

SHINE Newsletter, April 24, 2009

Hi Everyone,

The 2009 SHINE workshop is starting to come together and the working group leaders are working hard on defining their sessions and discussion focus. We have several new topics this year and want to thank all those that have proposed sessions and volunteered to lead them.

Most of this newsletter contains information on the upcoming workshop. 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://www.shinecon.org>. This page will be continually updated as we get more details from the hotel and local area.

Best,

Christina Cohen and the SHINE steering committee
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Items:

1. Registration and General Information for SHINE 2009
 2. Current SHINE Working Group Session List
 3. SHINE Session Descriptions
 4. CISM Space Weather Summer School Announcement
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Registration and General Information for SHINE 2009

Important Dates:

Workshop Dates: August 3-7, 2009
(Student Day August 2)
Registration: May 4 through June 15, 2009
Abstract Deadline: June 15, 2009
Hotel Reservation Deadline: June 15, 2009

Please register (after May 4th) through the SHINE web page

<http://www.shinecon.org>

Registration is \$375 before 5pm CDT June 15 and \$425 afterwards.

This year's SHINE workshop will be held at the Old Orchard Inn in Wolfville, Nova Scotia. Information about the resort can be found here: <http://www.oldorchardinn.com>. More details about the workshop venue, travel, etc. will be posted on the SHINE web site shortly.

Rooms for the hotel can be reserved through this page:

http://www.oldorchardinn.com/shine_2009/shine_accommodations.html
(the price is in Canadian dollars)

There are two lodging locations available. The Old Orchard Inn is the location of the meeting rooms. Free shuttle service will be provided between the Slumber Inn and the Old Orchard Inn.

Current SHINE Working Group Session List

1. Non-Balanced Turbulence in the Solar Wind

Session Leaders: Ben Chandran (UNH) and Stanislav Boldyrev (UW-Madison)

2. Introduction to Community Models

Session Leaders: Jon Linker (Predictive Science)

3. The Role of the Coronal and Heliospheric Magnetic Field in the Solar Cycle and Possible Feedback on the Solar Dynamo

Session Leaders: Ofer Cohen (CFA) and Axel Brandenburg (Nordita)

4. Pinning Down the Physical Processes that Generate the Slow Solar Wind

Session Leaders: Ben Chandran (UNH) and Steve Cranmer (CFA)

5. Corotating Interaction Regions: Heliospheric Structure in 3 (and 4) Dimensions

Session Leaders: Rick Leske (Caltech) and Kristin Simunac (UNH)

6. Recent Unprecedented Weak Solar Wind : A Solar Glitch or a Harbinger for the Next Maunder Minimum ?

Session Leaders: Joan Feynman (JPL) and Janet Luhmann (UCB)

7. Outstanding Issues on the Shock Formation by CMEs

Session Leaders: Angelos Vourlidas (NRL), Ilia Roussev (UHI) and Merav Opher (GMU)

8. Observational Tests of Suprathermal Particle Acceleration Theories

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

9. Active Region Magnetic Fields: From the Photosphere to the Corona

Session Leaders: Mark Rast (LASP) and Bill Abbett (UCB)

10. The Late/Gradual/Second Phase of Flares and the Implications for Solar Particle Acceleration

Session Leaders: Hilary Cane (GSFC) and Stephen White (UMD)

11. Merging Different Views of Structure: Structure of the Magnetic Field, Structure of the Plasma, Structure of the Suprathermal Particles, and Structure of the Flow

Session Leaders: Joe Borovsky (LANL) and John Steinberg (LANL)

12. Modeling a CME from Its Eruption to Its Interplanetary Propagation Out Past Earth: The May 13, 2005 Campaign Event

Session Leaders: Ofer Cohen (CFA) and Nick Arge (AFL)

13. Reconnection in Large, High-Lundquist Number Coronal Plasmas

Session Leaders: Amitava Bhattacharjee (UNH) and Terry Forbes (UNH)

