In This Issue

Dates to Remember

Sept. 11, 2009 (Friday) Deadline for submitting invited speaker suggestions for DMP Focus Topics
Oct. 1, 2009 Deadline for nominations for DMP Officers and Executive Committee Members
Nov. 20, 2009, (Friday) APS Abstract deadline submitted via the web at http://abstracts.aps.org
February 1, 2010 DMP Deadline for APS Fellowship Nomination
March 15 - 19, 2010 (with tutorials, etc., March 14): APS March Meeting in Portland, OR

A Note from the Chair

Welcome to the 2009 Summer Newsletter of the Division of Materials Physics.

MARCH MEETING. The organizers of the DMP Focus Topics for the upcoming March meeting (March 15-19, 2010) in Portland have been chosen and are listed in this newsletter. Now is the time to input your suggestions for invited speakers. Your input should go directly to the Focus Topic organizers who are preparing invited speaker nominations for their topic. DMP also sponsors a few select symposia, and these suggestions should go directly to Robert Nemanich (robert.nemanich@asu.edu), the DMP Program Chair this year. This is your meeting, so please make the effort to contribute to its organization and help identify the best and most deserving invited speakers in your area of expertise.

The American Physical Society-Division of Materials Physics Iris Ovshinsky Student Travel Awards

The Iris Ovshinsky Student Travel Awards was set up to assist in the career of young researchers. The Awards are named after Iris Ovshinsky who had a very strong interest and commitment to scientific education. It was endowed in perpetuity by the Ovshinsky family, their colleagues at Energy Conversion Devices (ECD) companies and all their numerous friends from many social, intellectual and business relationships.

There will be ten $500 awards each year to participate in APS meetings, which are sponsored by the Division of Materials Physics. The recipients will be chosen from suggestions from the physics community in general. Preference will be given to invited speakers at these meetings. The selection committee will consist of the following officers of the Division of Materials Physics: Treasurer, Vice Chair and Past Chair.

Nominations must be made 2 months before the meeting for which the Award Travel is requested and should include:

1) 1 page vita, including publication list
2) Abstract to be presented at the meeting.

This was the first year for the awards and they were presented by Stanford R. Ovshinsky. I would like to congratulate this year's winners: Rolando Valdes Aguilar (University of Maryland, College Park), Steven Byrnes (University of California, Berkeley), Young Jai Choi (Rutgers), Hugh Churchill (Harvard University), Jack Deslippe (University of California, Berkeley), Jackwang Lee (The University of Texas), Mohamed Majdoub (University of Houston), Sarah Thomas (University of Alabama), Daniel Ward (Rice University), and Mona Zebarjadi (University of California, Santa Cruz).

OUTREACH. Although there has recently been a lot of talk about the importance of Materials Physics and science in general, this may change very quickly. There are several ways in which we individually can continue to improve the perception of science and Materials Physics by participating in outreach activities and writing to the legislature. The APS has a series of outreach activities, which can be accessed by contacting Rebecca Thompson-Flagg (rand@aps.org) and at the following web sites:

PhysicsCentral www.physicscentral.com
PhysicsQuest www.physicscentral.com/physicsquest
Color Me Physics www.physicscentral.com/coloringbook
Adopt-a-Physicist www.adoptaphysicist.org

USEFUL INFORMATION. The following documents addressing general scientific issues related to Materials Physics maybe of general interest to you:

1) **CMMP 2010: An Assessment of and Outlook for Condensed-Matter and Materials Physics** (http://www7.nationalacademies.org/bpa/CMMP2010.html)

2) **Directing Matter and Energy: Five Challenges for Science and the Imagination** (http://www.sc.doe.gov/bes/reports/abstracts.html#GC)
3) **Condensed-Matter and Materials Physics: The Science of the World Around Us** (http://books.nap.edu/catalog.php?record_id=11967#toc)

INPUT REQUESTED I would appreciate receiving your general and/or specific comments regarding the DMP activities and in what form we can improve these. More specifically, I would appreciate receiving information in very brief format regarding:

a) **Public Speakers in Materials Physics** including title of possible talks, geographic area, email contact
b) Movies in Materials Physics, web site
c) Audio visuals, web site

I am trying to put together a repository of information useful to Materials Physicists, which hopefully would be made available through the DMP web page. Of course, your contribution to this is crucial and will not be possible without it.

