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The Solar Mass Ejection Imager (SMEI) experiment was launched on the STP Coriolis mission 6 January 2003 and is now recording all-sky, white light images on each 101-minute orbit. SMEI is fixed to the spacecraft and views the sky above Earth using sunlight-rejecting baffles and CCD camera technology. When fully calibrated, sky maps of structures having enhanced electron density in the inner heliosphere will be routinely produced. We will present some preliminary results of the early analysis of SMEI data. These include observations of several dozen coronal mass ejections (CMEs) as confirmed by the SOHO LASCO coronagraphs. One of these was a halo event which propagated to and beyond 1 AU and was associated with a major geomagnetic storm at Earth. Tomographic techniques are being developed to analyze the SMEI observations of the heliospheric plasma, including the transient CMEs and corotating interaction regions. SMEI also detected Comet NEAT inbound to and outbound from the Sun and the asteroid Vesta. With SMEI data we also can study solar and solar wind processes, and the experiment is capable of observing various other astronomical phenomena, such as variable stars, the Zodiacal light, near-Earth objects and extrasolar planetary transits.

SH41C-04 1105h INVITED

LASCO/SMEI Potential Joint Observations

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The SOHO LASCO complement of coronagraphs has observed many halo CMEs. A subset of these events is the source of geomagnetic storms. A major question is to understand the propagation of CMEs through the interplanetary medium and their interaction with the Earths environment. LASCO observes the lateral expansion of Earth directed CMEs and can only infer the speed in the direction of Earth. Thus, determination of the time of impact at Earth from LASCO observations requires an extrapolation from the near-Sun environment. Combining observations from instruments such as SMEI will enable the tracking of such events as they propagate toward Earth, providing reliable predictions of the time of impact. Comparing the measurements from LASCO with SMEI will permit a number of studies. For example, the volumetric electron density of CMEs can be tracked from the Sun to the vicinity of Earth assuming the velocity field. One study would be to determine the electron density of the leading edge of the CME. From LASCO observations, the frontal electron density decreased according to the expansion into a volume (declined by R^{-3}) and no sweeping up the ambient solar wind material could not be observed out to the edge of the C3 field (30 solar radii). We believe that this was because the electron density in the CME was much greater than the ambient and only became comparable to the ambient at the edge of C3. Thus SMEI observations should be able to detect if there is a snow plow effect occurs.

SH41C-05 1120h INVITED

IPS/SMEI potential joint observations

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Interplanetary scintillation (IPS) measurements are known as one of remote-sensing techniques which enable us to gain access to global features of the solar wind (e.g. quasi-stationary corotating structures, transient streams associated with CMEs). We have carried out a long-term collaboration on the reconstruction of the heliospheric features from IPS measurements made with the 327 MHz four-station system of the Solar-Terrestrial Environment Laboratory (STEL), Nagoya University. Under the collaboration, we have developed the computer-assisted tomography (CAT) analysis method, which allows us to retrieve the 3D distribution of the solar wind velocity and density from IPS data. We also have been making the real-time reconstruction experiment of heliospheric features using STEL IPS data and the CAT method. Based on these results, we propose here the joint observations of IPS and SMEI. The SMEI is a powerful tool to investigate the global heliospheric features, and its capability is complementary to one of IPS observations; That is, SMEI observations provide a high-resolution image of the solar wind density distribution, while IPS observations provide reliable estimates of the solar wind velocity. Therefore, a combination of IPS and SMEI observations is essential for achieving a precise reconstruction of global heliospheric (velocity and density) features by the CAT analysis.

SH41C-06 1135h INVITED

Solar Mass Ejection Imager (SMEI) - Hectometric/Kilometric Wave Comparisons

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Radio radiation is commonly produced throughout the interplanetary medium at long wavelengths in the decametric/hectometric/kilometric range. It results from plasma radiation mechanisms involving populations of energetic electrons either accelerated at the Sun –for instance during the solar flares–, or in the interplanetary medium –for instance at the front of interplanetary shocks–. These radio emissions are currently observed by several spacecraft including WIND and ULYSSES. They will be monitored in the near future by programs as STEREO. Several types of radiation have been identified. It is currently understood that the so-called interplanetary type III radio emissions trace large scale structures in the solar wind. The interplanetary type II radio emissions are associated with travelling shock fronts, possibly ahead of Interplanetary Coronal Mass Ejections. Long lasting (several days) storms of type III bursts are associated with solar active regions and may trace large scale corotating interplanetary structures. All these radio observations provide unique information on localized energetic phenomena in the solar wind. The comparison with the Solar Mass Ejection Imager will provide for the first time a unique chance to identify large scale structures in the interplanetary medium, either transient or corotating, that can be associated with radio emissions. In this paper we compare the respective capabilities of the instruments and we discuss a number of open questions for which SMEI - hectometric/kilometric comparisons could provide a clue.