14. Anomalous Cosmic Rays: How and Where are They Accelerated?

Session Leaders: Vladimir Florinski (UAH) and Alan Cummings (Caltech)

15. Relationships between Flares and CMEs

Session Leaders: Yan Li (UCB) and Ben Lynch (UCB)

16. ^3He -rich Impulsive SEP Events from a Quiescent Sun

Session Leaders: Dennis Haggerty (APL) and Matt Hill (APL)

SHINE Session Descriptions

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

1. Non-Balanced Turbulence in the Solar Wind

Session Leaders: Ben Chandran (UNH) and Stanislav Boldyrev (UW-Madison)

Alfven-wave turbulence in the solar corona and solar wind is "imbalanced," in the sense that the waves propagating away from the Sun have more energy than the waves propagating towards the Sun. At large MHD-like scales, only oppositely propagating Alfven waves interact, and so imbalance leads to fundamental changes in the properties of solar wind turbulence that are important for understanding the role of turbulence in the solar wind. For example, the reduced amplitude of Sunward waves reduces the rate at which energy cascades from large scales to small scales, thereby reducing the turbulent heating rate.

The last few years have seen a resurgence of interest in this longstanding problem, with new developments in numerical simulations, phenomenological theories, and observations of solar wind turbulence. This full-day session will be devoted to a critical analysis of this recent work, and to generating discussion between theorists and observers and between advocates of different emerging theoretical paradigms. There will be six

short (15-minute) talks, with ample time for discussion. Participants interested in presenting a very short (single slide) presentation on research relevant to the session are encouraged to contact one of the organizers.

2. Introduction to Community Models

Session Leaders: Jon Linker (Predictive Science)

The purpose of the session is to introduce the community to available solar & heliospheric models. After brief introductions to the available models, participants will have the opportunity to visit "stations" provided by the CCMC and model developers. Model developers will be available to show off their model web sites and/or point to where their model resides at the CCMC, explain how the different available parameters affect the solutions, and answer questions about the model.

3. The Role of the Coronal and Heliospheric Magnetic Field in the Solar Cycle and Possible Feedback on the Solar Dynamo

Session Leaders: Ofer Cohen (CFA) and Axel Brandenburg (Nordita)

The solar dynamo has been extensively studied in the past few decades. However, the classical treatment of the solar dynamo is limited to the the global circulation of magnetic field in the convection zone. On the other hand, some work has been done to study the role of the coronal field in the reversal process, mostly through reconnection and transport of the open flux, but these studies did not take into account the field in the convection zone. The coupling of the two regimes is nearly impossible due to wide range of both spatial and temporal scales involved, as well as very complicated physics. Nevertheless, the convection zone and the corona are magnetically connected, and we must begin to study them as a single system in order to have complete understanding about the long-term evolution of solar magnetic field. In this session we will address the main problems in coupling the two regimes, as well as addressing what are the physical processes that couple the two systems.

4. Pinning Down the Physical Processes that Generate the Slow Solar Wind

Session Leaders: Ben Chandran (UNH) and Steve Cranmer (CFA)

The origin of the solar wind is one of the enduring puzzles of heliospheric physics. The generation of the slow solar wind in particular remains a mystery, despite the importance of the slow wind for space-physics phenomena at Earth. The goal of this full-day session is to review theoretical progress on the proposed mechanisms for slow-wind acceleration, and to review a range of observational diagnostics that can help test these mechanisms. The theoretical models can be roughly classified into two camps: (1) those that provide energy via the eruption and reconnection of closed loops and/or streamers, and (2) those that energize the plasma in open-field regions by waves and turbulence. The observations that will be used to confront these models include measurements of the elemental composition of the solar wind (including the FIP effect and helium abundance versus wind speed), microphysical plasma properties such as entropy and electron beams, and recent observations from STEREO of time variability and plasmoid ejection from the streamer belt. We anticipate that not all of the theory will be presented in the

theory talks, and not all of the observations will be presented in the observational talks, such that the "confrontation" between the two will be ongoing and balanced throughout the session.

