current. The AU and AL indices express the strongest current intensity of the eastward and westward auroral electrojets respectively. In this study both the AU and AL indices are compared with the Sym-H index for storm-time events. The storm-time events are selected for minimal Dst less than - 50nT. It is found that the correlation between the auroral electrojets and ring current changes case by case. These events are then separated by high and low correlation coefficients. Upstream solar wind characteristics related to these events are investigated. Possible causes for changes of the correlation coefficients will be discussed as well.

SM52A-0571 1300h POSTER

Solar Cycle Effects on Different Levels of Geomagnetic Storms

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A yearly check on the correlation between the pressure corrected Dst and interplanetary parameters for the whole OMNI data set (1974–1996) reveals that apparently the main controlling parameter producing Dst variations is the solar wind speed v, however it is clear that the driving parameters during the main and recovery phases of approximately 300 magnetic storm events extracted from the OMNI database are the southward IMF B_S and the dawn-dusk component of the interplanetary electric field vB_S. To analyze solar cycle effects the selected set of storm events were separated in two subsets using, as a reference, a baseline given by a sunspot number of ~ 100. We found that the correlation is enhanced for those lying under the baseline and reduced for those events lying over the baseline. Apparently, the correlation is higher for storms occurring near minima of the solar cycle than those surrounding the solar cycle maxima. In a little further analysis we separate the selected data base in four subsets, two for the events occurring on opposite phases of the solar cycle and the other two for those occurring on the ascending and descending parts of the solar cycle. In this case, the correlations between the absolute value of Dst^* and B_S are similar for the opposite phases of the solar cycle ($R = 0.72$, with standard deviations of 30.7 and 40.5, respectively). The best correlation ($R = 0.79$) is found for the ascending phase of the solar cycle marking a significant difference with the descending phase ($R = 0.69$).

SM52B MCC: Level 1 Friday 1330h

Bow Shock, Magnetosheath, and Magnetopause II Posters *(joint with SH)*

Presiding: **C T Dum,** Max-Planck-Institut für Extraterrestrische Physik**; H Spence,** Boston University Center for Space Physics

SM52B-0572 1330h POSTER

The upstream boundary of the terrestrial foreshock ULF wave field: Cluster at large separations

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Cluster observations of the terrestrial foreshock made at large (1 Re) and intermediate (600km) spacecraft separations are presented. Case studies are presented where the spacecraft tetrahedron enters and exits the foreshock wave field as a result of changing Interplanetary Magnetic Field orientation. Rapid transitions in and out of the ULF foreshock wave field observed during intervals of stable upstream conditions are presented. The possibility of time dependence in the structure of the wave field is discussed. Two case studies based on observations at large spacecraft separations are also presented where the spacecraft straddle the upstream boundary of the foreshock wave field. It is shown that the spacecraft closest to the shock and connected to the more parallel region of the shock observe the largest amplitude and most prolonged wave activity. The implications of these results are discussed, particularly with reference to the extent of the out-of-ecliptic foreshock.

SM52B-0573 1330h POSTER

A Comparison of Shock Normals

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An accurate determination of the quasi-perpendicular bow shock orientation is crucial for the understanding of the physics that occurs within this boundary region. Using data collected by the Cluster spacecraft from a number of days during the first half year of operations this paper analyses the shock normal directions determined using three different methods. The first set of normals are derived using several shock models. The second set are computed using the coplanarity method based on FGM magnetic field data from the individual Cluster satellites. The final set are computed using multi-spacecraft timings of the shock crossing based on measurements of the EFW probe potentials. The normals for each shock are compared and the results are also analysed with respect to the upstream values of θ_{Bn} and the shock Mach number.

SM52B-0574 1330h POSTER

Three-Dimensional Global Hybrid Simulation of the Bow Shock

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A 3-D global-scale hybrid code is developed for simulation of the bow shock and the dayside magnetosphere. A spherical, (r, θ, ϕ), coordinate system is utilized in the simulation. The code is developed by generalizing our previous 2-D code [e.g., Swift, *GRL* 22, p.311, 1995; Lin, *PSS* 50, p.577, 2002] to 3-D. In the hybrid code, the solar wind and outer magnetospheric ions are treated as discrete particles, and the electrons are treated as a massless fluid. In the simulation, the bow shock forms by interaction between the supersonic solar wind and the geomagnetic dipole field. The simulation domain contains plasma regions from the geocentric distance of $r = 3R_E$ to $20R_E$. Massively parallel computation is used in the simulation. Our previous 2-D simulations showed the presence of various electromagnetic waves near the quasi-parallel and quasi-perpendicular shocks, and the formation of diamagnetic cavities in the foreshock and downstream regions of parallel and quasi-parallel shocks due to the interaction between backstreaming ion beams and the incoming solar wind plasma. In this presentation, our preliminary 3-D simulations of the kinetic structure of the bow shock will be shown, and the results will be compared with the previous 2-D simulations.

