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Coordinated UVCS/SOHO and VLA coronal observations took place during August 16–19, 2003. The radio source 3C 228 passed behind a streamer in the northeast at a heliocentric distance of about 7 solar radii, and behind the north coronal hole at about 4 solar radii in the latter part of the radio observation. The goal of this campaign is to combine the analysis of radio polarimetric sounding measurements of the corona with ultraviolet spectroscopy of the same regions, in order to obtain qualitatively new information about the properties of the solar coronal plasma. The Ultraviolet Coronagraph Spectrometer (UVCS) aboard SOHO 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 the corona. UVCS observations provide unique information on the heating and acceleration processes in the corona. The Very Large Array (VLA) observations reveal the Faraday rotation of polarized radio waves due to passage through the magnetized plasma of the corona. These measurements provide limits on the coronal magnetic field strength and constrain the properties of magnetohydrodynamic (MHD) waves. Radio propagation techniques are a useful complementary tool to ultraviolet coronagraphic spectroscopy in determining 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).

SH22A-0189 1330h POSTER

Statistical Study of Hard X-ray Footpoint Region

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We show statistical characteristics of hard X-ray footpoint sources derived from THE YOHKOH FLARE IMAGE CATALOGUE. We use many hard X-ray images over the whole YOHKOH mission period (1991/08 - 2001/12) and the study is concentrated on following two points. 1) Average height of hard X-ray footpoint sources in the four HXT(Hard X-ray Telescope) energy bands (14-23, 23-33, 33-53, 53-93 keV). 2) Spectral characteristics of hard X-ray footpoint sources. We mainly revealed that A) the hard X-ray emission comes from just above the Hα emitting region and the accelerated electrons loose their energy within 1000 km length leading to the high density around footpoints, and that B) Many hard X-ray footpoint sources show a broken power-law spectrum with very hard spectrum in the low energy range (20-30 keV), suggesting a cut off energy of accelerated electrons is around 20 keV - 30 keV at least.

SH22A-0190 1330h POSTER

Shear-Flow Reconnection Causing EUV Bright Point Heating

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EUV/X-ray Bright Points indicate permanent heating processes in the solar atmosphere. We used the information of observed magnetic fields and photospheric motion to simulate numerically by a global MHD approach, coupled to an appropriate kinetic model desrcibing dissipation, the physical processes behind the heating of the solar atmosphere. It appears that shear flow reconnection near the transition region is the main candidate to understand the localized heating behind Bright Points.

SH22A-0191 1330h POSTER

Multiple Flux-Rope Magnetic Ejecta in the Solar Wind: Separated Flux Ropes

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Recent studies (Hu et al., 2003a,b) have shown that multiple flux-rope configuration of magnetic ejecta in the solar wind at 1 AU is not rare. Those authors examined ACE magnetic and plasma data for the years 1998-2000. They found about 4 double flux-rope ejecta events and 1 triplet among 31 events which were identified by primarily looking at magnetic field measurement for flux rope signatures. The data analysis technique employed is capable of generating a two and a half dimensional cross-section of the structure convecting past the spacecraft by solving the plane Grad-Shafranov equation directly utilizing spacecraft data as spatial initial input. The results showed multiple non-axisymmetric cylindrical flux ropes nested within a boundary surface. They were assumed to have exactly the same axis orientation. Further analysis will be carried out by examining the individual flux rope in a multiple rope system separately. The individual field line twist and relative orientation between flux-rope axes will be reported. Implications of X-point formation in a presumably twisted multiple flux-rope system will be discussed. Multi-spacecraft validation of these results will be presented. Possible solar connections of these systems, such as the comparison of the signs of magnetic helicity, will be explored.

SH22B MCC: 3006 Tuesday 1340h

Physics of Eruptions in the Low Solar Atmosphere III

Presiding: **J Krall,** Naval Research Laboratory**; B J Thompson,** NASA Goddard Space Flight Center

SH22B-01 1340h

A Survey of Coronal Dimmings and EIT Wave Transients

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We present the results of a comprehensive catalog of EIT wave transients and coronal dimmings. We will compiled a set of more than 170 events, and we present strong evidence for the association of the co-development of coronal dimmings and EIT waves. Both limb and disk events are included in this study. We also include the speeds, locations, and associated flare timing in this study.