INTERNATIONAL MEMBERS As we all know Materials Physics is a truly international research activity. Because of this it would be desirable to have a stronger participation in our activities from the international members. Thus I would like to encourage international members to volunteer for DMP activities by writing directly to me (rramesh@berkeley.edu) and request all DMP committees to encourage the participation of qualified non US Materials Physicists in our activities.

ACKNOWLEDGEMENTS. The DMP thanks the members of the executive committee who have recently completed their service, for the generous donation of their time and expertise in carrying out the work of DMP. These are Jeff Lynn (Jeff.Lynn@nist.gov) who served as Chair and all that is associated with this and Frances Ross and John Tranquada, who have finished their terms as Members at Large.

Ramamoorthy Ramesh, DMP Chair

Nominations for DMP Officers and Executive Committee Members

A DMP election will be held late in 2009 to elect a Vice-Chair and two new at-large Executive Committee Members. The Nominating Committee shall nominate at least two candidates for the ballot for each office. Suggestions for candidates for these offices can be made to the Chair of the Nominating Committee, Ivan Schuler. In addition, candidates can be nominated directly to be placed on the ballot, by petition of five percent of the membership of the Division. Such petitions must be received by the Secretary-Treasurer (Chris Palmstrøm cpalmstrom@ece.ucsb.edu) by October 1, 2009.

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 2010 APS March Meeting (Portland, OR, March 15-19, 2010). 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 September 11, 2009. Suggestions can be made by emailing the suggestion directly to the appropriate focus topic organizers who are listed after the Focus Topic descriptive paragraphs. Please also send a copy to Robert Nemanich (Robert.Nemanich@asu.edu), the main DMP organizer of Focus Topics.

Your suggestions should 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 nomination will 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, too.

List of DMP-Sponsored or Co-Sponsored Focus Topics and Sorting Categories for the 2010 APS March Meeting

The co-sponsoring units are indicated in parentheses.

02.8.2
Dopants and Defects in Semiconductors (DMP)

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The properties of semiconductors are determined by the presence of impurities and defects. Defects control carrier concentration, mobility, lifetime, and recombination; they are also responsible for processes that involve atomic transport such as migration, diffusion, and precipitation of impurities and host atoms. In dilute III-N-V alloys, impurities even modify the band gap. The control of defects and impurities is the critical factor that enables a semiconductor to be engineered for use in electronic and optoelectronic devices as has been widely recognized in the remarkable development of Si-based electronics and the recent success of the GaN-based blue LED and lasers. The fundamental understanding, characterization and control of defects are proving to be important for the development of novel wide-band gap semiconductors and future solid-state based spintronic devices.

The physics of dopants and defects in semiconductors, from the bulk to the nanoscale, is the subject of this focus session. The electronic, structural, optical, magnetic and isotopic properties of dopants and defects in elemental and compound semiconductors; SiO2 and alternative dielectrics; wide band-gap semiconductors such as diamond, SiC, metal-oxides, and the group-III nitrides; and organic semiconductors are of interest. Abstracts on experimental and theoretical investigations are solicited.

02.8.3 (same as 25.9.2)
Electricity-to-Light Conversion: Solid State Lighting (GERA/DMP)

Robert M. Biefeld, Sandia National Laboratory, rmbiefe@sandia.gov

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This topic will focus on fundamental advances in the growth, characterization, and experimental as well as theoretical understanding of wide-gap semiconductors for applications in light emitting devices for solid state lighting. Contributions will cover fundamental physics related to the electricity-to-light conversion, such as band structure, quantum size effects, strain and piezoelectric effects, excitons, and surface phenomena. Contributions on epitaxial and bulk growth are encouraged, including MOVPE, MBE, HVPE, polar and semi-polar epitaxy, InGaN and InAlN alloys, and low-dimensional systems. Also encouraged is the presentation of studies of defects and doping, structural characterization, and optical characterization using luminescence and reflectance spectroscopy techniques. This topic also covers electrical characterization, carrier transport, photoconductivity, and device physics pertaining to diode lasers and light emitting diodes.

