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During the period of intense solar activity in October/November 2003, Ulysses was a little more than 5.2 AU from the Sun, and between about 4 and 6 degrees North of the heliographic equator. During the same period its heliographic longitude with respect to Earth decreased by about 1 degree per day starting from 128 degrees west of Earth on Oct. 22 (day 295), when the large active region No. 486 rotated onto the face of the Sun. Exceptionally strong solar activity began with an X17 flare having an X-ray maximum at 1110 on Oct. 28 (Day 301), and continued at least through Nov. 4 (Day 308), when an X28 flare occurred near the Sun's west limb. Protons with energy >40 MeV from the Oct. 28 event had clearly begun to arrive at Ulysses by 2300 UT, showing a rapid increase in intensity and strong outward flow along the interplanetary magnetic field. At energies of 2-4 MeV, proton intensities, already somewhat elevated, showed a clear and abrupt increase, also with strong particle flow outward along the field, several hours earlier at about 1700 UT, while 5-10 MeV electrons showed a very minor increase in intensity starting about 2300 UT, but did not show a large increase (again with outward flow) until 0600 UT on Oct. 29. For the protons, outward flow along a very quiet magnetic field persisted during a smooth decay (at high energies) and during a period with little intensity change (at low energies) until Nov. 7 (day 311). Other large X-class flares observed on Oct. 29, Nov. 2, and the X28 on Nov. 4, all of which produced significant particle flux increases at 1 AU, produced no clear increases in the particle fluxes at Ulysses. A second onset with a much softer energy spectrum began on Nov. 8 and continued through a period of disturbed magnetic structure until Nov. 14 (day 318) when a rapid decrease in intensity of the high-energy particles began. The decrease was associated with a progressive increase in solar wind speed towards the maximum of 1000 km/s observed on Nov. 15. We will present a comprehensive report of the particle intensities, spectra, and anisotropies from the COSPIN energetic particle telescopes, and will attempt to relate them to the evolving interplanetary disturbances initiated by the solar events. The instruments provide measurements over a proton energy range from 0.3 MeV up to GeV energies, and for electrons from a few MeV up to >100 MeV

SH33A-05 1440h

Cosmic Ray Observations During the October-November 2003 Storms With Spaceship Earth and the Muon Detector Network

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A series of very large relativistic solar proton events occurred in October-November 2003. During this period, many instruments observed events associated with this solar activity, such as large geomagnetic storms, cosmic ray ground level enhancements (GLE) and Forbush decreases. The global network of high energy cosmic ray observatories on Earth is able to measure precisely temporal variations of cosmic ray streaming (the anisotropy of intensity) from those events. We use data of the 11-station "Spaceship Earth" network of high-latitude neutron monitors and the ground-based muon detector network to analyze three types of anisotropies: Loss cone, bidirectional streaming, and $\mathbf{B}\times\nabla$n. Loss cone anisotropy is a cosmic ray intensity deficit in the small pitch angle region. This anisotropy may exist ~10% of an interplanetary scattering mean free path ahead of the shock front, which implies that it may be observed as a precursor of the CME shock impacting Earth. Bidirectional streaming is a type of second order anisotropy and indicates the presence of ejecta around Earth. The $\mathbf{B}\times\nabla$n anisotropy is produced from density (n) gradients associated with the cosmic ray depleted region in and near the CME. This anisotropy allows us to deduce the near-Earth trajectory of the ejecta. We will report temporal variations of anisotropies and discuss precursor anisotropies, bidirectional streaming, and the orientation of ejecta for each storm event during this solar high activity period. This work is supported in part by U.S. NSF grants ATM-0207196 and ATM-0000315 and in part by the joint research program of the Solar-Terrestrial Environment Laboratory, Nagoya University.