SH22B-02 1355h

The Relation Between Coronal Mass Ejections and Outward Motions in the Low Corona

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Outward motions are frequently observed in the low corona, especially in the early phase of solar flares. Some of these motions, observed in X-ray, EUV, and radio wavelengths, appear to be intimately linked to coronal mass ejections (CMEs) as observed by white-light coronagraphs, typically above 2 Rsun. In principle, a combination of X-ray/EUV/radio and coronagraph data should give many constraints on models of CME initiation and early propagation. However, such attempts are not straightforward because of the diversity of low coronal motions, which often have unclear relationships, if any, to the CME. In this presentation, we compare many examples of low coronal motions observed by TRACE and Yohkoh with CMEs observed by LASCO, and discuss what we can objectively conclude from the data. Errors resulting from the inclusion of different and possibly incompatible data in a single so-called height-time plot are discussed. We also study the reality of the flare association of CMEs, which, according to the height-time plots, precede the flare and hence the low coronal motions by more than an hour.

SH22B-03 1410h

The Three-Dimensional Velocity Fields Of Solar Disappearing Filaments And Their Relations To Coronal Activities

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Solar filament disappearance (Disparition Brusque: DB) is often accompanied by a great magnetic activities such as flares and transient shock waves on and near the solar surface as well as enormous disturbances in interplanetary space due to the associated coronal mass ejection (CMEs). Thus, DBs are of great interest not only to solar physics research, but also to space science, and solar-terrestrial study. Since it is impossible to measure the velocity field of DBs with ordinal observations in the Hα line center alone, most previous studies have focused on the morphological signatures of DBs. In order to obtain the physical characteristics of DBs and relate them to other active phenomena, much effort is put into the calculation of their three-dimensional (3-D) velocity fields. Using the Hα line center, blue and red wing (Hα $\pm$ 0.8 Å) images obtained by the Flare Monitoring Telescope (FMT) at Hida Observatory, Kyoto University, and based on the Beckers' cloud model, we developed a new method to obtain the line-of-sight velocity of disappearing solar filaments. The line-of-sight velocity is obtained (i) by calculating the Hα line profile of the filament, and (ii) by measuring the Doppler shift which best fits the observed temporal variations of contrasts of the filament. The tangential velocity is obtained by tracing the motions of internal structures on successive images, and both line-of-sight and tangential velocities are combined to yield the 3-D velcoty field of DBs. In this method, corrections for the effective filter bandwidths of the instrument, stray light and Doppler brightening effect, are performed. Using the 3-D velocity field of DBs, we also developed a method to judge whether the DB was ejected into interplanetary space (eruptive) or remained in the corona (quasi-eruptive). The type of DBs are compared with the type of the associated coronal activites such as arcade formations observed in soft X-rays and EUV, CMEs and we conclude that the calculation of the three dimensional vector trajectories of disappearing filaments with our method can enhance the quality of space weather forecast and improve its accuracy.

SH22B-04 1425h

Evolution of Morphological Features of CMEs Deduced from Catastrophe Model of Solar Eruptions

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We investigate the evolution of morphological features during a coronal mass ejection (CME) occurring in a specific magnetic configuration in the present work. The results indicate that part of the magnetic flux and plasma ejected into the heliosphere by a CME exist in the flux rope or prominence prior to the eruption. For the parameters we chose for the present work, our calculations show that more than one third of the ejected plasma is continuously brought by magnetic reconnection from the corona during the eruption, and around a half amount of the poloidal flux, together with the plasma, is collected by reconnection from the coronal magnetic field and then is sent into interplanetary space via the upper tip of the current sheet. The reconnected magnetic flux is able to account for the fast expansion of the ejecta. The temperature of the reconnected plasma is fairly high (up to $\sim 10^7$ K), and blending of this hot plasma with cold prominence material may drive the prominence from absorption to emission in the EUV. This process constitutes a natural and straightforward mechanism for prominence heating during the eruption.