03.8.1 (Same as 09.9.1)
Dielectric, Ferroelectric and Piezoelectric Oxides (DMP)

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Beatriz Noheda, University of Groningen, b.noheda@rug.nl

This topic will focus on recent advances in understanding of dielectric, ferroelectric, piezoelectric, and multiferroic phenomena in oxides, with emphasis on growth, characterization and theoretical modeling. We invite contributions on functional oxides in bulk, thin-film, superlattice, and nanostructured forms. Specific areas of interest include domain structure and dynamics, lattice dielectric properties, impact of disorder on cooperative behavior, physics of phase transitions and application of theoretical property-simulation and materials-design approaches to ferroic oxides.

A major scientific thrust of the topic will be to discuss how bulk dielectric, ferroelectric, and piezoelectric properties are modified in thin-film, superlattice, or other nanoscale geometries, for example by the effects of strain, surfaces and interfaces, chemical environment, and electrical boundary conditions. Contributions addressing how these local properties could be harnessed in macroscopic applications will be particularly encouraged.

04.15.10 (same as 16.12.2)
Organic Electronics and Photonics (DMP/DPOLY)

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The electronic and photonic properties of organic materials, including small molecules and polymers, are subject of active fundamental and applied research. This focus topic covers the recent developments in this field.

Contributions are solicited on the following studies of organic semiconductors and related devices:

- charge carrier transport and injection
- optical properties
  spectroscopy, physics of excitons, nonlinear optics, plasmonic effects in organic devices, lasing, photonic bandgap materials
- energetics of organic-organic and organic-inorganic interfaces

Studies of device physics of organic field-effect transistors, photovoltaic cells, lasers, spin valves, and sensors are welcome, both theoretical and experimental in nature.

4.15.11 (same as 25.9.3)

Polymers and Energy: Photovoltaic, LED and Batteries (DPOLY/GERA/DMP)

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Tom Russell, University of Massachusetts, Amherst, russell@mail.pse.umass.edu

Polymers and Energy: Photovoltaic, LED and Batteries: Advances in development of polymeric materials and polymer based devices for energy applications have generated new knowledge, concepts and strategies for solar energy conversion, generation of light and energy storage. This symposium covers recent developments in this field. Contributions are solicited for research related to the above topics such as utilizing polymer – nanofiller, multijunction, multilayer based energy capture and conversion schemes, polymers as variable band gap materials, polymers in the capacity of light emitting and charge carrier transport materials and for energy storage device such as Lithium ion polymer batteries or block copolymers for ultracapacitors. Advances in physics underlying polymer enabled energy devices such as in solar cells, light emitting diodes, batteries and capacitors and their efficiency and performance is solicited through both theoretical and experimental studies.

05.17.1
Iron Based Superconductors and Related Compounds (DMP)

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The discovery of superconductivity in Fe pnictides demonstrated the potential of non-cuprate superconductors to manifest high critical temperatures, currents and field, remarkably low anisotropy, and what may be a fundamentally new superconducting state. Considerable progress has been made in the past year toward delineating and even understanding both the normal and superconconducting states of these materials and their parent compounds. This includes a remarkable interplay between magnetic and superconducting behavior. This focus session will cover the materials, physical properties, excitations and superconductivity of Fe-based superconductors and related compounds.

05.17.2
Search for New Superconductors (DMP)

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This topic will focus on fundamental advances in the growth, characterization, and experimental as well as theoretical understanding of new superconducting materials with the exclusion of the recently discovered magnesium diborides and pnictides. The main goal of this focus topic is to explore non-conventional ideas in superconductivity, and to foster the exchange of information about discoveries that may conceive a change in our understanding of superconductivity. Its purpose is to promote interaction among theorists and experimentalists and seed new directions in superconductivity research, especially in areas cutting across traditional disciplinary boundaries. Areas of interest include new approaches in the study of superconductivity in complex materials, metamaterials, heterojunctions, and hybrid structures. The focus topic will cover novel materials including nanowires, nanotubes, fullerenes, graphite intercalation compounds, graphene layers, small metallic nanoparticles, doped germanium, and atypical superconductors such as organics. Of special interest is the fabrication of superconducting nanostructures with atomic scale control using physical and chemical methods. The focus topic will also include research on understanding of mechanisms for improvements in superconducting materials, engineering superconductors with ab initio methods, empirical approaches in the search for novel superconductors, and theoretical predictions. We especially encourage contributions showing the benefits of theoretical insights for explaining and predicting specific experimental results of existing and novel superconductors.

