

SHINE Newsletter, May 18, 2010

Hi Everyone,

Registration for the 2010 SHINE workshop is now open. You'll perhaps notice the new look and format of our website due to the hard work of Antoun Daou (thanks!). Some of the links are still being transferred from the old version, so please be patient with the new pages.

However, all the pieces for registering for this year's workshop are up and running, so go right ahead and get your registration in. Please note that the fax numbers and addresses for payments are different from last year.

This newsletter is longer than most as I've included not just the session titles and leaders but also descriptions for most of the sessions. This information can also be found on the web page:

<http://shinecon.org/shine2010/SHINE%202010%20Session%20descriptions.htm>

Best,

Christina Cohen and the SHINE steering committee

[shine-committee@dopey.caltech.edu](mailto:shine-committee@dopey.caltech.edu)

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Items:

1. Registration and General Information for SHINE 2010
  2. Current SHINE Working Group Session List
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  4. 2010 Sunanda and Santimay Basu Award Nominations
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Registration and General Information for SHINE 2010

Important Dates:

**Workshop Dates: July 26-30, 2010**  
(Student Day July 25)  
**Registration: May 3 through June 18, 2010**  
**Abstract Deadline: June 18, 2010**  
**Hotel Reservation Deadline: June 18, 2010**

Registration is now open! Please register through the SHINE web page

<http://www.shinecon.org>

Registration is \$375 before 5pm CDT June 18 and \$425 afterwards.

This year's SHINE workshop will be held at the La Fonda in Santa Fe, New Mexico. Information about the resort can be found here: <http://www.lafondasantafe.com/index.html>. More details about the workshop venue, travel, etc. will be posted on the SHINE web site shortly.

To make your hotel reservations please mention **SHINE** or #642445 to receive the special group rate of \$109.00 per night.

Reservations should be made by calling La Fonda at:  
(U.S.) 1-800-523-5002 and then choosing #1.  
(Int'l) 1-505-954-3500 or 1-505-982-5511  
Please call between the hours of (Mountain Time):  
Monday – Friday: 7am-8pm  
Saturday: 8am-5pm  
Sunday: 9am-5pm

Or faxing a request to: (505) 954-3599

Or online at: <http://www.lafondasantafe.com/email-group.html>

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Current SHINE Working Group Session List

**1. Imbalanced Turbulence in the Solar Wind**

*Session Leaders: John Podesta (LANL) and Stanislav Boldyrev (UW-Madison)*

**2. Pinning Down the Physical Processes that Generate the Solar Wind**

*Session Leaders: Ben Chandran (UNH) and Justin Edmondson (JPL)*

**3. Extended Duration High-Energy Flares and GLEs**

*Session Leaders: Hilary Cane (GSFC) and Stephen White (AFRL)*

**4. Progress and Challenges in Modeling a CME from its Eruption to its Interplanetary Propagation out past Earth: The May 13, 2005 Event**

*Session Leader: Nick Arge (AFRL)*

**5. New Questions about Energetic Neutral Atoms, Pickup Ions, and Anomalous Cosmic Rays in the Heliosphere**

*Session Leaders: Matt Hill (APL) and Maher Dayeh (SWRI)*

**6. When and How is Reconnection in the Solar Environment Turbulent?**

*Session Leaders: Tom Intrator (LANL), Joe Borovsky (LANL), and Giovanni Lapenta (Katholieke Uni)*

**7. Magnetic Data as Drivers of Coronal Models: the Good, the Bad, and the Ugly**

*Session Leaders: Nick Arge (AFRL) and Carl Henney (AFRL)*

**8. Understanding and Predicting the Solar Cycle**

*Session Leaders: Keith Strong (GSFC) and Julia Saba (GSFC)*

**9. SDO Data Analysis How-To**

*Session Leader: Marc DeRosa (LMSAL)*

**10. The Nature of Coronal Mass Ejections: Heliospheric Properties and Relation to In-Situ Properties**

*Session Leader: Noé Lugaz (UHI)*

**11. Chromospheric Connections to the Heliosphere**

*Session Leaders: Scott McIntosh (UCAR) and Bart De Pontieu (LMSAL)*

**12. Differential Emission Measure: Techniques and Implications**

*Session Leader: Rich Frazin (UMich)*

**13. How Much do Solar Flares Contribute to Large SEP Events at Earth?**

*Session Leaders: Dennis Haggerty (APL) and Mihir Desai (SWRI)*

**14. Physics-based “All Clear” Forecasting**

*Session Leaders: Dan Fry (JSC) and David Falconer (UAH)*

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SHINE Session Descriptions

These descriptions can also be retrieved from the SHINE web site (<http://www.shinecon.org>).