SM52B-0575 1330h POSTER

Macrostructure of the Quasi-Parallel Shock and Magnetosheath: 1. Scale Lengths

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Recently, we have utilized global hybrid (fluid electrons, kinetic ions) simulations of solar wind interaction with magnetic dipoles of various strength to demonstrate the existence of a spectrum of magnetospheric structures. Starting with a simple whistler wake, increasing the dipole strength results in magnetospheric structures which grow in complexity until a terrestrial type magnetosphere is formed. This occurs when the system size is considerably larger than ion gyroradii, specifically when the standoff distance of the magnetopause is at least 20 times the solar wind proton skin depth. In this study, we use a similar approach to understand the macrostructures of the quasi-parallel shock and the magnetosheath and their evolution as a function of system size. These macrostructures are directly tied to ion kinetic processes and microinstabilities which occur in the ion foreshock and the magnetosheath. As a result, the spatial extent of both regions influence the nature of system. Our objective is to establish the spatial scales associated with various kinetic processes in the ion foreshock and the quasi-parallel magnetosheath and determine the spatial scales beyond which the system has a self-similar solution.

SM52B-0576 1330h POSTER

Macrostructure of the Quasi-Parallel Shock and Magnetosheath: 2. Nature of the ULF Waves

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In an accompanying presentation, global hybrid (fluid electrons, kinetic ions) simulations were utilized to demonstrate the existence of spatial scales beyond which quasi-parallel shocks and magnetosheath exhibit self-similar macrostructures. This implies that the results of the simulations should be directly applicable to spacecraft observations at planetary shocks and magnetosheaths. An interesting aspect of the simulation results is that despite the presence of large levels of ULF turbulence in the upstream, at the shock and the downstream regions a macrostructure can be attributed to the system. This macrostructure is associated with large scale, and fairly coherent, density and field fluctuations which populate most of the quasi-parallel magnetosheath. Preliminary analysis of the waves suggest that these fluctuations may be in both mirror (density and magnetic field anti-correlation) and fast magnetosonic (density and field correlation) modes. Here, we present a detailed analysis of the waves observed in the simulations to better understand their mode structure and origin, as well as their influence in modulating the magnetosheath. Comparison between simulation results and observations in the quasi-parallel magnetosheath is also provided.

SM52B-0577 1330h POSTER

Bursty Electron Heating in Nonstationary Shocks

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It is well-known that high-Mach number shocks are nonstationary. The shock front steepens and unsteepens quasiperiodically, and some shocks even reform. It is widely believed that the typical timescale of this process is of the order of the ion gyroperiod, so that electrons feel a quasistationary electric field. Electrons, which cross the shock in the adiabatic regime during the unsteepening phase, may become demagnetized in during the shock steepening. Thus, the electron heating regime may be time dependent in high-Mach number shocks and bursty nonadibatic heating may coexist with adiabatic heating. The downstream electron distribution would be a mixture of nonadiabatically and adiabatically heated electrons.

SM52B-0578 1330h POSTER

Over-cooled and Over-heated Electrons Through a Perpendicular Collisionless Shock : Theory Versus Simulations

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Test particle simulations have been performed in order to analyze the time evolution of transmitted electrons dynamics through a supercritical perpendicular collisionless shock. In addition to the adiabatic transmitted particles, two distincts non adiabatic populations are observed. The first one suffers an "overheating" characterized by an increase of the gyrating velocity higher than that supposed by the conservation of the magnetic moment, and the second one suffers a "cooling" characterized by a deceleration of this velocity. a) Present simulations show that these two non-adiabatic populations, strongly depend on the particle injection parameters (both angles with respect to the shock front and initial gyrating velocities), at the beginning time of the ramp crossing. A single particle model is proposed and compared with these numerical results, and points out the key role of the DC electrostatic field at the shock ramp in the formation of non-adiabatic transmitted electrons. b) Moreover, a statistical analysis (electron heating) is performed with the use of a Lyapounov coefficient and a theoretical model including linearly varying profiles of the electric and magnetic fields. Numerical results are found in a good agreement with those issued from PIC simulations.