06.14.1 (same as 13.6.4)
Magnetic Nanostructures: Materials and Phenomena
(DMP/GMAG)

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This topic focuses on magnetic nanostructures, including thin films, multilayers, nanoparticles, nanowires, nanorings, nanocomposites, core-shell structures, hybrid structures, molecular magnets, magnetic point contacts and self-assembled as well as patterned magnetic arrays. The sessions will cover both experimental and theoretical advances in investigating these materials. Phenomena include the following: hysteresis, proximity and structural disorder effects, AC and DC spin torque, current- and field-induced domain wall motion, microwave resonance and microwave assisted reversal, magnetic quantum confinement, interlayer magnetic coupling, exchange spring, exchange bias, magnetic anisotropy, inter-particle interactions, relaxation dynamics, thermal and quantum fluctuations, and other unusual phenomena unique to the nanoscale. Of special interest is the fabrication or characterization of nanostructures with atomic-scale precision.

06.14.4 (same as 16.12.3)

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

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Spin-related effects in metals and in (ferromagnetic) heterostructures are generally robust and readily observed at room temperature. Fundamental discoveries such as the Giant and Tunnel Magnetoresistance and the current-induced spin-transfer torque have moved from discovery to applications in remarkably short times, and this whole field of research is rapidly expanding. This Focus Topic covers the new developments in this field, including experimental and theoretical aspects of spin transport and magnetization dynamics in metal-based systems, such as ultrathin films, lateral nanostructures, perpendicular nanopillars, and tunnel junctions.
In particular, contributions describing new results in the following areas are solicited:

- The interplay between spin currents and magnetization dynamics in magnetic nanostructures; spin-transfer, spin pumping and related phenomena, including current-induced magnetization dynamics in heterostructures and domain wall motion in magnetic wires.
- Effects of the spin-orbit interaction on steady-state and dynamical properties of nanostructures; intrinsic and extrinsic spin orbit interactions causing the (inverse) spin and anomalous Hall effects; microscopic mechanisms of magnetization (Gilbert) damping; out-of-plane spin-transfer torques in magnetization textures.
- Ultrafast magnetization response to (and reversal by) intense laser pulses.
- Thermoelectric spin phenomena such as giant-magneto thermopower and Peltier effects, spin-Seebeck effect, spin and anomalous Nernst and Ettingshausen effects (spin caloritronics).
- Magnetization dynamics in (composite) nanostructures including spin wave excitation, propagation, and detection (magnonics), as well as vortices.
- Coupling between magnetic and elastic degrees of freedom, such as the spin-current induced Einstein-de Haas effect in nanoscale mechanical systems.

6.14.5 (same as 2.8.1 and 16.12.4)
Spin Dependent Phenomena in Semiconductors (GMAG/DMP/FIAP)

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The field of spin-dependent phenomena in semiconductors is developing rapidly, with significant advances and challenges in a widening range of material systems (e.g., pnictides, oxides, silicon, diamond, carbon nanotubes, graphene), in semiconductor nanostructures (e.g., self-assembled and lithographically-defined quantum dots), and in hybrid ferromagnetic/semi conductor device structures. This series of Focus Sessions solicits contributions aimed at understanding spin-dependent processes in magnetic and non-magnetic structures incorporating semiconducting materials. Topics include: (i) growth, characterization, electrical, optical and magnetic properties of (ferro-)magnetic semiconductors, nanocomposite and hybrid ferromagnet-semiconductor structures including quantum dots, nanocrystals, and nano wires; (ii) high temperature ferromagnetism in semiconductors and semiconductor oxides (iii) transport and dynamical effects in semiconductors with or without spin-orbit interactions; (iv) electrical and optical spin injection, spin Hall effects, spin interference, spin filtering, spin lifetime effects, spin dependent scattering, and spin torque; (v) manipulation, detection, and entanglement of electrical and nuclear spins in quantum systems such as dots, impurities and point defects; and (vi) spin-dependent devices and device proposals involving ferromagnets and semiconductors.