**1. Imbalanced Turbulence in the Solar Wind**

*Session Leaders: John Podesta (LANL) and Stanislav Boldyrev (UW-Madison)*

Alfven-wave turbulence in the solar wind is imbalanced in that the energy of waves propagating away from the Sun is larger than the energy of waves propagating toward the Sun. This imbalance significantly affects the properties of the solar wind turbulence. Since only oppositely propagating Alfven waves interact with each other, the reduced energy of sunward propagating waves reduces the rate of energy cascade from large to small scales, affects the energy spectrum of solar wind turbulence, the rate of solar wind heating, etc.

Recent solar wind observations and numerical simulations attracted significant interest to this long-standing problem. In particular, they raised the questions of what model is most appropriate for describing the imbalanced solar wind turbulence? Why there is disagreement among recent numerical simulations of MHD turbulence, analytical modeling, and observations? Should compressibility or other non-ideal effects be taken into account to correctly describe the solar wind turbulence? The proposed session will review and discuss recent progress and challenges for both theory and observations of the

solar wind turbulence.

## **2. Pinning Down the Physical Processes that Generate the Solar Wind**

*Session Leaders: Ben Chandran (UNH) and Justin Edmondson (JPL)*

The origin of the solar wind is one of the enduring puzzles of heliospheric physics. Some theories of the solar wind focus on open-field-line regions and appeal to waves and/or turbulence to heat and accelerate the wind. Other theories focus on processes involving closed magnetic field lines, such as magnetic reconnection, loop heating, and the ejection of plasmoids from streamers. The goal of this session is to continue recent debates on the relevance of these different types of theories to both the slow solar wind and fast solar wind. Two discussion leaders will be invited to make short introductory presentations and help guide the discussion.

## **3. Extended Duration High-Energy Flares and GLEs**

*Session Leaders: Hilary Cane (GSFC) and Stephen White (AFRL)*

This session focuses on the highest energy particles accelerated in the solar atmosphere, observed via high-energy gamma rays and/or neutrons. The neutrons can be direct neutrons or secondary neutrons generated by the impact of high-energy protons on the Earth's atmosphere. In the latter case the interplanetary particle event is called a GLE (ground level enhancement).

These high-energy particles (over 1 GeV for protons, 100 MeV for electrons) raise many questions, including:

- what acceleration mechanisms are capable of producing such high energies; is more than one mechanism operating in GLEs, and if so, how are the different mechanisms related?
- where does the acceleration take place? If predominantly on closed field lines, how do the accelerated particles gain access to open field lines in order to reach the Earth?
- The arrival of high energy particles at Earth is delayed by propagation effects, and this complicates the identification of their source, but in a number of cases the inferred injection profile for the interplanetary particles seems to match the high-energy gamma-ray emission from the Sun. Are the electrons producing the gamma rays and the protons seen at Earth accelerated by the same mechanism?

A number of models have been proposed for such high-energy particles, including stochastic acceleration on closed field lines in a coronal trap followed by escape from the trap, shocks on predominantly open field lines, and extreme current sheets. In this session we address possible contributions from these scenarios and other issues raised by such high-energy particles from the perspective of observations of the Sun, observations of GLEs, and theory.

## **4. Progress and Challenges in Modeling a CME from its Eruption to its Interplanetary Propagation out past Earth: The May 13, 2005 Event**

*Session Leader: Nick Arge (AFRL)*

For almost a decade, the SHINE community has had a focused effort to model a CME from its eruption at the Sun to its interplanetary propagation out past Earth. While significant progress has been made, challenges still exist and much more work is required before this objective is fully achieved. Many difficulties

remain such as a lack of understanding of some of the basic physics involved (e.g., the CME initiation mechanism), technical complications in the numerical modeling (e.g., the need to adequately and simultaneously represent multiple spatial and temporal scales in the simulation), and the need for higher quality and cadence data (e.g., vector magnetograms). In this session, we review some of the progress made over the last year in modeling the May 13, 2005 event, as well as challenges encountered. This will be followed by an open discussion during which we will explore obstacles to and potential avenues for progress.

