A model of solar spectral irradiance has been developed that predicts the solar spectrum near Mg II at 280nm. This model uses sun spot, active region, and quiet sun spectra and high resolution limb darkening curves observed by the Naval Research Laboratory's HRTS rocket as the basis for modeling solar spectral variability. Ground-based Ca II K images are used to determine the contribution of each of these solar surface features to the total solar spectrum. The resulting spectra are at a resolution of about 0.01nm. These model spectra are currently being compared to observed spectra in order to identifty the solar sources of spectral variability. A predicted Mg II index is compared with the observed values of the index.

### SH12A-1162 1330h POSTER

## Solar UV and EUV Irradiance and Solar Indices

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Studies of the solar UV (120–290 nm) spectral irradiance have shown that its variation correlates well with that of the core-to-wing ratio of the Mg II compound absorption feature near 280 nm. The two chromospheric emission lines in the feature's core cause nearly all of the Mg II index variation. The Mg II index has also been shown to correlate with solar He II emerging from the transition region. Although earlier studies appeared to show that an accurate representation of the solar Ly-$\alpha$ irradiance required the separation of the long- and short-term components of the Mg II index, recently recalibrated measurements show that Ly-$\alpha$ also has a linear relationship with Mg II. We analyze the solar spectral irradiance derived from SOHO EIT images roughly corresponding to coronal line emissions of Fe IX/X, Fe XII, and Fe XV and find that the Mg II index represents their variation more effectively than the more commonly used F10.7 cm flux. The long-term behavior of F10.7, Mg II, and sunspot number are compared showing a strong divergence of the latter during the latter stages of the solar cycle 23 maximum.

### SH12A-1163 1330h POSTER

## The SORCE Science Data Products available at the NASA GES DAAC

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The Solar Radiation and Climate Experiment (SORCE) was launched into Earth orbit in January 2003. About a month after launch, the four instruments aboard SORCE began making scientific measurements. The instruments are the Total Irradiance Monitor (TIM), the Solar Stellar Irradiance Comparison Experiment (SOLSTICE), the Spectral Irradiance Monitor (SIM), and the XUV Photometer System (XPS). TIM measures the total solar irradiance, while the other three instruments measure the solar spectral irradiance from x-rays, ultraviolet, visible and the near infrared spectral regions. This presentation describes the SORCE standard science data products and data support provided by the NASA Goddard Earth Sciences Distributed Active Archive Center (GES DAAC). There are four level 3 standard products: daily averaged solar spectral irradiance (SOR3SSID), 6-hourly averaged solar spectral irradiance (SOR3SSI6), daily averaged total solar irradiance (SOR3TSID) and 6-hourly averaged total solar irradiance (SOR3TSI6). All of the SORCE derived product files are generated using the Hierarchical Data Format version 5 (HDF5), and are available to the public free of charge.

URL: http://daac.gsfc.nasa.gov/upperatm/sorce/

# SH12B MCC: 2008 Monday 1340h

## The Termination Shock, Heliosheath, and Heliopause II

***Presiding:*** **M E Hill,** University of Maryland**; J R Jokipii,** University of Arizona

### SH12B-01 1340h INVITED

## A Brief Overview of the Heliosphere and Heliosheath

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Recent intriguing observations from the Voyager I suggest that the spacecraft has observed phenomena associated with the near proximity of the termination shock, or possibly even the crossing of the termination shock itself. This overview will summarize briefly the nature of the shock and phenomena which might be expected to be observed in its vicinity, in order to place the recent observations and some recent ideas into context.

### SH12B-02 1355h INVITED

## Unusual Energetic Particle Signatures as Voyager 1 Approaches the Heliospheric Termination Shock

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The heliospheric termination shock is the expected site for the acceleration of anomalous cosmic rays and the further re-acceleration of low energy particles from the inner solar system and of galactic cosmic rays. Increases in the intensity of these diverse energetic particle populations are one of the expected harbingers of Voyagers approach to the termination shock. In mid-2002 as Voyager 1 moved beyond 85 AU there began an increase of 2-3 MeV ions that remained at an unusually high level near 0.1 protons/cm$^2$ - s - sr - MeV ions for some 6 months. This event differs from any previously observed in that there is a simultaneous increase in galactic cosmic ray ions and electrons, anomalous cosmic rays and low energy ions. However the low intensity level and the spectral form of the anomalous cosmic ray component indicates that we have not reached the termination shock and the observed increase is a precursor event of the type expected as Voyager approaches the shock. Beginning in 2003.09 the unusual increases are abruptly terminated by the passage of a large interplanetary transient.