06.14.6
Frustrated and Low Dimensional Magnetism (GMAG/DMP)

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There is a robust framework for describing the low temperature structures, phase transitions, and excitations of conventional three dimensional magnetic materials. However, when fluctuations are enhanced by low dimensionality or competing interactions, qualitatively new behavior can emerge. This is well established in one and two dimensions where controlled theory and experiment have uncovered phases lacking long-range magnetic order but exhibiting novel statistical and quantum phenomena. Such phenomena include valence bond solids and various forms of spin liquid and spin ice phases. This Focus Topic solicits abstracts for presentations that explore both theoretical and experimental aspects of the field. Topics of interest include: one dimensional quantum magnetism, geometrical frustration and associated effects of quantum spin liquid and spin ice, magnetism in frustrated or low dimensional artificial structures, order by disorder, the role of magnetoelastic coupling, quantum critical two dimensional spin systems and magnon Bose condensation. Also of interest are the effects of strongly fluctuating spins on properties beyond magnetism including transport, thermal transport and ferroelectricity.

6.14.7

Spin Dependent Physics in Organic-based Materials (GMAG/DMP)

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This focus topic is on spin transport and exchange in organic- and molecular solids including all-carbon systems, transition-metal with and without organic radical systems, as well as π-conjugated polymeric systems. Research at the intersection of several forefront areas in condensed matter and material physics are of interest: spin injection at the inorganic to organic interface, the degree of spin polarization attainable by organic-based solids, understanding and demonstrating the low Z attributes to spin transport, hyperfine interaction between the electronic spin and nuclear magnetic moments, and novel forms of magnetic exchange that may be adapted to inorganic dilute magnetic semiconductors. Phenomena/ materials of interest include, hybrid ferromagnetic/organic structures, spin transport in graphene, Kondo effect, spin qbits in diamond, quantum tunneling, triplet states and coherence in molecular nanomagnetics, organic magnetoresistance and magnetic field effects and all related topics.

06.14.8
Novel Magnetic Devices (DMP/GMAG)

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This topic focuses on novel magnetic devices of all kinds, with a special interest in devices that make use of the spin torque effect. Of particular interest are spin torque switching of magnetic nanobits --which could be used in an advanced magnetoresistive random access memory (MRAM) -- and spin torque nano-oscillators, both theoretically and experimentally. Other devices of interest include magnetic tunnel junctions, or spin valves with special properties that can enable advanced magnetic technologies such as thermal assisted MRAM, toggle MRAM, high density magnetic recording, or magnetic sensors for field detection and biological sensing. Less mature devices are also of interest, including semiconductor devices that make use of electron spin or that use magnetic semiconductors, as well as negative resistance magnetic devices to achieve power gain. Also of interest are the results of novel metrology techniques that have been applied to examine the underlying physics of the above devices. Examples of interest include high frequency/high speed electrical or optical measurements to examine magnetodynamics, and imaging techniques such as XMCD.

07.11.1
Carbon Nanotubes & Related Materials (DMP)

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Interest in the fundamental properties and applications of carbon nanotubes and related allotropes continues to grow. The reason for this interest lies in the unique combination of chemical, mechanical, thermal, optical, opto-electronic, spectroscopic, electrical and magnetic properties of these systems.

This focus topic addresses recent developments in (i) the fundamental understanding of nanotubes and related materials, including characterization, synthesis, processing, purification, chemical, mechanical, thermal, electrical, optical, opto-electronic and magnetic properties, and (ii) in their potential applications as nanosensors, nanoprobes, field emitters, displays, field-effect transistors, composite materials, high surface-area storage media, superconducting and magnetic devices, and others.