URL: http://www.bartol.udel.edu/~neutronm/

SH34A CC: 517 A Wednesday 1530h

Parker Lecture *(joint with SA, SM)*

Presiding: **D N Baker,** Laboratory for Atmospheric and Space Physics

SH34A-01 1540h INVITED

The Sun and Heliosphere as Revealed by Suprathermal Electrons

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Solar wind electron distributions near 1 AU are generally well described as a superposition of two distinct components: a cool core or thermal component and a relatively hot suprathermal component. The breakpoint between these two populations commonly occurs at about 60 eV at 1 AU. The suprathermal component carries the solar wind electron heat flux, is almost always nearly collisionless, behaves largely as a test particle population streaming freely through the solar wind along the heliospheric magnetic field, and is commonly highly anisotropic in the solar wind rest frame. In this lecture I demonstrate some of the remarkable spatial and temporal intensity and pitch angle variability of the suprathermal electron component at energies below about 1.4 keV, relate that variability to different solar and heliospheric processes, and illustrate aspects of the large-scale magnetic topology of the heliosphere revealed by suprathermal electron observations.

SH41A CC: 220 C-E Thursday 0830h

Solar Wind I Posters

Presiding: **P Riley,** Science Applications International Corporation**; B J Vasquez,** University of New Hampshire

SH41A-01 0830h POSTER

Recent Developments in the Virtual Heliospheric Observatory (VHO)

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The Virtual Heliospheric Observatory (VHO) is the currently developed distributed data system for the NASA Sun-Earth Connection heliospheric data sets. The purpose of this middleware, remote data distribution system is to bring the same data products available to the PI sites to the general scientific users as quickly as it is generated via a uniform interface and with proper description of the data content. The latest versions of the data dictionary used for the VHO metadata generation along with prototype interfaces currently tested will be presented.

URL: http://vho.nasa.gov

SH41A-02 0830h POSTER

MHD Simulations on an Unstructured Tetrahedral Grid with MH4D

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MH4D (Magnetohydrodynamics on a TETRAhedral Domain) is a numerical algorithm to solve the resistive and viscous MHD equations on an unstructured grid of tetrahedra. MH4D is device independent and runs on desktop computers as well as massively-parallel systems. Thanks to the use of an unstructured grid, the computational domain can be of arbitrary shape and the resolution can be increased in the regions of physical interest. Consequently, a wide range of spatial scales can be studied at the same time, for example active regions can be embedded in the large scale corona. A variational formulation of the differential operators ensures accuracy and the preservation of the analytical properties of the operators ($\nabla\cdot\mathbf{B}=0$), and self-adjointness of the resistive and viscous operators. The combined semi-implicit treatment of the waves and implicit formulation of the diffusive operators can accommodate the wide range of time scales present in the solar corona. The capability of mesh refinement and coarsening is also included. We will present some new results obtained with the full MHD algorith on the IBM SP3.

SH41A-03 0830h POSTER

Differences in Plasma Conditions Among 85 Large Coronal Holes

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We have measured ultraviolet spectroscopic parameters as a function of heliocentric distance for more than 85 coronal holes, in order to characterize the physical properties of coronal holes at different phases of the solar cycle. The Ultraviolet Coronagraph Spectrometer (UVCS) aboard SOHO was used to observed O VI (103.2 and 103.7 nm) and H I Lyman alpha (121.6 nm) emission lines to determine kinetic temperatures, average densities, and outflow speeds in coronal holes. UVCS observations provide unique information on the heating and acceleration processes in the corona. Our previous analyses of UVCS observations have shown that solar minimum (polar) and solar maximum (equatorial) coronal holes produce different acceleration profiles and have different oxygen kinetic temperatures. We also examine the differences in the characteristics of representative coronal holes producing a variety of high-speed conditions (550-800 km/s) at 1 AU. These analyses provide limits on the coronal plasma properties and put constraints on the physical processes that are responsible for the heating of the extended corona and the acceleration of the solar wind. This work is supported by NASA under Grant NAG5-12865 to the Smithsonian Astrophysical Observatory, by the Italian Space Agency and by PRODEX (Swiss contribution).