5. Corotating Interaction Regions: Heliospheric Structure in 3 (and 4) Dimensions

Session Leaders: Rick Leske (Caltech) and Kristin Simunac (UNH)

Corotating interaction regions (CIRs) develop when high-speed solar wind overtakes and interacts with the preceding slow solar wind. Forward and reverse shocks often form at CIR boundaries, usually beyond 1 AU, where they may accelerate particles to ~20 MeV/nucleon. Since early 2007 solar energetic particle (SEP) activity has been at an extreme minimum, but the relatively large tilt of the heliospheric current sheet has (at least until recently) allowed high-speed wind from polar coronal holes access to the ecliptic and resulted in significant CIR activity regularly appearing at 1 AU. This situation provides an ideal opportunity to study CIR particles without SEP contamination.

New in-situ observations using modern instruments are being made of CIR particles and solar wind structures from a variety of latitudes (Ulysses) and longitudes (STEREO) in addition to 1 AU near Earth (ACE, Wind, SoHO, etc.), and remote sensing observations (STEREO) have even directly imaged the solar wind interaction regions. With multi-point observations of CIRs over multiple Carrington rotations, along with modern modeling efforts, we can hope to disentangle spatial from temporal changes in the particle acceleration and transport and obtain a more complete picture of CIRs and their effects on heliospheric particles, fields, and plasma.

We are planning and will encourage presentation and discussion of the new observations and models and the insight they provide (or questions they may raise) regarding the nature and physics of CIRs.

6. Recent Unprecedented Weak Solar Wind : A Solar Glitch or a Harbinger for the Next Maunder Minimum ?

Session Leaders: Joan Feynman (JPL) and Janet Luhmann (UCB)

This solar minimum is like no other observed with modern instrumentation. The average solar wind pressure and magnetic field intensities are the lowest they have been since the space age began. At the vicinity of the Earth the interplanetary magnetic field is 1/3 smaller than any previous comparable interval and the solar wind pressure has decreased by 20 percent. Ulysses also observes weaker solar mass flux and magnetic fields at high heliolatitudes. The onset of Cycle 24 seems to have been delayed, and the usual solar minimum near-equatorial coronal streamers have not appeared as expected.

Although solar minima during the space age had been remarkably alike before this one, historical records show this was not always the case. The minima at the beginning of the 19th and 20th centuries were also deep or delayed but the cyclic nature of the sunspots in the following decades was clearly evident (Solar Glitch). On the other hand, between 1645 and 1715 (the Grand Maunder Minimum) sunspots were very rare and their cyclic

nature was not apparent.

This session is envisioned as an open discussion of the newest Solar and Heliospheric conditions, their causes and consequences, and speculations on how solar activity may develop in the upcoming years.

7. Outstanding Issues on the Shock Formation by CMEs

Session Leaders: Angelos Vourlidas (NRL), Ilia Roussev (UHI) and Merav Opher (GMU)

The aim of this half-day session is to bring together observations and numerical simulations that focus on the formation of shocks by coronal mass ejections (CMEs). The questions we would like to focus the discussion on are:

- How can we use MHD models and observations to constrain the Alfvén speed in the corona?-
- How does the large scale magnetic field affect the shock properties in the corona?
- How are the CME sheath flows modified by the large scale magnetic field?
- What physics can we address from streamer compression/bending due to a shock passage?

8. Observational Tests of Suprathermal Particle Acceleration Theories

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

Increasingly over the last two decades, heliospheric ion composition measurements in the suprathermal energy range have become possible with the launch of spacecraft having more capable mass spectrometers. Suprathermal particles are those with more energy than the bulk solar wind plasma but less than energetic particles, which move through rather than make up the solar wind. Such measurements have provided discoveries such as the ubiquitous presence of distribution functions with suprathermal tails and the dominance of the suprathermal ions over the source population for coronal mass ejections, interplanetary shocks, corotating interaction regions, and large solar energetic particle events. However, the origin, acceleration, and spectral evolution of the suprathermal population are yet poorly understood. In this session, we will follow-up on the progress of the related SHINE suprathermal workshop sessions from 2007 and 2008 and bring together experimentalists and theoreticians to explore two key questions:

Questions to be Addressed:

- (1) What are the major source contributors of the suprathermal population?
- (2) How common are the v^{-5} spectra in the heliosphere?
- (3) What acceleration mechanisms are responsible for the suprathermal tail distributions?