Experimental and theoretical contributions are solicited in the following areas:

1. Synthesis and characterization of pure and doped nanostructures of carbon and boron nitride, including nanotubes, nanohorns, and other graphitic nanostructures;
2. purification, separation and chemical functionalization of these nanostructures;
3. the structure and properties of hybrid systems, including filled and chemically modified carbon nanotubes and nanotube peapods;
4. mechanical and thermal properties of these nanostructures and their composites;
5. electrical and magnetic properties of these systems; and
6. their spectroscopic (angle resolved photoemission and scanning tunneling microscopy), optical (Raman, Rayleigh, Photoluminescence), structural (atomic force microscopy), excited state processes (time resolved optical measurements), opto-electronic, mesoscopic, and transport properties including non-equilibrium processes.

The symposium will also cover the broad range of unique applications of these nanosystems, including their use for:

7. gas adsorption and storage;
8. multifunctional nanotube composites;
9. chemical and bio-sensing applications;
10. field emission; and
11. a new generation of magnetic, electronic, and optoelectronic devices.

07.11.2
Graphene (DMP)

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Graphene is one of the fastest growing fields in condensed matter research. Albeit it is only one atom thick, its unusual optical properties (mostly due to its exotic Dirac quasi-particles), make it possible to observe with an optical microscope. Graphene conducts electricity better than copper and ordinary semiconductors and can sustain enormous current densities. Graphene is also a unique example of the thinnest metallic soft membrane although it is structurally stronger and conducts heat better than diamond. Furthermore, graphene is highly impermeable to gases and is one of the best scaffolds for electron microscopy. Recent advances in synthesis of large area graphene samples make it now possible to envisage the emergence of new graphene-based technologies, ranging from fast electronics to surface coating and to photovolatics. Given all these amazing properties, and their possible applications, the interest in understanding its properties is ubiquitous in the scientific literature. The Graphene Focus Topic will cover the latest experimental and theoretical developments in this expanding field.

07.11.3 (same as 06.14.2 and 09.9.2) Bulk Properties of Complex Oxides (DMP/GMAG)

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Transition metal oxides exhibit a wide range of novel phenomena, which originate from the complexity induced by competing interactions and the presence of multiple ground states. Associated with this complexity is a tendency for short range order such as the formation of stripes, ladders, checkerboards, or phase separation, and an enhanced response to external fields that gives rise to giant and colossal effects with potential for applications. This Focus Topic explores the nature of the various ground states observed in bulk specimens of complex oxides and their competing interactions, the ways in which the spin, lattice, charge and orbital degrees of freedom respond on a variety of length scales, and how they interact and compete with each other to produce novel phenomena. It provides a forum to discuss recent developments and results covering basic aspects (new materials synthesis, experiment, theory and simulation) of bulk systems, including 3-, 4-, and 5-*d* transition metal complex oxides.

7.11.4 (same as 06.14.3 and 09.9.3) Complex Oxide Thin Films (DMP/GMAG)

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A rich variety of intriguing behaviors has been observed in complex oxides, many of which remain far from understood. High Tc superconductivity, ferroelectricity, metal-insulator transitions, or colossal magnetoresistance are just a few of them. When grown in the form of thin films, heterostructures, or nanostructured systems, they often exhibit additional effects resulting from epitaxial strain, reduced dimensionality, charge transfer, proximity effects or phase competition across interfaces. New effects can emergence at such interfaces including two-dimensional electron gases or ferromagnetism. This Focus Topic is dedicated to fundamental advances in the growth, characterization, and experimental as well as theoretical understanding of the physical properties of complex oxides in thin-film, superlattice, and nanostructured forms, paying special attention to the role of interfaces. It also will focus on understanding the impact of defects on their properties, growth conditions on film microstructure, and the mechanisms by which the macroscopic properties are affected, which may include strain, electronic phase separation, charge transfer or localization, etc. These mechanisms often play an important role in the interaction between spin, charge, lattice, and orbital degrees of freedom in thin films of these complex oxides.