SH41A-04 0830h POSTER

Relative Timing of Coronal Mass Ejections, Flares and Type II Radio Bursts

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An investigation of 229 interplanetary type II radio bursts and the associated white-light coronal mass ejections (CMEs) is presented. The radio bursts were detected by the Wind/WAVES experiment in the 1-14 MHz (decameter-hectometric, DH) range, while the CMEs were observed by the Solar and Heliospheric Observatory (SOHO). The study period, 1997-2003, encompasses the current solar cycle (23) between minimum and beyond maximum. We could only find 144 solar flares associated with DH type IIs. We obtained the difference onset times (solar flare - DH type II) and found that DH type IIs onset is well after the flares. On the other hand the difference between CME and DH type II onset times indicates that the type II bursts occur well after the CME onset. The present study suggests that the CMEs are more likely to be the source of the shocks responsible for the type II bursts. We extended the study to metric type II bursts and found that they are after the CMEs and flares. A chronological order of these phenonmena is CME, flare, metric type II, and DH type II. Work supported by NASA/LWS and NSF/SHINE Programs

SH41A-05 0830h POSTER

Fitting Flux Ropes to a Global MHD solution: A comparison of techniques

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Flux rope fitting (FRF) techniques have been shown to be an invaluable tool for extracting information about the properties of a sub-class of CMEs in the solar wind. However, it has proven difficult to assess their accuracy since the underlying global structure of the CME cannot be independently determined. In contrast, large-scale MHD simulations of CME evolution can provide both a global view as well as localized timeseries at specific points in space. In this study we apply 5 different fitting techniques to 2 hypothetical timeseries derived from MHD simulation results. Independent teams performed the analysis of the events in "blind tests", for which no information, other than the timeseries, was provided. From the results, we infer the following: (1) Accuracy decreases markedly with increasingly glancing encounters; (2) Correct identification of the boundaries of the flux rope can be a significant limiter; and (3) Results from techniques that infer global morphology must be viewed with caution. In spite of these limitations, FRF techniques remain a useful tool for describing in situ observations of flux rope CMEs.

SH41A-06 0830h POSTER

Factors controlling suprathermal electron isotropy in the solar wind

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Suprathermal electrons (E>80eV) carry heat flux away from the Sun. Their distributions can be separated into an isotropic halo and a focused strahl parallel or antiparallel to the solar wind magnetic field. Processes controlling the observed strahl are not well understood. Insight into these processes has important implications for models of heliospheric magnetic flux. We define a parameter to characterise electron pitch angle anisotropy (and hence in effect the strength of the strahl) and investigate its behaviour using data for 1995 from the Wind 3DP instrument. We show that anisotropy is strongly controlled by a combination of suprathermal electron flux integrated over pitch angle and plasma beta. Using these parameters, we apply multiple linear regression to simulate pitch angle anisotropy. There is excellent correspondence between the simulated value and the observed anisotropy, throughout the solar wind, implying that both total electron flux and plasma beta control the observed anisotropy. The results suggest that the strength of the strahl depends strongly on the strength of its solar source, but that local plasma conditions can induce electron scattering and substantially weaken the strahl.

SH41A-07 0830h POSTER

Solar Wind Spatial Scales in, and Comparisons of, Hourly Wind and ACE IMF and Plasma Data