### SH12B-03 1410h INVITED

## Evidence That Voyager 1 Exited the Solar Wind at ∼85 AU and Re-entered at ∼87 AU in August 2002 and February 2003.

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The LECP instrument on V1, V2 consists of a collection of solid-state detectors designed to perform measurements of ions (∼30keV to 10s of MeV) and electrons (∼28 keV to ∼10 MeV), including elemental composition over a range of energies ($\gtrsim$0.3 MeV/nuc) and species (H, He, C, N, O, Ne, etc). Salient features of the observations during 2002-2003 are as follows: (a) A gradual increase in ∼1 MeV proton intensity in late 2000 culminated in an 100-fold step increase in mid-2002 lasting for >6 months and ending within a few hours in early 2003. (b) The step increase was seen in energies ranging from ∼40 keV to >70 MeV for protons and >0.35 MeV for electrons. (c) Large intensity fluctuations lasting from <1 to several days were present coherently in all energies and species throughout the period. (d) The composition of H, He, O and C are consistent with an ACR or PUI source. (e) Outward streaming anisotropies show that the particle source lies inside the V1 location. (f) Generalized (non-linear) Compton-Getting fits to the angular distributions show the convection velocity changed from 300 km/s to <50km/s and back to ∼230km/s before, during, and after the increase, respectively. Post-reentry observations show frequent inward and some outward proton flows, suggesting a significant radial component of the IMF. The observations will be discussed in the context of current theoretical models of the interaction between the heliosphere and the local interstellar medium.

### SH12B-04 1425h INVITED

## Search for the Heliosheath with Voyager 1 Magnetic Field Measurements

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The magnetic field measured by Voyager 1 (V1) near 85 AU from 2002.0 to 2003.17 has the expected properties for the heliospheric magnetic field at that distance and epoch of the solar cycle. The average field magnitude is $< B >= 0.04$ nT, significantly lower than the value predicted for the heliosheath. The fluctuations in $B$ observed during 2002 are similar to those observed during 2001. The distribution of daily averages of $B$ is lognormal, and the normalized standard deviation SD($B$)/$< B >= 0.55$ for hourly averages of $B$, similar to previous heliospheric observations. Changes in the intensity of > 70 MeV/n cosmic rays are correlated with changes in $B$, as has been observed in the heliosphere beyond 11 AU. The V1 magnetic field observations from 2002.0 2003.17 do not provide evidence for exit from the heliosphere, entry into the heliosheath, or transit of the termination shock near 85 AU.

### SH12B-05 1440h INVITED

## The Return of the Heliospheric 2-3 kHz Radio Emission During Solar Cycle 23

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In this paper we report the detection of a new heliospheric 2-3 kHz radio emission event by the Voyager 1 spacecraft, the first to be observed during solar cycle 23. The new event started on Nov. 1, 2002, and is believed to be associated with a strong interplanetary shock that originated from a period of intense solar activity in early April 2001. Following previous interpretations of events of this type, we assume that the radio emission is produced when the interplanetary shock interacted with the heliopause, which is the boundary between the solar wind and the interplanetary medium. From the onset time of the radio emission and a simple model for the propagation speed of the interplanetary shock the heliocentric radial distance to the nose of the heliopause can be calculated, and is about 153 to 158 AU, depending on the parameters used. From computer simulations that give the ratio of the radial distance to the termination shock to the radial distance to the heliopause, the distance to the termination shock can also be calculated and is estimated to be about 101 to 108 AU.

### SH12B-06 1455h INVITED

## The Solar Wind Near 70 AU in the Declining Stage of the Solar Cycle.

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The declining portion of the solar cycle near 35 AU was characterized by a shock-ramp structure with a period of roughly a solar rotation. We discuss the structure observed near 70 AU by Voyager 2, where the shock ramp structure is again seen but with a period of 4-5 solar rotations. At Voyager 2, merging of solar wind driven by CMEs results in correlated changes in speed, density, and magentic field magnititude and thus in dynamic pressure. These order of magnitude changes in pressure should have significant effects on the movement of the termination shock and the propagation of ACRs.

### SH12B-07 1510h

## Observations of the Anisotropies of Enhanced MeV Ion Fluxes at Voyager 1 at ∼85 AU

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From ∼2002 day 195 through 2003 day 38, the Cosmic Ray Subsystem (CRS) experiment on Voyager 1 (V1) at 85 AU and 34 degrees N recorded a large increase (factor of ∼100) in the intensity of protons with 2-3 MeV. There was no similar increase at Voyager 2 (V2) (∼68 AU and 24 degrees S) during this period. Large and variable field-aligned anisotropies of 3.3-7.8 MeV protons were observed during this period. The variable field direction resulted in large outward and inward radial components of the flow that were much larger than the Compton-Getting convective component. Although the average radial streaming for the entire period was small, it was dominated by the large positive and negative radial components of the field-aligned flows and is not a definitive indicator that V1 crossed the solar wind termination shock. The spectra of anomalous cosmic rays suggests that V1 was not at or beyond the main portion of the termination shock. This work was supported by NASA under contract NAS7-1407 and by JPL under contract 959167.