9. Active Region Magnetic Fields: From the Photosphere to the Corona

Session Leaders: Mark Rast (LASP) and Bill Abbett (UCB)

Magnetic active regions on the Sun, comprising sunspot groups observed in the

photosphere and bright knots of X-ray emission observed in full disk coronal images, are the largest contributors to measures of solar activity. That is, large solar flares and coronal mass ejections, and nearly all of the observed X-ray and much of the EUV radiance that reaches the Earth's atmosphere are associated with active region magnetic fields.

But where do active regions come from? What aspects of their observed properties can be explained theoretically? What happens to active regions as they decay and die? While much progress has been made in the past several decades addressing these fundamental questions, a number of thorny issues persist: Do we fully understand the flux emergence process, and can we reliably quantify how much magnetic free energy or helicity is introduced into the corona during the emergence process? Why do active regions behave like isolated magnetic structures connected to a large-scale field during their emergence through the turbulent convection zone, but then behave as though they were disconnected from any subsurface mooring after they have emerged? Can we explain the observed asymmetry and fragmentation during the emergence process? What happens to the large-scale magnetic field below the visible surface after an active region emerges and begins to decay?

In this session, we will address these questions from both an observational and theoretical point of view, and explore whether our current understanding of active region evolution and decay can explain recent observational results.

10. The Late/Gradual/Second Phase of Flares and the Implications for Solar Particle Acceleration

Session Leaders: Hilary Cane (GSFC) and Stephen White (UMD)

The concept of impulsiveness and gradualness in solar flares is based on temporal variations in intensities of hard X-rays or microwaves. Solar energetic particle (SEP) events are also classified as impulsive and gradual primarily because of the differing elemental composition of the events associated with impulsive flares compared with those associated with gradual flares. Traditionally SEP researchers refer to particle acceleration in terms of phases with the first phase being less energetic and more localized than second phase. This terminology has its origins with meter wavelength radio observations where the first phase is evidenced by fast-drift type III radio bursts and the second phase is linked to slow-drift type II bursts attributed to coronal shocks. These two types of radio emissions have their origins in electron beams accelerated by different mechanisms and similarly SEPs in the two classes are believed to be accelerated by different mechanisms; stochastic acceleration in flare loops for the impulsive class and shock acceleration for the gradual class. In contrast, recent observations suggest that the impulsive and gradual phases of flares may have a similar acceleration mechanism but with an evolution of the flare region. The gradual phase of flares is microwave-rich, the microwaves are delayed relative to the hard X-rays and the hard X-rays exhibit spectral hardening with time. Various arguments indicate that there must be a continuous acceleration mechanism in the gradual phase. Shock acceleration related to type II emissions is not likely because the shock is too high in the corona. Given the association of large SEP events with gradual flares and with X-ray spectral hardening it is important

to address the question of what would be the characteristics of the particles from the gradual phase if they were to escape to space? How do the physical conditions in the flare region change from the impulsive phase to the gradual phase? How good is the association between large SEP events and flares with spectral hardening? Does a collapsing trap provide the necessary particles in the gradual phase?

Further questions are: Why do researchers identify type II bursts, rather than type IV/type III-like emission, with the gradual phase of flares? Type II bursts are associated with impulsive and gradual flares whereas type IV, extended type III is only with gradual flares.