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Hourly averaged Wind and ACE solar wind magnetic field and plasma parameters, built from 1-4 min data time-shifted to Earth, have been analyzed to determine: scale lengths of solar wind structures; systematic offsets between data sources; and random differences between concurrent parameter values. During the solar active years 1998-9, autocorrelation functions (ACF) in Bt, Bx and Bz fall from unity at zero lag to 0.75, 0.62 and 0.26 at lags of 6 hours. For the solar quiet years, the ACF's are 0.64, 0.50 and 0.19. For plasma proton flow speed and logs of density and temperature, for solar active (solar quiet) period, the 6-hour-lag ACF's are 0.91, 0.78, 0.74 (0.92, 0.70, 0.77). Flow speed remains highly correlated over 1350 Re, IMF intensity and flow density and temperature have shorter scales comparable to each other, sector-structure-organized ecliptic-plane field components have yet shorter scales, Bz has the shortest scale, with its ACF falling to 0.5 at about lag=2 hours. Scales lengths are greater during solar active periods than during solar quiet periods for some parameters and are equivalent for others. Wind-ACE 1998-9 cross correlations at zero lag, in an "impact parameter" (IP) bin of 0-60 Re, are in the range 0.970-0.995, except for temperature with 0.907. Corresponding values in the 60-120 Re bin are different by less than .01 except that the temperature value unexpectedly increases by .03 while the Bx and Bz values decrease by .02 and .04. RMS differences between (Wind, ACE) values and a best fit linear regression line, for IP $<$ 60Re (60-120 Re), are 0.21 (0.23) nT (Bt), 0.44 (0.64) nT (Bx), 0.50 (0.95) nT (Bz), 4.6 (5.6) km/s (V), 0.053 (0.054) (log N), and 0.114 (0.110) (log T). Hourly averages obtained off the sun-Earth line cannot be taken as representing conditions at the bow shock nose with greater accuracy than these RMS differences. The primary finding in performing linear regressions is that the moments-based ACE/SWEPAM proton densities are up to 17% greater than the fits-based Wind/SWE proton parameters.

URL: http://nssdc.gsfc.nasa.gov/ftphelper/merged.html

SH41A-08 0830h POSTER

Composition and Magnetic Structure of ICMEs at 1 AU

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We present preliminary results of a study of the charge state ratio as well as the magnetic structure characteristics of 154 interplanetary coronal mass ejections (ICMEs) observed at 1 AU by the ACE and Wind spacecrafts. Measurements of charge state composition in the solar wind combined with magnetic field structures are important to understand the physical conditions in the source regions of the solar wind. We used magnetic field (Wind and ACE), plasma (Wind) and ion composition (ACE) data over a period of time from 1998 to 2002. All the events were indentified using the low proton temperature criterion, a common plasma signature of ICMEs. According to their magnetic field structure, the 154 events were classified as magnetic cloud, non-cloud and complex ICMEs. The later one is refered to a magnetic clouds that are followed and/or preceded by another ICME. We discuss the differences and similarities of our results with those of previous studies. Supported by NSF/SHINE, NASA/LWS, and CONACyT.

SH41A-09 0830h POSTER

The effect of compression on the magnetic field strength of ICMEs at 1 AU.

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One of the primary goals of the Center for Integrated Space-weather Modelling (CISM) effort is to assess and improve prediction of the solar wind conditions in near-Earth space, arising from both quasi-steady and transient structures. To achieve forecast times of a day or more, such predictions must be made on the basis of remote solar observations. However, the current lack of magnetic field measurements in the corona severely limits our ability to forecast the 1 AU magnetic field strengths resulting from the interplanetary manifestations of coronal mass ejections. In this study we investigate the empirical relation between magnetic field strength and speed of both magnetic cloud and non-cloud ICMEs at 1 AU. In particular, we analyze to what degree compression controls the magnetic field in both the sheath region ahead of a fast-moving ICME and in the body of the ICME itself. We then investigate the feasibility of using this empirical relation in combination with the relation between the coronal and 1 AU speeds to provide an advanced forecast of the magnetic properties of ICMEs in near-Earth space.