07.11.5 (same as 17.13.1)
Computational Design of New Materials (DMP/DCOMP)

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Advances in theoretical understanding, algorithms, and computer speed are enabling computational tools to play an increasing role in the development and optimization of materials. This session will provide an overview of recent applications and methodological developments at the frontier of computational materials design, from molecular level prediction to large scale property optimization. The focus will include, but not be limited to, ab initio materials design; combinatorial computational chemistry and high-throughput materials screening; thermodynamic and kinetic property optimization; innovative applications of computational tools to materials development and optimization; new theoretical understanding that enables computational materials development; methodological innovations yielding improved accuracy, stability, and efficiency for treating complex materials. All application areas are welcome, but we particularly encourage those in energy materials (batteries, fuel cells, photovoltaics, catalysts, etc.) and complex oxide electronics (multiferroics, superconductors etc.).

12.7.3 (same as 14.9.3) (DMP/GSNP)
Tribophysics: Friction, Fracture and Deformation Across Length Scales

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This focus topic broadly engages research in friction, fracture and deformation, motivated by the fact that these processes play important roles separately and combined during tribological processes. During sliding contact in materials and earth systems energy is dissipated on scales ranging from the atomic to the macroscopic. New experimental methods and expanded computational capabilities have greatly expanded our opportunities for obtaining insight into processes which involve phenomena ranging from interatomic interaction of surfaces to fracture and mechanical deformation resulting in wear and microstructure evolution. The sessions will explore the current state of theoretical models and the extent to which they are supported by results from experiment and simulation. Of particular interest are state-of-the-art measurements on the small scales by atomic force microscopy, surface forces apparatus, crystal quartz microbalance and other nano-scale probes. Contributions are sought regarding theory, experiment and simulations that pertain to diverse systems ranging from clean material surfaces in vacuum, to coated and lubricated surfaces through run-in of machine parts and earth systems that result in faulting and earthquakes.

13.6.1
Optical Properties of Nanostructures (DMP)

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Lu J. Sham, University of California, San Diego, lsham@ucsd.edu

There is currently great interest in optical properties of nanoscale structures include nanoparticles and quantum dots; nanorods, nanowires and nanotubes; graphene systems;

and plasmonics and metamaterials. Optical properties include the results from theoretical research and from experimental research by any of a wide range of spectroscopic, scattering, and time-resolved methods spanning from the visible to the far-infrared. The principal aim of the focused topic sessions is to bring together colleagues from different disciplines to advance our understanding of novel optical phenomena in these nanosystems. Theoretical and experimental research on the optical properties of a broad range of naostructures will be covered in these sessions.

13.6.2 (same as 14.9.2)
Fundamental Challenges in Transport Properties of Nanostructures (DMP)

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This focus topic will address the fundamental issues that are critical to understand, characterize and control electronic transport in nanostructures, with potential for impact in fields such as advanced information processing, solar energy utilization, or nano-mechanical devices. Contributions are solicited in areas that reflect recent advances in synthesis and assembly, characterization and theory for a variety of nanosystems, including those based on individual quantum dots, nanowires, molecules and self-assembled functional systems. Specific topics of interest include: fabrication or synthesis of nanostructures involved with charge transport; nanoscale structural characterization of materials and interfaces related to transport properties; advances in the theoretical treatment of electronic transport at the nanoscale; and experimental studies of charge transport in nanostructures.

Separate focus sessions sponsored or cosponsored by DMP will organize presentations on carbon nanotubes, graphene, magnetic nanostructures, photovoltaics, and thermoelectrics.

13.6.3 (same as 16.12.4 and 25.9.1)
Thermoelectric Materials & Phenomena (DMP/GERA/FIAP)

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About 90 percent of the world's useful power (approximately 10 TW) is generated by heat engines that convert heat to electrical or mechanical power, but they also dissipate about ~15 TW of heat to the environment. If even a modest fraction of this low-grade thermal waste can be converted to electricity, the potential impact on energy efficiency could be enormous, leading to savings in fuel and reductions in carbon dioxide emissions.