11. Merging Different Views of Structure: Structure of the Magnetic Field, Structure of the Plasma, Structure of the Suprathermal Particles, and Structure of the Flow

Session Leaders: Joe Borovsky (LANL) and John Steinberg (LANL)

The texture of the wind is differently emphasized when seen by different measures. For example, the magnetic field shows the solar wind to be filled with flux ropes, magnetic depletions, current sheets, and Alfvén waves. The flow velocity shows microshears, flow tubes, and turbulence. The plasma density and temperature show pressure-balance structures, periodic variations, compressions, rarefactions, and density plugs. The electron heat flux shows topology changes, disconnections, and strahl variability.

In this session we call for studies that may lead to more-unified views of solar wind structures and their origin.

Questions addressed will include:

- What do flow velocities, plasma properties, and heat flux indicate about solar-wind discontinuities and filamentary structures?
- What are the roles of fields and flows in solar-wind turbulence?
- How do flow tubes near the Sun relate to flux tubes at 1 AU?
- What causes abrupt flow shears in the solar-wind plasma?
- Are density periodic structures seen in other measures?

12. Modeling a CME from Its Eruption to Its Interplanetary Propagation Out Past Earth: The May 13, 2005 Campaign Event

Session Leaders: Ofer Cohen (CFA) and Nick Arge (AFL)

Over the last several years the SHINE community has had a focused, coordinated effort to model a CME from its eruption at the Sun to its interplanetary propagation out past Earth. The May 12, 1997 CME was selected as the event to focus on, as it occurred near solar minimum when the Sun had a relatively simple configuration. While significant progress has been made over the years on this event, last year SHINE members decided it was time to shift the focus on the newer May 13, 2005 CME. This event is remarkably similar to May 12, 1997 (see Yurchyshyn et al., 2006, Solar Physics) in many respects, but it was much better observed by both ground and space based observatories. In this second session on the May 13, 2005 CME, a brief observational overview of the event

will be provided followed by two short presentations discussing recent efforts to model it. Even though the primary focus of this session is the modeling effort of this event, participants are encouraged submit posters on any relevant aspect of this event (flux rope and magnetic cloud structure, EIT waves, SEPs etc.), as well as to bring one page summaries of them, since there should be time for a select few of them to be presented (i.e., depending on their relevance to the discussion during the session).

13. Reconnection in Large, High-Lundquist Number Coronal Plasmas

Session Leaders: Amitava Bhattacharjee (UNH) and Terry Forbes (UNH)

Recent work has demonstrated that reconnection in large, high-Lundquist-number systems, in resistive as well as collisionless regimes, shows dynamical behavior qualitatively different from systems of moderate or small size. By large systems, we mean systems in which the aspect ratio of thin current sheets in the reconnection layer exceeds about 30 or so. Such systems are easily realized in the corona, where the typical Sweet-Parker width is expected to be much smaller compared with the system size. A universal feature of these systems, seen in high-resolution simulations and confirmed by analytical theory, is the spontaneous development of super-Alfvénic secondary instabilities that can lead to new regimes of fast reconnection. The electric fields in such regimes are super-Dreicer. The reconnection in such systems is strongly impulsive and time-dependent. These new results have potentially important consequences for models of eruptive coronal dynamics as well as coronal heating.

In this session, we propose to address the following questions:

1. How does reconnection scale with the Lundquist number, the electron and ion inertial lengths, and the system size in large coronal sheets?
2. What controls the onset of fast reconnection in large coronal sheets? What is the role of secondary instabilities?
3. What do recent observations of coronal current sheets imply about the scaling and onset of fast reconnection?

14. Anomalous Cosmic Rays: How and Where are They Accelerated?

Session Leaders: Vladimir Florinski (UAH) and Alan Cummings (Caltech)

Anomalous cosmic rays (ACRs) are energetic ions produced from interstellar atoms ionized inside the heliosphere. Modulated ACR spectra has been observed by the Voyager and other spacecraft for over 30 years. Prior to Voyager 1 and 2 crossing of the termination shock in 2004 and 2007, respectively, it was generally thought that ACRs were accelerated via diffusive shock acceleration from the pickup ion population at the termination shock. After the ACR spectra failed to unfold to a single continuous power law predicted by the theory, it became clear that the existing models of ACR acceleration were in need of revision.