SH41A-10 0830h POSTER

Three dimensional power spectra in the solar wind at 1AU

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Observations and theory motivate the study of possible anisotropy in the turbulent fluctuations of the solar wind, with respect to the large-scale magnetic field. We analize data from the ACE specraft, at 1AU, essentially in the ecliptic plane. We present an analysis of reduced spectra for the helicity, velocity, magnetic and Elsasser fluctuations, at different orientations with respect to the mean magnetic field. The implications to standard models of the solar wind fluctuations are briefly discussed. This work was in part supported by the NASA grants NNG04GA54G and NAG5-11603

SH41A-11 0830h POSTER

Test particle acceleration by non-uniform MHD fields in short time scales

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We consider the acceleration of test particles in non-uniform electric and magnetic fields obtained from direct numerical solutions of the MHD equations in a turbulent regime. Numerical experiments are performed for cases with and without a strong background magnetic field and results are compared. Distribution functions of the particles velocities are computed at short time scales and the appearance of anisotropic effects is studied. We found different behavior according to the particle motion lengthscale compared to the turbulent correlation scale and the dissipative scales. An acceleration mechanism by fields in reconnection geometries is proposed to explain qualitatively the behavior of the particles. A question remains as to how these results relate to the understanding of the self-consistent heating of solar protons and electrons. Work supported by NSF grant ATM-9977692 and DOE grant DE-FG02-98ER54490.

SH41A-12 0830h POSTER

Electrostatic Instabilities Induced by Large amplitude Left-Hand Waves

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We study the effect of a large amplitude left-hand polarized wave on the two stream ion-acoustic instabilities. We show that the presence of a finite left-handed polarized amplitude wave produces electrostatic instabilities above a threshold amplitude. These instabilities occur when the phase velocities of the ion-acoustic waves become equal due to the action of the nonlinear wave. We examine their growth rates and threshold amplitude behaviour as a function of the beam speed, temperature, and large amplitude wave frequency

SH41A-13 0830h POSTER

Significant Magnetosheath Disturbances and Their Upstream Counterparts

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We have identified about 50 fast, forward-propagating interplanetary shocks observed by the Wind spacecraft in the time when Interball-1/Magion-4 measurements were available in the solar wind or in the magnetosheath in order to investigate the influence of shock parameters on disturbances following the shock arrival near to the Earth. We have determined the angle between shock front normal and the interplanetary magnetic field (IMF) direction and jumps of plasma and magnetic field parameters across the shock and tried to find their correlation with corresponding parameters in the magnetosheath. Multipoint observations allow us to compare the shock speeds computed from the jump conditions and from the propagation time. These speeds agree rather well in the solar wind, whereas we have found a significant difference in the magnetosheath.

SH41A-14 0830h POSTER

A New Approach in Designing an Empirical Bow Shock Model

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In more than three decades, spacecraft have crossed the terrestrial bow shock tens of thousand times providing enough data to construct bow shock models by fitting various model surfaces to the observations. However, the existing models often employ controversial techniques that are no longer necessary or, at least, their validity should be investigated. In particular, the popular model of Peredo et al. [1995] employed the method of averaging consecutive bow shock crossings into a single data point even when the first and last crossings were separated by hours. Furthermore, they took the upstream properties as 1-hour averages which may improperly parametrize the bow shock for varying solar wind conditions. We will compare the Peredo et al. model with our new bow shock model employing the same functional form but with every single bow shock crossing used independently together with the 5-minute averages of the upstream parameters. We will discuss the new insights gained from our new model employed to the recently completed large IMP-8 database along with HEOS-2 and MAGION-4 observations.

SH41A-15 0830h POSTER

Properties of High Heliolatitude Solar Energetic Particle Events: Ulysses Observations

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We analyze 10 large solar energetic particle events detected by the Ulysses spacecraft at high heliolatitudes during the recent solar maximum polar passes. The time intensity profiles from the Ulysses KET instrument are compared with those measured by SOHO/COSTEP and GOES near Earth. Surprisingly, the intensity of < 100 MeV protons differs only by a factor of 2 to 3 at latitudes > 50, while the corresponding intensity at Earth varies by several orders of magnitude. We find no correlation of the Ulysses peak intensities and fluences with respect to the flare location for the first two days. This implies: 1) nearly isotropic injection to high heliolatitudes, and 2) similar propagation mechanismen during the first two days of the event. We find that cross-field particle transport but not the presence of a shock establishes near equal intensities at Ulysses and in the ecliptic during the decay phase.