Participants are encouraged to submit posters on this event as well as to bring one page summaries of them, as there should be time for a select few to be presented (i.e., depending on their relevance to the discussion during the session). They are also encouraged to bring a list of key problems and questions they would like discussed during the session.

## **5. New Questions about Energetic Neutral Atoms, Pickup Ions, and Anomalous Cosmic Rays in the Heliosphere**

*Session Leaders: Matt Hill (APL) and Maher Dayeh (SWRI)*

Over the last five years a number of well-established explanations for phenomena broadly related to the heliospheric and interstellar interaction have been placed into doubt and new observations with potentially far-reaching consequences have arisen unexpectedly. Despite decades of anticipation that anomalous cosmic rays (ACRs) were accelerated at the termination shock (TS), in 2005 the Voyager team reported the dramatic fact that classical ACRs were not accelerated there, at least not at the point of the Voyager 1 TS crossing. In 2007 Voyager 2 observations revealed the dominance of pickup ions and suprathermal ions, in addition to plasma, in TS dynamics and energy balance. These observations included much colder than predicted post-shock plasma temperature and persisting supersonic solar wind downstream of the shock. Around this time, observations of pickup ions and suprathermal ions from ACE, Wind, Ulysses, and Cassini were published. They showed a widespread preference for a phase space density vs. velocity ion spectrum with a power law index of approximately -5. Most recently in 2009 the IBEX full sky campaign, supplemented by Cassini measurements, discovered a “ribbon” of energetic neutral atoms across the sky that was entirely unforeseen.

The theoretical landscape has been similarly rich, with explanations ranging from modest modifications of traditional theories (such as spatial and temporal (or turbulent) variations in local features and the global structure of the blunt TS to explain the dearth of ACRs); to new theories on the origin of suprathermal tails (such as reconnection, an energy cascade process, or stochastic variability leading to universal tails); to wholesale rethinking of the ACR acceleration problem (such as relocation of the ACR source from the TS to the heliopause); to the range of explanations of the new and unanticipated IBEX observations (such as ENA generation from the pickup ring on local interstellar magnetic field lines). The observations from ACE, Wind, Ulysses, Cassini, Voyager, and IBEX are ushering in the synthesis of new paradigms in heliospheric physics, and revealing unanticipated connections between suprathermal particles, accelerated particles and the global structures of the plasma domains surrounding our solar system.

## **6. When and How is Reconnection in the Solar Environment Turbulent?**

*Session Leaders: Tom Intrator (LANL), Joe Borovsky (LANL), and Giovanni Lapenta (Katholieke Uni)*

## **7. Magnetic Data as Drivers of Coronal Models: the Good, the Bad, and the Ugly**

*Session Leaders: Nick Arge (AFRL) and Carl Henney (AFRL)*

This session will address the key challenges and limitations of creating global solar magnetic field maps and, as the primary data input, how this affects modeling of the corona and solar wind. With current ground and space based instruments, the global solar magnetic field can only be recorded for approximately half of the solar surface at any given time. Since the rotation period of the Sun as observed from Earth is approximately 27 days, any global solar magnetic field map includes data that is ~13 days to a few months old for equatorial to polar regions, respectively. Global magnetic maps are made using numerous methods that range from extremely simplistic (e.g., assuming the sun rotates as a solid body) to attempting to model magnetic flux transport processes. Depending on the method and the complexity of activity on the sun, the maps can include a large monopole moment, poor or no data for a given pole, lack of flux evolution on the far-side, and poor field orientation assumptions when mapping from line-of-sight to the final radial map. All these artifacts have tremendous influence on heliospheric models. The session will have active discussion on the techniques for minimizing these problems so as to make further progress toward our ultimate goal of reliable instantaneous snapshots of the global photospheric field distribution. Possible topics to be discussed:

- What are the challenging topologies in global magnetic maps which create the most havoc on models?
- How best to estimate poorly observed polar regions when creating global maps?
- How best to minimize the discontinuity between ~13-day old and newly observed data?
- What are the primary sources of monopole signals, and how best to remove these residuals: add flux globally, active regions and/or the poles?
- How best to incorporate data assimilation techniques using data & model uncertainties?
- How best to propagate global map uncertainties to the coronal & solar wind models?
- How best to include far-side estimation of magnetic activity from helioseimology?
- How to validate and quantify success, that is, what metrics capture the flux evolution of the photosphere globally best?