SH22B-05 1440h

On the time coincidence between H_α-filament eruptions and soft X-ray emissions

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The interrelationships among coronal mass ejections, solar flares, and filament eruptions have been a long standing issue in solar physics. In particular, timing and spatial relationships among such eruptive phenomena play a key role in understanding any possible causality among them. Presently, observational ambiguities often result from insufficient temporal and spatial resolution. However, we expect that observational capabilities will continue to improve, and in the near future, produce large volumes of solar data with high time-cadence and spatial resolution. We present a technique for quantitatively characterizing dynamics in H_α-data. We report on the result of applying this technique to a sequence of 1-min H_α-images from the Kanzelhöhe Solar Observatory. We chose H_α-data for our initial application because many solar eruptive phenomena have observable signatures in chromospheric dynamics and long periods of H_α-observations are readily available. The data set contains quiescent filaments and a filament eruption accompanied by a two-ribbon flare. The analysis reveals the spatially and temporally correlated phenomena on the H_α-solar disk. The H_α-dynamics are compared with variations in the integrated soft X-ray flux detected by the GOES 8 satellite.

Work supported by ONR, NSF ATM 0205157, and ATM 9903515.

SH22B-06 1455h

Photospheric Sources of Very Fast (>1100 km/s) CMEs Between 1999 and 2001

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We identified photospheric sources for 39 very fast (faster then 1100 km/s) front-side coronal mass ejections, which occurred between 1999 and 2001. For our study we used data on CMEs and their sources provided by the CME Catalog, SOHO spacecraft (LASCO, EIT, MDI), Big Bear Solar Observatory (Halpha, magnetograms), Mount Wilson Observatory (sunspot drawings) and Joint USAF/NOAA active region summary. We distinguished three different groups of active regions which are responsible for very fast CMEs: 1) Complex delta spots (delta spots with a Mt. Wilson classification of beta gamma). This group of active regions (21 events) can be represented by active regions 9393 and 9415 and is characterized by the presence of at least two large opposite polarity sunspots located close to each other. 2) Simple delta spots (8 events). A typical configuration of this type can be represented by active regions 8375 and 9236 and consists of one large twisted tadpole-shaped sunspot, surrounded by many small satellite-sunspots. 3) Extended magnetic regions, which consist of two adjacent decaying active regions or a new active region emerging inside a decaying active region (active regions 9046 and 9085). In this presentation we will discuss in detail the evolution and the type of the magnetic structures which are responsible for very fast CMEs originating from delta-configurations.

URL: http://www.bbso.njit.edu/~vayur/results.html

SH22B-07 1510h

Coronal Mass Ejections and Other Activities in the Inner Corona Observed by the LASCO/C1

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We present observations of coronal activities observed in the inner corona from 1 to 3 solar radii by the LASCO (Large Angle Spectrometer and Coronagraph) C1 instrument on SOHO spacecraft. These activities include initiation and acceleration of coronal mass ejections, transient dimming and brightening of active regions, large scale trans-active region loops, expanding of post-eruption loop arcades and et al. A set of CME events will be investigated to reveal their velocity and acceleration profiles in the inner corona.

SH22B-08 1525h

Comparison of the Breakout Model With Flare-Loop and Ionic Composition Data

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We discuss our ongoing analysis of the observational properties of Breakout coronal mass ejections. Presented are quantitative analyses of the post-eruption evolution that produces the commonly observed flare-loop arcades at the limb and the spreading flare ribbons at disk center. The simulation dynamics are compared to observational results of long-duration flares. We also present a novel application of the ionic charge freeze-in analyses to the numerical simulation output. This post-processing allows us to 'predict' the heavy ion charge states (O7+/O6+) from the simulation density, temperature, and velocities. Due to limitations in the energy accounting and initial conditions of the MHD simulation, we do not obtain the observed O7+/O6+ values, but we emphasize the potential of this method and show how it can be used to study relative variation in charge state composition throughout the ejecta volume.

