SH11A-0383 0830h POSTER

New 3D transport equations for solar energetic particles and cosmic ray propagation

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We present a derivation of both anisotropic and isotropic transport equations of energetic particles in three dimensions including magnetic forcusing effect in inhomogeneous heliospheric magnetic fields, cross-field diffusion, and particle adiabatic cooling effect. To study solar energetic particles transport it is essential to have an anisotropic transport equation, but the anisotropic transport equation used by the community is only in one dimension. A 3-dimensional anisotropic transport equation may become necessary for the study of solar energetic particle propagation when there is a significant cross-field transport which is particularly true for later stage of SEP events. In cosmic ray modulation work, on the other hand, three dimensional isotropic transport equation is used by the community, but in the equation there is no forcusing effect. It is found that the forcusing effect may play a significant role in cosmic ray modulation even under the diffusion approximation. We plan to calculate solar energetic particles transport and make comparison with latest observational data from spacecraft.

SH11A-0384 0830h POSTER

Time evolution of probability density functions observed in solar wind plasma densities

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The variation of the solar wind densities observed by the ACE and Wind spacecraft is examined on time scales ranging from one minute to one week. The probability density function (PDF) of the differences of the logarithms of the plasma densities is well represented by a one-dimensional Kappa distribution. Kappa distributions of plasma velocities are found in various space environments including that near Earth, planetary magnetospheres and the solar corona. Compared to a Maxwellian velocity distribution which describes a plasma in a thermal equilibrium, a Kappa distribution is characterized by fat tails, frequently generated by anomalous Levy-type diffusion processes.

For time lags ranging from minutes to hours we find highly leptokurtic PDFs with Kappa indices of about 2. The slope of the variance (2nd moment) vs. time lag, and the observed power spectra are consistent with those found in a turbulent fluid flow. The Kappa index increases with time lag, and the PDF converges toward a Gaussian distribution on a time scale of a few days. The evolution of the observed PDF and the possible physical causes are discussed.

SH11A-0385 0830h POSTER

Energetic Particle Composition at High Helio-latitudes During the Declining Phase of Solar Cycle 23: Ulysses COSPIN/LET Observations

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One of the key questions to be addressed during the solar maximum phase of the Ulysses mission has been the nature of the ubiquitous energetic particle populations observed at all latitudes from equator to poles. In particular, studies of the elemental composition have been carried out in order to shed light on the likely sources of these particles. In the majority of cases, the composition signatures recorded by the COSPIN/LET experiment on board Ulysses during the recent high-latitude passes were consistent with a Solar Energetic Particle (SEP) origin (e.g., Hofer et al., GRL, in press, 2002). This result adds further evidence to the finding that energetic particles are transported with relative ease from low to high latitudes, either by enhanced cross-field diffusion, or by direct propagation along field lines that connect the polar regions of the heliosphere to active regions at lower latitudes. During the current, post-maximum, phase of its mission, Ulysses has encountered the return to more stable solar wind stream structures, leading to the formation of Corotating Interaction Regions (CIRs), in addition to the CME-associated transients. In this paper, we present the latest composition measurements from the COSPIN/LET, and interpret them in the light of the changing heliospheric structure.

SH11A-0386 0830h POSTER

Large Increases of Low-Energy Ion Intensities at Voyager 1 (85 AU) in Mid-2002: Association with Solar Activity in Late-2001