## **8. Understanding and Predicting the Solar Cycle**

*Session Leaders: Keith Strong (GSFC) and Julia Saba (GSFC)*

Given the extended solar minimum that we have just been through, there is renewed interest in the solar cycle in the research community, and equally important, by the general public. The failure of most predictions to accurately predict the timing and amplitude of the upcoming Cycle 24 is an embarrassment

to the solar community, demonstrating our lack of understanding of even the fundamental processes that drive the solar cycle.

This session will look at four aspects of solar cycle studies:

- The observations: Cycle 23 is probably the best observed solar cycle to date and yet we seem unable to predict even the simplest aspects of the upcoming cycle. This part of the session would address questions like:
  - What data do we have available? How reliable are they?
  - Are there other resources that we can draw on to help better understand the physical processes driving the cycle and determining future activity?
  - What other observations do we need to better be able to predict medium and long-term solar activity? Do we need continuous full-Sun coverage, including the farside, for example?
- Analysis and Interpretation: We use many different type of solar and heliospheric data to look at the cycle yet there are still problems in bringing together inhomogeneous imaging, spectral, and temporal data sets from different sources in the way that we need to potentially sort out this complex problem. This aspect of the workshop session would try to answer questions like:
  - What new analysis techniques are needed to better interpret the solar cycle data?
  - What are the key parameters and what accuracy is needed for the modelers to improve our concepts of the cycle?
  - How do we get the data readily available to everyone and in what form?
- Theory and Modeling: Many different approaches have been taken to modeling the solar cycle but do any of them adequately reflect the complexity of the processes that are occurring on the Sun? This portion would discuss questions like:
  - How can we build a better physics-based model of the solar cycle?
  - What physical processes dominate under what circumstances?
  - How do we deal with asymmetries (e.g., northern vs southern hemisphere)?
- Space Weather: The practical application of any improved understanding of the solar cycle is a unique aspect of solar research. Here we would discuss questions like:
  - What do the customers of our predictions want to know or really need? As opposed to what they are used to?
  - What are the useful timescales of the predictions compare dto what is currently practical? How do we bring these into closer alignment?
  - How does the research community keep in touch with those changing needs? How do we better inform data and prediction users of advances in our research?

## **9. SDO Data Analysis How-To**

*Session Leader: Marc DeRosa (LMSAL)*

The recently deployed Solar Dynamics Observatory (SDO) is designed to help

us understand the Sun's influence on Earth and near-Earth space by studying the solar atmosphere on small scales of space and time and in many wavelengths simultaneously. The high spatial and temporal resolution of SDO translates into terabytes of data per day that will be available for scientific analysis, and such volumes of data require new and efficient techniques for locating and downloading datasets of interest. In this session, we use a multitude of examples to demonstrate many of the tools that researchers can use to browse, find, retrieve, and analyze data during the SDO era.

## **10. The Nature of Coronal Mass Ejections: Heliospheric Properties and Relation to In-Situ Properties**

*Session Leader: Noé Lugaz (UHI)*

The aim of this session is to discuss CME observations and simulations in the heliosphere in an effort to better understand the nature and properties of CMEs. We will focus on how the CME 3-D magnetic structure can be determined from remote-sensing observations and how these properties compare to those derived from in-situ data. The questions we plan to address are:

- do CME remote and in-situ observations always point towards twisted flux ropes?
- how can the CME direction and orientation be best determined in the heliosphere and does it agree with in-situ measurements?
- is it realistic to assume self-similar and radial expansion of CMEs in the heliosphere?