SH41A-16 0830h POSTER

Modelling Anomalous Cosmic Ray Spectra during Sucesive Solar Minima

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This contribution analyzes the anomalous cosmic ray (ACR) modulation through the heliosphere during the solar minimum conditions for 1977/1997 positive and 1987 negative drift periods. We use a time-dependent two-dimensional model of the transport particle equation, that takes into account all physical processes of the modulation, including the effects of the solar wind termination shock and the heliosheath. The best set of diffusion coefficients that fits the observed ACR spectra in the inner as well in the outer heliosphere for H and He, is presented. These parameters are compared with those inferred from galactic cosmic ray spectra. The implications of our results are discussed.

SH41A-17 0830h POSTER

Voyager-1/LECP Energetic Ion Angular Distributions at 85-88 AU are Inconsistent with Diffusion-Convection Theory

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Voyager-1 (V1) has now encountered two remarkable and similar regions in the outer heliosphere during the latter half of 2002 and again in the latter half of 2003 (Decker et al., poster, this conference). These regions are characterized by episodes of strong field-aligned streaming of 40 keV-10 MeV ions as measured by the Low Energy Charged Particles Instrument (LECP). However, we are unable to detect the expected effect on the ion anisotropies of any significant (V>100 km/s) solar wind flow (Krimigis et al., Nature, 2003). It has been suggested that absence of a persistent radial component of the ion anisotropies might still be consistent with a nominal solar wind flow (V>300 km/s) if there was a diffusive cross-field intensity gradient increasing radially outward (i.e., towards a termination shock that would lie beyond V1). However, the strong field-aligned anisotropies are usually in the outward direction (-T) for a nominal (nearly azimuthal) Parker spiral, implying that the source of these ions is inside the radius of V1. Independent of this contradiction of the observed parallel streaming with diffusion theory, a quantitative analysis using the radial component of the diffusion-convection equation leads to another contradiction. The large variations in the ion intensity (up to a factor of 10 with a time scale $\sim$15 days) would imply a mean (outward) radial gradient $\sim$100%/AU with a comparable standard deviation. We consider it unreasonable that such a configuration could appear (with normal solar wind flow) once, let alone twice in the outer heliosphere, lasting a half a year each time. Therefore we regard the LECP observations to be inconsistent with diffusion-convection theory.

SH41A-18 0830h POSTER

Voyager 1 in the Vicinity of the Termination Shock: An Update on Energetic Ion Distributions Observed during 2002.6-2004.3

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Since 2002.6 to at least 2004.1, Voyager 1 (86-91 AU, $N34^{\circ}$) has continued to observe remarkable variations in energetic ion intensities, energy spectra, and anisotropies. We present the most recent data (to 2004.3) and summarize our analyses of data acquired by the Low Energy Charged Particle (LECP) instrument during the entire 1.7-year period. The Voyager 1 data include (1) a period $\sim$2002.6-2003.1 of exceptionally large and sustained intensity increases of ions 40 keV to 20 MeV (Krimigis, Nature, 2003; Roelof et al., poster, this conference), (2) a period $\sim$2003.1-2003.7 of impulsive ($\sim$days) but less intense increases, and (3) a period $\sim$2003.7-2004.1 marked by a return to high intensities. During periods (1) and (3) the energy spectra of ions 40-4000 keV show the same relatively hard power-law form, with index $\sim$1.5, while during the intervening period (2), the spectrum is softer, with index $\sim$2-2.3. During periods (1) and (3), ion anisotropies are mainly unidirectional outward (away from the sun) along the azimuthally-directed average Parker spiral; however, compared with period (1), occurrences of strong outward beaming during period (3) are somewhat less frequent and shorter lived. We discuss the implications of the large ion intensities and intensity variations, beam-like ion anisotropies, and relatively hard ion energy spectra with regard to the likely origin of these ion distributions. We also discuss the more recent data as they pertain to the view that during $\sim$2002.6-2003.1, Voyager 1 was downstream of the termination shock (Krimigis, Nature, 2003), but since at least early 2003, Voyager 1 has remained in the near upstream vicinity of the termination shock.