SH41C-07 1150h INVITED

The Solar Mass Ejection Imager: Early Results and Prospects for Space Weather Forecasts

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The Solar Mass Ejection Imager (SMEI) was launched on 6 January 2003 on a proof-of-concept mission to demonstrate the feasibility of a space-based heliospheric imager for detecting and tracking Coronal Mass Ejections (CMEs) and other dense structures in the solar wind. SMEI is comprised of three spaceward-looking push broom imagers that together provide photometric images of the entire sky, minus a small region near the Sun, every 101 minutes. The unique sunlight rejection baffles and high photometric sensitivity of the SMEI cameras allows for the imaging of CMEs via relatively faint Thomson-scattered sunlight from regions of enhanced electron density. Due to its all-sky field-of-regard, SMEI can track and monitor the evolution of CMEs from near the Sun out to and beyond 1 A.U. This capability affords the unprecedented opportunity to study interplanetary CMEs and to forecast the arrival of potentially geoeffective structures at Earth. A number of CMEs have been detected by SMEI since its launch, including a halo event on 28-29 May 2003 that was associated with a geomagnetic storm on 30 May as indicated by both ACE and ground-based measurements. In this talk, we show examples and pertinent statistics of several of the events captured by SMEI and explore prospects for the use of SMEI data in operational space weather forecasting as well as pertinant simulations made using the Hakamada-Akasofu-Fry (HAF) kinematic solar wind model.

SH41C-08 1205h INVITED

Stellar Variability Studies with SMEI

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The Solar Mass Ejection Imager (SMEI) instrument images most of the sky every 105 minutes. From this unique dataset, the brightnesses of stars down to and below the eight magnitude can be measured to investigate their variability. This paper presents the methods developed to extract the stellar brightnesses, and the accuracies obtained as a function of brightness and crowding. Example lightcurves are given.

SH41D MCC: 2010 Thursday 1020h

Coronal Magnetic Fields: Models to Measurements II

Presiding: **R Casini,** High Altitude Observatory, NCAR**; N U Crooker,** Boston University Center for Space Physics

SH41D-01 1020h INVITED

Constraints on the structure and evolution of the coronal magnetic field from in situ observations

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In this talk we briefly review current theories of the large-scale heliospheric magnetic field. We address how measurements of the coronal magnetic field can be connected to in situ observations through numerical models, and likewise, how in situ observations can be connected back to both solar observations and model results. We focus on deviations from the ideal Parker spiral (e.g., radial field lines, under-winding, over-winding, magnetic flux variations, transient phenomena, etc) from near-Earth spacecraft as well as Ulysses, and ask to what extent these observations can place constraints on theories of the structure and evolution of the coronal magnetic field.

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SH41D-02 1040h

Large-Scale Magnetic Field Inversions at Sector Boundaries and Their Relation to Coronal Mass Ejections

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During the declining phase of the last solar cycle, the Wind spacecraft observed a quasi-recurrent pattern of mismatches between sector boundaries identified in suprathermal electron pitch angle spectrograms and in magnetic field data alone. Intervals of mismatch imply the presence of magnetic fields that are locally inverted or turned back on themselves in a way that is intrinsic to the sector boundary. We analyze 8 cases of inversion during 9 successive solar rotations in 1994-1995. These range in duration from 15 to 53 hours. In most the inversions are incomplete in a systematic way: Rather than pointing opposite to its true polarity along the Parker spiral, the magnetic field hovers at an orientation more nearly orthogonal to it, always in the sense of decreasing azimuth angle. The inversion pattern is consistent with passage through coronal streamer belt loops in which the polarity of the two legs of each loop matches the sector structure and where one leg has been released from the Sun through interchange reconnection. There are four possible variations of this pattern, depending upon the sense of polarity change across the sector boundary and whether the leading or trailing leg has been released. The latter determines whether the sector boundary or the local field reversal passes first. Three of the 4 variations are represented in the 8 cases. Plasma parameters in the inversions are typical of the slow wind. While a some cases display signatures of interplanetary coronal mass ejections, many do not. Thus the inversions may represent the quiet, quasi-steady end of a spectrum of large-scale transient outflows.

SH41D-03 1055h

Nature of the Plasma Sheet Between Same-Polarity Solar Wind Streams

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Heliospheric spacecraft occasionally encounter consecutive high-speed streams that map to two different solar source regions with the same magnetic polarity. The low-speed wind between the two streams has many similarities to the plasma sheets commonly observed between high-speed streams, except that there is no current sheet. We have studied several such plasma sheets observed with the Ulysses spacecraft during the fast, pole-to-pole latitude scans in 1995 and 2001 and with ACE. Common features are large amplitude tangential discontinuities, regions of low entropy, some very low helium abundances, and magnetic holes.