### SH12B-08 1525h

## Is the Local Interstellar Medium Strongly Magnetized?

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The magnitude and direction of the magnetic field in the Local Interstellar Medium remain by far the poorest known parameters of the solar system space environment. The current prevailing opinion is that the magnitude of the field is relatively small (1.5 microGauss) and close to the galactic average. The above value is based on the heliospheric confinement data and remains too small to account for the general equilibrium between matter in the Local Bubble and the Local Interstellar Cloud. Here we analyze the consequences of the magnetic field being almost 3 times larger on the structure of the heliospheric interface in the axisymmetric case when the LIC magnetic field direction is parallel to the relative direction of motion between the LISM and the Sun. A field of such strength is expected to exist in the LIC, if the latter condensed from material inside a magnetic flux tube rebounding from the wall of the Local Bubble cavity. The analysis is performed using a newly developed multifluid-neutral MHD model. We show that a bow shock ahead of the heliopause still exists for supersonic and subalfvenic LISM parameters, and is of a slow, rather than a fast, type. Our results agree well with the observations of the Lyman-Alpha absorption spectra and exhibit positions of the termination shock and the heliopause similar to those obtained from the standard superalfvenic model.

# SH12C MCC: 2008 Monday 1600h

## The Termination Shock, Heliosheath, and Heliopause III

*Presiding:* **V Florinski,** Institute of Geophysics and Planetary Physics, University of California, Riverside; **W H Matthaeus,** Bartol Research Institute, University of Delaware

### SH12C-01 1600h

## Rapid Slow-Down of the Solar Wind Upstream of the Termination Shock from Strong Electron-Impact Ionization of Interstellar Neutrals: A Possible Explanation of the Voyager Observations

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Slow-down of the solar wind due to mass-loading from interstellar pickup ions upstream of the heliospheric termination shock may explain the recent Voyager 1 low-energy particle and magnetic field observations. This slowing down of the solar wind is expected to be accompanied by comparable increases in magnetic field strength, B, as is required by the "frozen-in" magnetic field condition. We suggest that the solar wind speed decrease during 2002, and consequently the B increase, is likely to have occurred in two steps: first, the speed decreased gradually due to mass loading by pickup H and He from ∼430 km/s at 1 AU to ∼350 km/s at 70 AU, and then more rapidly to lower values at ∼85 AU, due to, e.g., additional production of pickup ions from electron-impact ionization with enhanced fluxes of suprathermal electrons produced in, e.g., the fast-slow wind stream-stream interaction region associated with the heliospheric current sheet. These additional pickup ions would cause the additional decrease in speed to between ∼200 and ∼300 km/s at 85 AU, consistent with the solar wind speed inferred from Voyager 1 LECP measurements during 2002-2003 upstream of the termination shock. We will discuss the implications of this scenario on the termination shock location and present some ideas on how the suprathermal electrons may be produced.

### SH12C-02 1615h

## Hydromagnetic Wave Excitation at a Heliospheric Shock

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We present observational evidence for self-consistent wave-particle interaction upstream of the main interplanetary traveling shock driven by the Bastille Day coronal mass ejection. Spectra of protons in the energy range 300 keV to 2 MeV derived from SOHO/CELIAS/HSTOF data and the power spectral densities of the magnetic field fluctuations measured by the magnetometer onboard ACE are consistent with theoretical predictions on coupled hydromagnetic wave excitation by protons with asymmetric distribution near interplanetary traveling shocks. We discuss theoretical models and apply them to describe the generation of turbulent plasma waves in the outer heliosphere by Anomalous Cosmic Rays. These waves mediate the termination shock, which has impact on its structure and location. Lee, M.A., Coupled Hydromagnetic Wave Excitation and Ion Acceleration at Interplanetary Traveling Shocks, JGR 88, 1983, pp. 6109-6119

### SH12C-03 1630h

## Location of the termination shock: an attempt to reconcile recent Voyager observations with Ulysses/SWICS pickup ion data and other diagnostics

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Our Solar System moves through a warm (∼6,500 K), partly ionized local interstellar cloud (LIC) with a relative speed of ∼26 km/s. The solar wind interacts with the LIC to form a cavity around the Sun called the heliosphere. The solar wind meets the interstellar charged component at the heliopause, where solar wind pressure balances the pressure of the LIC. Before reaching the heliopause, the supersonic solar wind is decelerated at an extended shock wave, the heliospheric termination shock (TS). Here we apply our new multi-component time-dependent model of the interaction of the solar wind with the local interstellar medium to predict the location of the TS. We put constraints on the model parameters by using (1) IMP 8, ACE, Wind and Ulysses observations of the solar wind velocity and numbers density at one to several AU, (2) SWICS/ Ulysses pickup ion data, (3) Ulysses and Wind measurement of interstellar helium, and (4) recent results on ionization of helium and hydrogen in the LIC (Wolff et al., 1999). These four sets of observational data allow us to determine that the TS location should be between 93−100 AU in 2003. Our model predicts the heliopause location at ∼ 160 AU, which is in agreement with analyses of the heliospheric radio emission events of 1983−1984 and 1992−1994 at the plasma cutoff frequency 2.2−2.8 kHz detected by Voyagers 1 and 2. However, recent measurements of the enhanced fluxes of energetic particles observed by the LECP and CRS instruments on Voyager 1 suggest that Voyager 1 at ∼ 85 AU was close or beyond the TS

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