SM52B-0579 1330h POSTER

Reformation of perpendicular shocks: EMHD-hybrid Simulations

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We study properties of one-dimensional perpendicular shock using hybrid simulations. Standard hybrid simulations treat ions as particles and electrons as a massles isothermal fluid. Ohm law in our model is extended so the time evolution of both the electron parallel and perpendicular temperature is described by an EMHD model. Many numerical studies were already devoted to the properties of one-dimensional perpendicular shocks using particle in cell (PIC) and hybrid codes. It is known that shocks for colder and/or higher Mach numbers show a nonstationary feature, namely a periodic reaperence of a new shock front. These nonstationary shocks have shock front gradient scales governed only by the spatial resolution of the numerical model. We study properties of these shocks by an extended hybrid code and compare the results with previous simulations.

SM52B-0580 1330h POSTER

The Density Transition Scale at Quasi-perpendicular Collisionless Shocks - Hybrid Simulations

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The dependence of the shock thickness on the shock Mach number and the upstream proton beta have been subject of several studies. We carry out a parametric study of several numerical experiments of quasi-perpendicular shocks in two dimensions using standard hybrid code. Hybrid simulations treat ions as particles and electrons as a fluid. Having ions as particles allows ion kinetic behavior and waves to be included. We take the advantage of the fact, that in a numerical experiment whole shock front is available. A hyperbolic tangent is fitted to each density transition profile along the shock front to obtain a measure of the mean value of the shock thickness L and a the typical value of absolute error dL of this value caused by natural perturbations (ripples) of the accelerating shock front. Both parameters are scaled by both the upstream proton inertial lenght and by the ratio of the shock velocity and the inverse of the downstream proton gyrofrequency. Cluster II multispacecraft allows us to obtain an estimate of the mean value L and also a rough estimate of the absolute error dL. We find the dependency of the shock thickness L and the error dL on the wide range of shock's Mach number and and upstream proton beta in the numerical model and compare these results with Cluster II observations.

SM52B-0581 1330h POSTER

Kinetic Jump Conditions and Vlasov Simulations of 1-D Electrostatic Shocks and Contact Discontinuities in Collisionless Plasma

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Kinetic jump conditions of one-dimensional electrostatic shocks and contact discontinuities (CDs) are studied analytically and verified by Vlasov simulations. Kinetic jump conditions can provide information on heat flux and electron-ion temperature ratio on both upstream and downstream boundaries. For a steady shock structure in electron time scale with uniform boundary conditions, a set of equations needs to be fulfilled. In most cases, only approximate solutions can be found, which indicate that shock transition region must be a time-dependent structure in electron time scale. Our analytic solutions also indicate that different electron-ion temperature ratio on upstream boundary can result in different potential jump and plasma heating across the shock ramp. These analytic solutions are consistent with numerical results obtained in Vlasov simulations. Jump conditions of an electrostatic CD are the same as jump conditions of a magnetized CD propagating parallel to the ambient magnetic field. It is found that a steady electrostatic CD requires different electron-ion temperature ratios on upstream boundary and on downstream boundary. Using the kinetic jump conditions as boundary conditions, steady CD structures are found in our Vlasov simulations. Differences between our simulation results and previous simulation results of CDs will be discussed.

SM52B-0582 1330h POSTER

3D Hybrid Simulations of Finite Amplitude Alfven Wave Filamentation.

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Recents observations of the Earth bowshock (Alexandrova et al., 2003, to be published in J. Geophys. Res.) suggest that the Alfven waves observed downstream of the shock may be unstable to a "filamentation" instability. The outcome of this instability, which occurs for wavelength larger but comparable to the ion inertial length and a large plasma beta, is the formation of field aligned magnetic tubes at the expanse of the initial Alfven wave energy. This instability and its nonlinear development have been extensively studied and simulated in the three dimensional Hall MHD regime (Laveder et al., 2002). In the present work we present the first 3D hybrid simulations (the protons are treated as particles and the electrons as a massless fluids) of this instability, with 400 cells in each direction, allowing to resolve the fine structure (of the order of a fraction of proton inertial length) of the final magnetic tubes, resulting from the instability of a parallel propagating Alfven wave, of wavelength of the order of 10-20 inertial length. We shall discuss the influence of kinetic effects on the instability and its development as well as the comparison with the space observations.