SH41D-04 1110h

The Coronal Magnetic Field, Signatures of Coronal Holes and Silicon Nanometer Dust Grains

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The near-infrared part of the solar spectrum is where some of the strongest coronal forbidden lines are formed. Polarized emission in these lines offers the only tool currently known for the inference of the direction of the coronal magnetic field. The first successful observations of the polarized emission from the 1074.7 nm Fe XIII line were made by Eddy, Lee and Emerson during the eclipse of 1966 in a limited region of the corona. The only subsequent polarimetric observations in this line were carried out with the coronagraph at Sac Peak from 1977-1980. We report on the first successful polarimetric measurements of the 1074.7 nm line in a field of view extending out to 3.5 solar radii which were made during the total solar eclipse of 21 June 2001. In addition to confirming earlier results of the predominance of a radial direction of the coronal magnetic field, these measurements yielded the first polarimetric signature of coronal holes, and the signature of nanometer size dust grains in the corona. These observations suggest the existence of a rich coronal spectrum of narrow lines in the near-infared produced by the fluorescence of silicon nanometer dust grains in the inner corona. This work was funded by NSF grant ATM-0003661 and NASA grant NAG5-10873 to the Smithsonian Astrophysical Observatory.

SH41D-05 1125h

Successful Measurement of the Full Magnetic Vector Near the Base of the Solar Corona

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The measurement of coronal fields has in the past generally been restricted to the field strength or to only some of the components of the magnetic vector. We present here a technique for measuring the full magnetic vector near the base of the solar corona. As an application we report on observations of a developing active region with ongoing magnetic flux emergence. The data allow the first measurement of the 3-D structure of magnetic loops. They also provide the first detection of an electric current sheet located near the base of the solar corona. Such current sheets or tangential discontinuities of the coronal magnetic field have long been thought to be a major source of coronal heating.

SH41D-06 1140h

Thermal IR Prospects for Coronal Magnetic Field Measurement

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The SOLARC Haleakala reflecting coronagraph was designed and built for studying the IR solar corona. High dynamic range imaging and spectroscopy in the thermal IR offers unique prospects for coronal field measurements. Here we summarize the interesting opportunities, our progress and results toward this goal.

SH41D-07 1155h

Stereoscopic Spectrosopy for Magnetic Field Measurements

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We present a novel, photon-efficient technique for measuring the Zeeman splitting of a spectral line everywhere in an image plane. The technique, *differential stereoscopy*, allows extraction of spectral line profiles from multiple dispersed, slitless "smearogram" images of the Sun such as are formed by a slitless, multi-order ("stereoscopic") spectrograph. Because stereoscopic spectrographs admit all photons of interest, they can be over an order of magnitude more photon-efficient than traditional techniques. We will discuss the technique in the context of chromospheric and coronal magnetic fields, and present results from an initial proof-of-concept photospheric test using the ASP at the National Solar Observatory.

SH42A MCC: Level 1 Thursday 1330h

Space Science Research With Societal Consequences I Posters *(joint with SA, SM, AE)*

Presiding: **W D Gonzalez,** National Institute for Space Research**; N Gopalswamy,** NASA Goddard Space Flight Center

SH42A-0472 1330h POSTER

Modeling Services at the Community Coordinated Modeling Center

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The Community Coordinated Modeling Center (CCMC) has as one of its functions the provision of research community access to modern space science models. For this purpose, CCMC hosts a set of state-of-the-art space science models, provided by model developers in all domains, ranging from the solar atmosphere to the Earth's upper atmosphere. CCMC provides, for the benefit of the researcher, a web-based run-on-request system, by which the interested scientist can readily request simulations of science problems. CCMC also provides a tailored web-based visualization interface for the model output, as well as the capability to download to the user simulation output directly. In this poster, we will provide an overview of CCMC services, as well as illustrations of the scientific benefit of open access to modern space science models.

URL: http://ccmc.gsfc.nasa.gov

SH42A-0473 1330h POSTER

Real Time Movies From the GOES Solar X-ray Imager Provide an Unprecedented View of Ongoing Solar Activity

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Data from NOAA's Solar X-ray Imager (SXI) are collected onboard GOES-12, down-linked and processed by NOAA's Space Environment Center, then immediately sent to NOAA's National Geophysical Data Center (NGDC) for archiving and public access. NGDC makes these data available via its public interface (http://sxi.ngdc.noaa.gov)the moment that they are received. In addition to providing browse imagery (PNG) and scientific imagery (FITS), NGDC also generates a series of movies (MPEG), which include sliding 12-hour movies that are updated every five minutes – an ideal means of observing ongoing solar activity. Also, 54-day movies are updated at UT midnight, and daily and monthly movies of all historical imagery are generated and maintained online for retrospective use.

URL: http://sxi.ngdc.noaa.gov