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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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