## **11. Chromospheric Connections to the Heliosphere**

*Session Leaders: Scott McIntosh (UCAR) and Bart De Pontieu (LMSAL)*

We look to explore the connections of the chromosphere to the heliosphere by exploring topics as far reaching as: chromospheric magnetism and structure as a basis for magnetic models of the heliosphere; plasma heating and dynamics; the chromosphere's impact on solar wind composition; large-scale dynamic phenomena and tapping the chromospheric mass and energy reservoir. With data from the Hinode spacecraft and many ground-based platforms chromospheric physics is advancing rapidly. In the lead-up to data from the SDO and Interface Region Imaging Spectrograph (IRIS) we look to add some SHINE context to this complex region of the solar atmosphere.

## **12. Differential Emission Measure: Techniques and Implications**

*Session Leader: Rich Frazin (UMich)*

The differential emission measure, or DEM, concept deals directly with the with highly structured, multi-thermal nature of plasma in the transition region and corona as seen in UV, EUV and X-ray observations. While in use for several decades now, there is still much discussion of the best way to determine the DEM for a given set of observations, and there are fundamental points of controversy. Accurate recovery of DEMs is a critical step in validating coronal heating models. We will start by covering various DEM techniques, including 3D, and their limitations. Then we will focus on using DEM analysis to learn about the physics, i.e., comparison to numerical models and chromospheric vs. coronal heating. Our current outline is as follows:

- DEM techniques

- single Temp vs. multi-temp
- Survey of DEM methods
  - MCMC, curve fitting, etc.
  - 3D techniques (DEMT, stereoscopy)
- Uncertainty sources
  - atomic physics
  - ill-posed inversion (statistics, kernels, number of lines, etc.)
  - abundances
  - non-equilibrium ionization
- Learning about the solar physics from DEM
  - How to go from DEM results to physics?
  - comparison to numerical models
  - chromospheric vs. coronal heating

### **13. How Much do Solar Flares Contribute to Large SEP Events at Earth?**

*Session Leaders: Dennis Haggerty (APL) and Mihir Desai (SWRI)*

The goal of this session is to bring together theoreticians and experimentalists and assess the potential contributions that flare-accelerated ions make to large SEP events at Earth. Recent studies have shown that energetic ions accelerated in the low solar corona during solar flares may make a significant contribution to the observed particle fluxes above tens of MeV during some large gradual solar-energetic-particle events observed at Earth. In contrast, other studies suggest that the energetic ions at 1 AU originate almost entirely from acceleration at shocks associated with coronal mass ejections. In addition, more recent STEREO observations have revealed that flare-related 3He-rich ISEP events have significantly broader longitudinal distributions than previously thought. This working group session will invite participants to discuss relevant topics such as: (1) observational and theoretical arguments that constrain flare contributions to large gradual SEP events at Earth, (2) empirical estimates of the fraction of flare populations that escape into interplanetary medium, (3) coronal conditions (e.g., proximity to open field lines) that facilitate their escape, (4) correlation between the escaping populations and 1-AU SEP ions and electrons, (5) implications of the recent STEREO observations that show the broader than expected longitudinal extent of 3He-rich impulsive SEP events, and (6) the possible distortion of SEP properties (e.g., time-profiles of Fe/O) due to transport-related effects.

### **14. Physics-based “All Clear” Forecasting**

*Session Leaders: Dan Fry (JSC) and David Falconer (UAH)*

The need for “All Clear” solar particle event forecasting has received substantial support over the past decade (references can be found at least as far back as Michael Golightly (NASA SRAG), in a presentation at Space Weather Week in April, 1999:

<http://www.scostep.ucar.edu/archives/newsletters/Jun99news.html>.)

An interagency workshop on this topic was hosted in Boulder, Colorado, in 2009 the week before Space Weather Week. The 2009 NASA Heliophysics roadmap noted: “The largest potential impact on exploration would derive from the ability to predict “all clear” periods.”