Thermoelectric energy converters can directly convert heat to electricity using semiconducting materials via the Seebeck effect; they are all solid-state, robust, and have a high power density. Their efficiency depends on the thermoelectric figure of merit (ZT) of the material, which is defined as ZT = S^2 T / r k where S, r, k, and T are the Seebeck coefficient, electrical resistivity, thermal conductivity, and absolute temperature, respectively. Thermoelectric technology is scalable to various power levels such as those encountered in automotive exhaust heat recovery and residential distributed solar-thermal electrical generators. In these applications, it can become competitive with current technologies provided one can develop materials with ZT > 1.5 at the appropriate temperatures; higher ZT values would open many more applications. Although there is no fundamental upper limit to ZT, over the last 50 years the ZT of commercially available materials has increased only marginally, from about 0.6 to 1, resulting in performance less than 10 percent of the Carnot limit. However, recent research results have used various strategies to enhance ZT by reducing the phonon k and/or enhancing the electron power factor (S^2 / r).

The goal of this session is to bring together scientists and engineers working on both bulk and nanostructured thermoelectric materials to examine the approaches and infuse cross-disciplinary themes for increasing ZT towards improved energy efficiency. Topics will range broadly from the very fundamental (e.g. Dirac electrons) to the more applied (e.g. physics of thermal interfaces for improved devices incorporating the high ZT materials).

Topics of particular interest include, but are not limited to:
(1) Fundamental understanding of the thermoelectric effects themselves, such as the thermoelectric properties of Dirac electrons, etc.
(2) Thermal conductivity reduction by engineered anharmonicity or nanoscale boundary scattering in bulk materials and thin-films.
(3) Power factor enhancements using electron energy filtering or density-of-states engineering in bulk or nanostructured semiconductors.
(4) Thermoelectric materials for energy efficiency: device physics, thermal interface physics, and applications.

14.9.1 (same as 13.6.5)
Controlled Self-Organization of Functional Thin Film (DMP) Nanostructures

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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 atomic composition. This focus session will highlight recent experimental and theoretical developments associated with the formation and stability of nanostructures, surfaces, thin films, and interfaces, of hard and soft matter. Particular emphasis will be placed on tailoring functional (i.e., mechanical, electrical, optical and magnetic) properties of thin-film nanostructures. Novel hybrid nanostructures with potential relevance to energy harvesting, catalysis, sensing, and biology will be addressed.

16.12.1
Hydrogen Storage; Materials, Measurements & Modeling (DMP)

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Numerous fundamental challenges still beset hydrogen storage technologies. Thermodynamic limitations associated with high sorption or formation enthalpies confront strategies whether they are based on traditional metal, complex, chemical, or physisorbent materials. For systems that do appear to offer possibilities based on thermochemical data, predicted reaction pathways during hydrogenation/dehydrogenation cycling are not necessarily observed. Also challenging are the kinetic barriers associated with solid-state diffusion in so-called "destabilized" hydride systems, where atomic mobility at temperatures < 200 °C is required. While the use of schemes such as hydride incorporation into scaffolds has been shown to improve kinetic behavior and reversibility, presumably by reducing diffusion distances, transport mechanisms are poorly understood, and the synthesis of these hybrid compounds is a highly non-trivial task. In this focus session we encourage experimental and computational contributions that address these outstanding thermodynamic, kinetic, and synthetic challenges.

16.12.7 (same as 25.9.4)
Physics and Materials for Inorganic Photovoltaics (DMP/GERA)

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The search for abundant and clean energy sources has placed photovoltaics at the focus of research spanning a variety of disciplines including physics, chemistry and materials science. Inorganic photovoltaics are currently the most scientifically as well as commercially developed technology for solar energy conversion. However, the quest for more cost-efficient photovoltaics is challenged by limitations in efficiency of charge excitation and collection in the materials and their interfaces. Progress has been made recently in developing new photovoltaic materials and systems by nanostructuring, non-equilibrium alloying, strain engineering, self-assembly, and heterostructures integration. In line with these advances, improved understanding is needed regarding the fundamental physics of charge transport in these materials and structures and their interaction with light. This Focused Topic session brings together experts from all related disciplines to discuss the fundamental problems in charge excitation and collection in inorganic photovoltaic materials, as well as the most recent discoveries made in these fields.