SH22C MCC: 3006 Tuesday 1600h

Interplanetary Physics III and Scarf Award *(joint with SA, SM)*

Presiding: **J T Gosling,** Los Alamos National Laboratory

SH22C-01 1605h INVITED

Low Energy Anomalous Cosmic Ray Observations: New Insights and Challenges to our Understanding of Heliospheric Particle Transport

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In an ongoing series of papers, we report modeling results and observations from 1991 to 1999 related to the inner and outer heliospheric transport of anomalous cosmic rays (ACRs) having significantly lower energies (0.3 to 40 MeV/nucleon) than have been previously studied. The measurements (which are from the last A > 0 recovery phase) provide crucial information on the transport of H, He, and O at energies below the ACR spectral peaks. A consistent picture that has emerged from our systematic study of these data—primarily from the Voyager 1 & 2 probes, but also including various 1 AU spacecraft—includes the following key features: (1) The initial ACR recovery at all observable rigidities takes about 1 year, suggesting that the dominant timescale is that which arises from the global variation of the interplanetary (IP) transport properties (not the rigidity-dependent "relaxation" time needed for equilibrium to develop). (2) The IP transport properties of the outer heliosphere reach a quasi steady state by mid-1994, which lasts until renewed modulation becomes evident around 1999. (3) The distinct exponential growth of the low-rigidity ACR intensities and the nearly constant intensities at higher rigidities are primarily due to the motion of the Voyager spacecraft through spatial intensity gradients, not to continued temporal evolution. (4) Most of these effects can be modeled in a time-dependent manner with a spherically symmetric transport model, suggesting a reduced role for drifts at low rigidities in the outer heliosphere. (5) Latitudinal intensity gradients for ACRs having rigidities below 2 GV are negative (not positive as expected for the A > 0 phase), again consistent with weak drifts for these particles and suggesting an important contribution from the latitudinal dependence of the solar wind velocity. In this paper we will summarize these observations and interpretations, highlighting those aspects that are felt to be generally unrecognized. The possible adjustments to our present understanding of the transport of ACRs through IP space will be outlined and we will emphasize the opportunities there are for modelers and theoreticians to utilize the largely untapped resource that our large dataset represents. Until these unique lower-energy ACR measurements are explained, a complete understanding of the transport and acceleration of energetic particles in the heliosphere cannot properly be claimed.

URL: http://space.umd.edu/VOYAGER/

SH22C-02 1625h

Energetic Particles Upstream From the Earth's Bow Shock: Multipoint Observations by Cluster and Polar

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One of the primary goals of the Cluster mission is to use multipoint observations to separate temporal and spatial variations in the measured fields and particle fluxes. An example is found in observations by the Cluster RAPID instruments of 30-1500 keV particle populations upstream of the Earth's bow shock. When the Cluster constellation is closely spaced (~600 km), the energetic particle fluxes observed by the four spacecraft are nearly identical because the locations differ by less than one gyroradius of the lowest energy particles. The measured magnetic field vectors at the four spacecraft are also virtually identical, and connect to a single region on the bow shock surface. We contrast this with recent cases in which the Cluster separation is much greater (~6000 km) and the magnetic field connects the four spacecraft to different points on the shock. In this way, the particle acceleration processes at several points on the shock may be monitored simultaneously. Similar energetic particle measurements in the dayside outer magnetosphere by the Polar spacecraft are compared with the Cluster observations with a special focus on the differences in relative ion composition between the upstream populations and the magnetospheric particles.

SH22C-03 1640h

The Interstellar Hydrogen Shadow: Observations of Interstellar Pickup Ions Beyond Jupiter

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This study analyzes the first observations of heliospheric pickup ions beyond the orbit of Jupiter. The Cassini Plasma Spectrometer observes H+, He+, He++, and O+ pickup ions of interstellar origin between 6.4 and 8.2 AU. Surprisingly, however, there is a strong depletion of pickup H+ compared to He+, in contrast to the interstellar H/He ratio of approximately 10. We show that this depletion is produced by a combination of gravitational focusing of He by the Sun and a newly observed "interstellar hydrogen shadow" that diminishes the source of pickup H as Cassini moves through the region behind the Sun relative to the local interstellar flow. Most H atoms cannot penetrate