SM52B-0583 1330h POSTER

MHD Simulation of Magnetosheath and Magnetosphere ULF Waves for Solar Wind ULF Induced Events

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Two high-speed stream events where ULF activity is present in the solar wind have been used as input for runs of the BATS-R-US MHD model. In both events propagating waves are found in the dayside magnetosheath. These are accompanied by ULF waves in the magnetosphere. The magnetosheath waves, which appear as variations in the magnitude of B at the equator, are initiated by large and small wave-like modulations in By and, or Bz in the solar wind. The IMF can be northward at the time the magnetosheath waves are launched. The magnetosheath waves travel downstream and as they do so the wave motion penetrates deeply into the magnetosphere as a compression in B. It appears that the magnetosphere ULF waves in in the model at the dawn and dusk meridians are a reaction to the magnetosheath waves. Movies of successive model time-steps will be used to illustrate both the magnetosheath and magnetosphere waves and their connection.

SM52B-0584 1330h POSTER

Mirror Waves With Finite Ion Larmor Radius Effects

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The fully kinetic theory of mirror waves accounting for the finite ion Larmor radius effects is developed. Their influence on the wave polarization both in uniform and nonuniform plasmas is discussed. Theoretivcal results have been compared with multi-satellite observations of mirror waves in the terrestrial magnetosheath.

SM52B-0585 1330h POSTER

Magnetosheath plasma response to a slow compression

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Effect of a slow compression on the magnetosheath plasma is studied using two-dimensional hybrid expanding box model. In this model the plasma is under an externally driven continuous compression and responds to this compression self-consistently. The evolution in the simulated plasma has two distinct phases: during the first one, when the system is stable with respect to the Alfven ion cyclotron (AIC) and mirror instabilities, the ions behave double adiabatically. This behavior leads to strong ion temperature anisotropies and eventually the system crosses the treshold of the AIC instability. After a short transition the second phase starts: the plasma follows the marginal stability condition of the AIC instability. During this phase the temperature anisotropy decreases whereas the ion parallel beta increases. In higher beta plasma the mirror instability appears but the mirror waves does not alter the overall system behavior. We investigate a role of the compression speed and of the presence of alpha particles. We discuss the simulation results in the magnetosheath context.

SM52B-0586 1330h POSTER

A Study of Generalized Kelvin-Helmholtz Instability With Asymmetric Development of Compressible Waves at a Tangential Discontinuity

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Simulation results of Kelvin-Helmholtz (K-H) instability at a magnetohydrodynamic (MHD) tangential discontinuity (TD) show asymmetric development of nonlinear waves when magnetic field is perpendicular to the velocity shear on one side of the TD but parallel to the velocity shear on the other side of the TD. To explain these simulation results, an analytic study is carried out to obtain generalized solutions of K-H instability. Both incompressibility and pure surface wave conditions are removed from our basic assumptions. Nonlinear waves in our model are allowed to propagate at directions both tangent and normal to the surface of TD. Plasma is assumed to follow an adiabatic process. Nonlinear waves on two sides of the TD have a common tangential wavelength, but may have different normal wavelengths. Wave amplitude is assumed to decay exponentially away from the surface of TD. Our solutions indicate that the exponential decay length increases with increasing normal wavelength. On the other hand, the normal wavelength will decrease with increasing velocity shear. Our simulation results are in good agreement with the analytic solutions. For magnetic field parallel or anti-parallel to the velocity shear direction, the normal wavelength is much longer than the tangential wavelength. Thus, nonlinear waves are developed from the TD like a toothbrush with wave normal nearly perpendicular to the normal of the TD. With flow energy converted into wave energy and carried away from the TD, amplification of the surface wave become stabilized. Only a finite amplitude disturbance can be found at surface of the TD in our simulation. Our analytic solutions and simulation results indicate possible existence of another type of nonlinear waves in magnetosheath and in the tail lobes as a result of solar wind-magnetopause interactions.