A number of alternative theories have emerged in the past five years. It was suggested that acceleration at the termination shock is more intermittent rather than continuous, as previously thought, occurring at preferred locations and/or times. Parts of the shock with

a more favorable orientation of the magnetic field relative to the shock normal were suggested to be the principal acceleration sites. Other models propose that ACRs are energized close to the heliopause, where the heliosheath magnetic field is compressed. In this scenario the dominant production mechanism is stochastic acceleration on compressional turbulence.

The ACR spectra continue to evolve as the Voyagers travel deeper into the heliosheath. It is the objective of this session to bring together experimental and theoretical scientists working on the problem of energetic particle acceleration and transport in the heliosphere to share their results and ideas in an attempt to solve the problem of the physical mechanism and acceleration site of anomalous cosmic rays.

15. Relationships between Flares and CMEs

Session Leaders: Yan Li (UCB) and Ben Lynch (UCB)

This session solicits both observational and theoretical studies addressing the relationships between solar flares and CMEs. The questions include 1) is there a causal relationship between flares and CMEs? 2) the energy partition among various aspects of the flare-CME system; 3) the interpretation and connection between directly and indirectly observed flare and CME products and properties; 4) are there fundamental differences between the process producing flare-CME pairs and that producing flare-less CMEs? While some of the questions have become relatively clear over the past decade, many remain unanswered.

17. ^3He -rich Impulsive SEP Events from a Quiescent Sun.

Session Leaders: Dennis Haggerty (APL) and Matt Hill (APL)

Understanding the physical processes operating in Solar Energetic Particle (SEP) events is a major goal of SHINE. Most SEPs in large events appear to be accelerated in the high corona by a fast CME and the associated large solar flares. Small impulsive SEP events generally are dominated by non-relativistic electrons and show strong enrichments of ^3He and were believed to be due to flare acceleration. High-resolution observations over solar cycle 23 have shown that even in large SEP events there is very often a ^3He enhancement. The current extended solar minimum has provided a unique opportunity to study small impulsive SEP events while minimizing the complications associated with a very dynamic and explosive Sun. In this session we will explore both observationally and theoretically these SEP events and possible acceleration mechanisms during the very quiescent solar minimum. Glenn Mason will provide an overview of the SEP observations during solar minimum and James Drake will expand on his theoretical work concerning a possible acceleration mechanism.

The Center for Integrated Space Weather Modeling Summer School 2009
July 20-31, 2009, Boston University

Space Weather Phenomena, Consequences, and Modeling

or Reality, Harsh Reality, and Virtual Reality

July 20 - 31, 2009, Boston University

The Ninth Center for Integrated Space Weather Modeling (CISM) Summer School will be held at Boston University July 20 – 31, 2009. The two-week school will closely follow the model of the previous successful Summer Schools, which comprehensively immersed students in the subject of space weather, what it is, what it does, and what can be done about it. The CISM summer school supplements standard curricula relating to the physics, meteorology, and climatology of space with integrated overviews of the solar-terrestrial weather system from the Sun to the earth, its effects and consequences, and the state of the art in modeling it. A unique feature of the school is a series of three-hour computer labs to learn how to use models being developed by CISM to understand the space environment and to make space weather predictions. The team of instructors will be led by Jeffrey Hughes, Harlan Spence, Nicholas Gross, and John Lyon.

The school is intended primarily for students about to enter graduate school in the space sciences or early in their graduate careers. We encourage supervisors to recommend the school to their prospective or current students. However others with a professional interest in space weather have also attended and benefited from earlier schools. Further details and the application form, including a request for financial support, can be found under Summer School on the CISM web site at <http://www.bu.edu/CISM/> . Applications are due by May 1. CISM is an NSF Science and Technology Center.