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SH41A-19 0830h POSTER

Interpretation of Recent Data from the Voyager 1 Plasma Instrument

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Voyager 1 (V1) was launched in September 1978 and the onboard M.I.T. Plasma (PLS) instrument returned a wealth of information, most notably for the plasma environments around Jupiter and Saturn. Shortly after the Saturn encounter in 1980 the V1 PLS instrument failed. Despite this failure the instrument was still able to make limited "DC" measurements of integral current and DC data was collected from 1981 to 1985. Until recently, the V1 PLS instrument was turned off for power sharing reasons. Given the controversial evidence that V1 crossed the termination shock around August 2002, the V1 PLS instrument was reactivated in May of 2003. A second similar event/crossing began at V1 in mid 2003 and recent data from the V1 Cosmic Ray Subsystem (CRS) instrument show fluxes as high as those observed for the 2002 event. In this paper we attempt to calculate likely electron/ion fluxes seen by the V1 PLS instrument during the most recent 2003 event. We also present estimates of the present capabilities of the V1 PLS instrument. These calculations and estimates are compared alongside recent data taken from the V1 instrument. We also present recent V2 observations and discuss their implications for plasma conditions at V1 during the recent energetic particle events.

SH41B CC: 518 A Thursday 0830h

Violent Sun-Earth Connection Events of October-November 2003: Geospace Impact I *(joint with SA, SM)*

Presiding: **B Giles,** NASA Headquarters**; R Skoug,** Los Alamos National Laboratory

SH41B-01 0830h

The Solar Storms of October/November 2003: Operations Lessons Learned

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The Sun-Earth space weather related to sunspots 484,486, and 488 affected a number of NASA spacecraft and instruments between mid-October and early November 2003. Information available from Earth and Space Science Missions indicate about 59% of the spacecraft and about 18% of the instrument groups experienced some effect from the solar activity. This paper summarizes the impacts on spacecraft, instruments and science data. The types of environmental effects observed on spacecraft were electronic upsets, housekeeping and science noise, proton degradation to solar arrays, upper atmosphere induced changes to orbit dynamics, high levels of accumulated radiation and proton heating. The paper concludes with the development of best practices that foster continuing and expanding feedback on the environment in all space mission phases, designing to the mission's observing mode so that planning is appropriate to mission science goals, distributing operational experience and lessons learned widely among both developing and operating missions and uniformly applying the developed knowledge base.

URL: http://ssmo_home.hst.nasa.gov/

SH41B-02 0845h INVITED

Russian cooperative investigation of solar, heliospheric and magnetospheric processes during October-November 2003

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The review of the Joint Russian Cooperation of Solar Extreme Events of October-November, 2003(JRC - SEE) efforts will be presented in the multidisciplinary analysis of the data obtained on ground based geophysical and astronomical observatories as well as spacecrafts.Strong solar, heliospheric and magnetic storms are well documented and placed in the context of current studies and retrospective knowledge. Data from CORONAS-F satellite substantially contribute to the better understanding of the solar flare and coronal mass ejection dynamics in the EUV, X-ray, gamma-ray and neutron emissions. In situ measurements of charged energetic particles characteristics in broad spectral ranges are performed onboard CORONAS-F, METEOR, ISS, and several geo-stationary satellites in the near the Earth space. This allows to make important conclusions about the radiation conditions, acceleration and propagation processes of energetic ions and electrons. ODYSSEY/HEND instrument on the orbit around the Mars also brings the valuable information from the different vantage point during this period of time. Observed electromagnetic emissions in the broad range from radio to gamma rays, plasma waves and motions, energetic particle and cosmic ray characteristics, neutrons give some clues to the physics of the solar and heliospheric releases as well as solar-terrestrial relations during this highly perturbed period of time. New features in this respect will be presented and discussed.

