transport, pattern formation from both experimental and theoretical perspectives. The emphasis is on unifying themes, concepts, measurement techniques, and computational methods that foster understanding of various low-dimensional systems from common perspectives.

Organizers: Raymond J. Phaneuf, Department of Materials and Nuclear Engineering, University of Maryland, College Park, MD 20742; Tel: (301) 935-6472, Fax: (301) 935-6723, e-mail: phaneuf@renaissance.umd.edu

Robert Q. Hwang, MS-9161, Sandia National Laboratories, P.O. Box 969, Livermore, CA 94551, Tel: (925) 294-1570; Fax: (925) 294-3231, e-mail: rqhwan@sandia.gov

James W. Evans, Department of Mathematics/Ames Lab, Iowa State University, Ames, IA 50011, Tel: (515) 294-1638, Fax: (515) 294-0266; e-mail: evans@ameslab.gov

Theodore L. Einstein, Department of Physics, University of Maryland, College Park, MD 20742-4111, Tel: (301) 405-6147, Fax: (301) 314-9465, e-mail: einstein@physics.umd.edu

14.9.3 Fundamental Challenges in Transport Properties of Nanostructures (DMP)

Nanotechnology has become one of the most prominent disciplines in science and technology, encompassing a number of different fields such as biology, physics, chemistry, and engineering. The technol-

ogy of “small matter” holds great promises for many applications ranging from the semiconductor industry to medical research. However, for a successful development of nanotechnology, many key challenges in nanoscience must be tackled and a number of fundamental problems must be scientifically explored and solved. This session will focus on current fundamental challenges in understanding transport phenomena in nanostructures and how to exploit them to design and build new devices. This includes problems in the synthesis, characterization and modeling of nanostructures and their relation to new transport properties at the nanoscale. Both semiconductor nanostructures with potential applications as photovoltaics, lasers, biological labels and sensors, as well as metallic and magnetic nanoparticles will be discussed. The session will consist of four 1/2 days: two of them focused on semiconducting and insulating nanoparticles and two of them on metallic and magnetic nanoparticles. Each session will contain experimental, theoretical and computational papers, with special emphasis on interdisciplinary contributions.

Organizers: Giulia Galli, Lawrence Livermore National Laboratory, P.O. Box 808, L-415, Livermore, CA 94551, USA, Phone: (925) 423 4223, Fax: (925) 422-6594, e-mail: galligygi1@llnl.gov

Geoffrey F. Strouse, Department of Chemistry and Biochemistry, UCSB, Santa Barbara, CA 93106, Phone: (805) 893-5326, Fax: (805) 893-4120, e-mail: strouse@chem.ucsb.edu

16.9.2 Front-End Materials and Processes for Scaled Silicon CMOS (FIAP/DMP)

As silicon CMOS continues to scale, physics and chemistry play a critical role in technology development. Scaling is no longer simply reducing dimensions to improve speed and density. Many new materials are being introduced to improve performance, including advanced high-k gate dielectrics, new approaches to fabricating poly-Si gates, metal gates, strained silicon-germanium alloys, strained silicon channels on relaxed SiGe buffers, nanoparticles and ferroelectrics for embedded memories, barrier materials, etc. There are also many new processes being developed to allow continued scaling, such as laser doping, atomic layer chemical vapor deposition, etc. This session will focus on the physics and chemistry associated with these new materials and processes, and how they will impact the performance and reliability of silicon integrated circuits. Abstracts are solicited in all aspects of materials, processes, performance, and reliability of scaled silicon for the 100 nm node and beyond. There is also an interest in ideas for novel materials and processes that are beyond the current roadmap, and that provide new functionality to silicon such as wafer bonding and the integration of molecular devices with silicon.

Organizers, Bruce E. Gnade, Department of Materials Science, University of North Texas, PO Box 305310, Denton, TX 76203-5310, Phone: (940) 565-3260, Fax: (940) 565-4824, e-mail: gnade@unt.edu

R. Ramesh, Center for Superconductivity Research, University of Maryland, College Park, MD 20742, Ph: (301) 405-7364, Fax: (301) 316-7136, e-mail: rr136@umail.umd.edu

16.9.3 Progress in Photovoltaic Technology (FIAP/DMP)

The various photovoltaics technologies have shown very significant improvements in efficiency and cost reduction over the last decade. This

focus session will invite contributions pertaining to all technologies that are related to photovoltaic energy conversion. The contributions can be related to new materials, fabrication techniques, device configurations, and measurement science innovations from the variety of relevant technologies. This category is very broad and includes silicon materials such as crystalline silicon, amorphous silicon, microcrystalline silicon and nano-structured silicon. Also, other materials to be included here are the polycrystalline, thin film compound semiconductors such as copper-indium gallium sulfide and cadmium telluride, and other thin film compounds that have potential photovoltaic applications. Also solicited are recent developments in very high efficiency epitaxial thin film devices based on III-V compounds which are being developed for applications such as space cells and terrestrial concentrators. Included also are photoelectrochemical cells and thermophotovoltaic devices. The latter are being developed for waste heat recovery and other potential applications. New methods of characterization and innovations in measurement science are also solicited. These include all aspects of characterization including electrical, optical, and physical methods.

Organizer: Richard Ahrenkiel, National Renewable Energy Laboratory, 1617 Cole Blvd, Golden CO 80401, Phone: (303) 384-6670, Fax: (303) 384-6604, e-mail: Richard_ahrenkiel@nrel.gov

19.9.1 High Pressure Research (DMP)

Major advances in experimental techniques and in theoretical methods are occurring in high-pressure research, increasing the depth of understanding of materials under pressure, and deepening our understanding of physics of materials in general. New techniques include the explosion of synchrotron techniques and capabilities, the growth of neutron diffraction under pressure, and the development of accurate in situ measurements at simultaneous high-pressure/variable-temperature conditions from millikelvins to above 5000 K up to multimegabar static pressures, and a variety of new dynamic compression methods that include on gas-gun, laser-driven shock, and pulsed power techniques. Theoretical simulations are now important tools in understanding materials under extreme conditions, and theory and experimental together are making inroads that would be impossible separately. Comparing theoretical predictions for high-pressure response with experiments tests models for material behavior. High pressure is providing important data for geophysics and planetary physics, constraining parameters for simulations and modeling of planetary processes.

Sessions will be organized by material type, and will contain both theoretical and static and dynamic experimental studies.

Organizers: Ronald E. Cohen, Geophysical Laboratory, Carnegie Institution of Washington, 5251 Broad Branch Rd., N.W., Washington D.C. 20015, Phone: (202) 478-8937, Fax: (253) 322-2539, e-mail: cohen@gl.ciw.edu

Russell J. Hemley, Geophysical Laboratory, Carnegie Institution of Washington, 5251 Broad Branch Rd., N.W., Washington, D.C. 20015, Phone: 202-478-8951, Fax: 202-478-8901, e-mail: hemley@gl.ciw.edu