Solar particle events are rare: out of 2917 days from 1998 through 2005, SPEs, by the NOAA definition of an event, were underway only 256 days (~9% of the time). Large events that could have a significant impact are even more infrequent. Until we get to the point that we can accurately forecast the onset of specific events, it should be possible to identify periods when an event is substantially more unlikely than even persistence would suggest. The ability to provide physics-based forecasts of 8 to 12 to 24 hours of “all clear” periods could substantially improve operational flexibility. The challenge to the space weather community is to understand the precursors, and necessary and sufficient conditions, of large events well enough to expand the operational window without putting astronauts or other space systems at risk of a “surprise” event. Among the topics to be considered in this session are: What is really meant by “all-clear” ---is there an event threshold that would improve the feasibility of such forecasts...and from the operational point of view are there events that astronauts could reasonably work through? Do we know enough about the fundamental physics involved to identify 8-12-24 hour periods when a significant event is extremely unlikely, even near solar maximum? What gaps do we have in our understanding that limit a strategy of reliance on “all-clear” forecasts? What observations are necessary to support research that may lead to “all-clear” forecasts? Would a research program focused on “all clear” forecasting differ in any substantial way from one focused on predicting the evolution of an event just before or soon after on-set? This is a tremendously interdisciplinary topic. The session(s) would include participants with expertise in solar active region growth, magnetic flux emergence, flare and CME initiation, solar energetic particle acceleration and transport, suprathermal particle population generation, and solar wind/IMF structure and evolution. Again quoting the 2009 NASA Heliophysics Roadmap, “Accurately predicting when safe intervals will occur, or the exact times of sudden releases of radiation at the Sun, poses major challenges to the system science of heliophysics.” The daunting nature of collaboration suggests the need for such a session as soon as possible as the new cycle begins, so appropriate observational strategies can be planned.

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#### Call for Nominations for the 2010 Sunanda and Santimay Basu Award

The Space Physics and Aeronomy (SPA) Section of the American Geophysical Union (AGU) is seeking nominations for the 2010 Sunanda and Santimay Basu Award in Sun-Earth Systems Science. This award is presented annually to honor an individual young scientist from a developing nation for making outstanding contributions to research in Sun-Earth Systems Science that further the understanding of both plasma physical processes and their applications for the benefit of society. The award is open to scientists who received their Ph.D. degree after June 1, 2003 and currently live and work in developing nations. Consideration is to be given to candidates who have overcome obstacles in attaining their research objectives.

The Space Physics and Aeronomy Section will invite the recipient to present a

paper at AGU's Fall Meeting in San Francisco, California. Travel funds and living expenses will be provided to attend the meeting, where the recipient will also receive a certificate of appreciation and three years' membership to AGU. The award will be presented at the SPA dinner, for which the awardee will receive a complimentary ticket. The awardee will also be announced in /Eos/.

Nominations should be prepared by an AGU member or other geoscientist who is knowledgeable of the candidate's qualifications and include the following information:

- nominator's name and title, address and contact numbers;
- nominee's name and title, institutional affiliation, and address;
- a statement (not to exceed 2 pages) of the action(s)

or achievement(s) for which the candidate is nominated;

- two letters of support from AGU members or from other recognized geoscientists belonging to institutions other than that of the nominee;
- a curriculum vitae (not to exceed 3 pages).

A list of previous recipients of the award can be found at:

[http://www.agu.org/about/honors/section\\_fg/spa/](http://www.agu.org/about/honors/section_fg/spa/)

The deadline for receipt of the nomination package is \*1 June 2010\*.

Send nominations to:

American Geophysical Union  
Attn: Leadership  
2000 Florida Avenue, NW  
Washington DC 20009 USA  
Tel: +1-202-777-7502  
E-mail: [\\_leadership@agu.org](mailto:_leadership@agu.org) <<mailto:leadership@agu.org>>\_

You can also contact the Chair of the Sunanda and Santimay Basu Award Committee with questions: David Hysell ([david.hysell@cornell.edu](mailto:david.hysell@cornell.edu)).

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Dear Colleagues,

Please consider submitting a SPECIAL SESSION PROPOSAL for the Fall 2010 AGU meeting. The deadline for session proposals is MAY 27, 2010.

2010 AGU Fall Meeting  
13–17 December, 2010  
Moscone Convention Center  
San Francisco, California, USA  
<http://www.agu.org/meetings/fm10/>

To read the guidelines for AGU Special Sessions and to submit a proposal, visit:  
[http://www.agu.org/meetings/fm10/program/session\\_proposals.php](http://www.agu.org/meetings/fm10/program/session_proposals.php)

Thanks in advance for helping to plan a lively and topical meeting!

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