SH41B-03 0905h INVITED

Structure of the Magnetospheric Boundary Layers during the Extreme Compression Events of October-November 2003

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How the solar wind mass, momentum and energy are transported across the magnetopause boundary remains a fundamental problem in Sun-Earth connection. A way to study this problem is to investigate the magnetopause boundary. This talk will present multi-spacecraft observations of the magnetospheric boundary layers by the Cluster experiments during the violent Sun-Earth connection events of October-November 2003. In particular we will focus on comparing boundary structures during two CME induced magnetospheric compressions, the first on 24 Oct 2003 and the second on 29 Nov 2003. In both events, magnetopause was compressed to inside of geosynchronous orbit (6.6 R_E). While the second event period developed into a magnetic superstorm (Dst < -300 nT), the first event period did not apparently related to an extended period of strongly northward IMF (B_z > 20 nT) following the initial CME impact. Preliminary observations indicate the first magnetopause crossing showed a thin or no boundary layer while the second period showed a very thick boundary layer. O+ was observed on both boundary crossings. By contrasting these two extreme space weather events, we hope to gain insight into the processes involved in solar wind-magnetosphere coupling.

SH41B-04 0925h INVITED

Impact of the October-November 2003 Super Storms on the Distant Geomagnetic Tail: Wind Observations

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Between October 22 and November 4, 2003 the Wind spacecraft repeatedly encountered the distant geomagnetic tail from X_{GSE} = -120 R_E to X_{GSE} = -180 R_E. During the major solar storms on October 28 - November 1, 2003 Wind observed an unusually hot plasma sheet with the electron temperature often reaching 1 keV. High energy solar particles were present both outside and inside the magnetosphere. The magnetic cloud event with strongly northward interplanetary magnetic field on October 23, 2003 produced unusual low frequency fluctuations in the distant magnetotail, lasting more than 17 hours. The periodic fluctuations indicate that the entire magnetotail was flapping with a period of ∼10 min.

SH41B-05 0945h

Gyrophase-Bunched Energetic He+ and O+ Accelerated to Several Hundered keV (by Cusp Reconnection?) in the October 31 Superstorm

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During the recovery phase of the super storm of October 31, 2003, the Earth was hit by a pressure pulse in the solar wind flow, accompanied by strong northward Bz. The IMAGE spacecraft was just south of the equator near apogee when the pressure pulse apparently pushed the magnetopause earthward of IMAGE around 0500UT. At 0530 UT, energetic O+ and He+ (with sufficient E/q to enter the High Energy Neutral Atom imager (HENA) above the cut-off E/q of HENA's ion rejection system) appeared, but only at very specific angles. Although there is no magnetometer on IMAGE, the field apparently remained very steady over the next 1.5 hours, and the ions were continuously present, always with a very beam-like angular distribution. The appearance of these high energy singly ionized ions coincides with the onset of intense Doppler shifted Lyman-alpha emission in the polar cap, as seen by the SI12 imager of the IMAGE FUV instrument. This indicates intense precipitation of energetic protons in association with the solar wind event, although there is no evidence for very energetic protons (above the 160 keV rejection cut-off) in the HENA data. We will investigate the possibility that the ions seen by HENA are extracted from the polar ionosphere, and accelerated to very high energies as they encounter a reconnection region in the high latitude cusp/lobe region. Other data sets may be brought in to investigate this unusual acceleration event.

URL: http://sd-www.jhuapl.edu/IMAGE/