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We report on observations of relatively large intensity increases of low-energy ions (∼30 keV to ∼10 MeV) that began at Voyager 1 in July 2002. At this time Voyagers 1 and 2 were at respective helioradii 85 AU and 68 AU, and at heliographic latitudes 34°N and 24°S. We use data from the Low Energy Charged Particle (LECP) instruments on each spacecraft. Thus far during the mid-2002 event (which was still evolving when this abstract was written), peak intensities of protons 0.6-1.8 MeV and 3-17 MeV have reached ∼10% and ∼30%, respectively, those observed by Voyager 1 in association with the powerful GMIR-driven shock in late-1991, when the spacecraft was at 45 AU (i.e., half as far from the Sun). The intensity increases at Voyager 1 are relatively rapid (∼few days) and nearly coincident for ion energies from at least 30 keV to several MeV. This is strong evidence that the intensity increases arose from local acceleration at a heliospheric shock, probably that driven by an MIR formed by coalescence of ejecta from enhanced solar activity during the period October-November 2001. An estimate of the disturbance's average radial speed during the ∼8-9 months it took to reach 85 AU is then ∼600-550 km/s. In contrast to the situation at Voyager 1, energetic ion intensities at Voyager 2 have remained at relatively low levels during 2002. There is no evidence that the disturbance that began passage by Voyager 1 in July passed Voyager 2 ∼1-2 months earlier, as one might expect for a uniformly expanding spherical disturbance. The disturbance is evidently non-spherical and is confined mainly to latitudes well north of Voyager 2. This is consistent with observations made in the inner heliosphere. The October-November 2001 solar activity produced high intensities of energetic ions not only near the ecliptic at 1 AU, but also at Ulysses, which was at ∼2 AU and above ∼70°N heliographic latitude during this period. We will discuss the Voyager 1 low-energy ion data, including angular distributions. We will also describe the effects, if any, of the disturbance on higher energy ions (e.g., Forbush decreases); however, such effects have yet to appear in the evolving intensity profiles.

SH11A-0387 0830h POSTER

Scattering of Superthermal Solar Wind Electrons Inside 5 AU

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Several theories invoke scattering of the outward propagating strahl electrons to populate the sunward directed part of the solar wind superthermal (halo) electron distribution. If such a scattering mechanism occurs then does it occur in the inner or outer heliosphere? We examine how the sunward moving and anti-sunward moving superthermal electrons vary with distance from the Sun and assess whether or not the source of sunward moving electrons lies between 1 and 5 AU. We use in-ecliptic Ulysses SWOOPS (Solar Wind Observations Over the Poles of the Sun) electron measurements from 1991 when Ulysses was on its way to Jupiter. We start with electron velocity distributions in magnetic coordinates, and determine if the magnetic field is pointing towards or away from the Sun. We then integrate daily average distributions to determine the relative populations of superthermal electrons moving towards and away from the Sun, and assess their variations with distance.

SH11B MCC: 134 Monday 0830h

Nicolet Lecture *(joint with SA, SM)*

Presiding: **D N Baker,** University of Colorado, Boulder

SH11B-01 0830h INVITED

Aeronomy: From Exploration to Data Assimilation

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Please see paper number SA11A-01 for abstract.

SH12A MCC: Hall D Monday 1330h

Turbulence, Waves, and Particles in the Solar Wind Posters *(joint with SM)*

Presiding: **S R Cranmer,** Harvard-Smithsonian Center for Astrophysics

SH12A-0388 1330h POSTER

Compressive Fluctuations in High-Latitude Solar Wind

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Compressive fluctuations in solar wind have been extensively studied in the past using data from spacecraft on the ecliptic plane. In present analysis, based on Ulysses data, for the first time the nature of polar wind compressive fluctuations is investigated. Data are from the first out-of-ecliptic orbit of Ulysses, when solar activity is low. In such conditions, as well known, the high-latitude wind appears as a fast and relatively steady plasma flow. Correlation coefficients at hourly scale for several pairs of solar wind parameters like velocity, density, temperature, magnetic field magnitude, thermal pressure, magnetic pressure, and total plasma pressure are used to characterize the wind compressive state. Results appear to confirm the view that compressive fluctuations in solar wind are a complex superposition of MHD compressive modes and pressure-balanced structures.

SH12A-0389 1330h POSTER

Mechanism for Generating Differential Motion of Minor Ions in the Solar Wind

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Measurements with SOHO/CELLAS in high-speed solar wind show that some minor ions such as O^{6+} have a relatively high drift velocity, however others such as Fe^{9+} tend to lag behind oxygen by a few tens of km/s (Hefti et al. 1998). This subtle observational