SM52B-0587 1330h POSTER

Electron Inertia Effects in Highly Rolled-up MHD-Scale Kelvin-Helmholtz Vortices

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In order to understand the universality of substantial non-MHD effects in MHD-scale Kelvin-Helmholtz (KH) vortices, we have performed two-dimensional simulations by a two-fluid system including finite electron inertia effects. An MHD-scale velocity shear with density gradient between two regions is set up and evolution of MHD-scale KH-mode is followed. Firstly, the magnetic field is assumed to be perpendicular to the flow and the simulation plane. In this case, we have already shown the quick decay of an MHD-scale KH vortex induced by the electron effects to exist; smaller vortices appearing within the MHD-scale vortex grow in size as they intrude into the center of the parent's vortex. Then the well-ordered parent's flow pattern is destroyed. By investigating the detailed nature of the decay process, here we show that the parameter range for the quick decay involves the typical parameter range of the tail-LLBL and thus the vortex decay is well expected in the tail boundary layer. Secondly, we have simulated cases with in-the-plane magnetic field component. We particularly focus on the case where magnetic field lines on both sides of the shear layer are parallel to each other. In this case, the magnetic reconnections within the MHD-scale vortex are generated by the electron inertia effects when the vortex highly rolls-up, stretching the field lines into an anti-parallel geometry overcoming the tension of in-the-plane magnetic field. The number of the magnetic islands formed by reconnection and the degree of the electron acceleration in the islands depend on the size of the vortex measured by the electron inertial length. Furthermore, when in-the-plane magnetic intensity is extremely different between the two sides of the shear layer, we observe the magnetic islands to be injected into the side with the weaker field. We will present more details pointing to the general importance of the electron effects in an MHD-scale KH vortex and discuss its relevance to dynamics of the tail-LLBL.

SM52B-0588 1330h POSTER

Three-dimensional MHD Simulations of Kelvin-Helmholtz Instability in a Tail-flank Like Geometry

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In order to understand the nature of the Kelvin-Helmholtz (K-H) instability in the tail-flank situation, we have been performing three-dimensional MHD simulations of the K-H instability. We have obtained the results for the two basic configurations, one in which the magnetic field is uniform and perpendicular to the velocity flow (transverse case) and the other where the field is uniform and parallel to the flow (parallel case). We have set the density variation that makes an unstable layer of finite thickness to be located between two stable regions. Whether the vigorous growth of the K-H instability is available or not would depend on the thickness of the unstable layer H. Indeed, for the transverse case, the critical thickness below which no growth is available is about a half of the wavelength of the fastest growing mode. However, the growth rate obtained even when the thickness is as small as 1/3 of the wavelength is almost unaffected for the parallel case. These results have the following implications to the magnetotail flank situaition. The thickness H mentioned above corresponds to the thickness of the plasma sheet. The magnetosheath magnetic field has substantial component transverse to the velocity flow and the magnetospheric field is mostly parallel to the flow. It is the copuling between the sheath field and the thickness of the plasma sheet that gives rise to three-dimensional effects. When the shear flow at the tail-flank give rise to the K-H instability, the magnetosheath magnetic field lines will be bent and their tips will intrude into the plasma sheet. The strength of magnetosheath field and the plasma sheet thickness H should control the stability and the non-linear phase of the K-H instability. The parameter space where significant effects of the K-H instability are available will be shown and it is compared with the tail-flank parameters.

SM52B-0589 1330h POSTER

What are the causes of the formation of the sub-Alfvénic flows at the high latitude magnetopause?

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We study magnetopause crossings made by the Interball Tail spacecraft at high latitudes under various interplanetary conditions. When the IMF is mostly northward the Interball Tail observes quasi steady state reconnection signatures at the high latitude magnetopause, which include a well-defined de Hoffman-Teller frame, satisfaction of stress balance (Walen relations) and D-shaped ion velocity distributions. Under variable or southward IMF the high latitude magnetopause is a tangentional discontinuity. However, in certain conditions, just after the magnetopause crossing, irrespective of the IMF orientation, decelerated magnetosheath flows are observed in the magnetosheath region adjacent to the high latitude magnetopause. This leads to formation of the region where the sub-Alfvénic flow at high latitudes exists. We suggest that in some cases the dipole tilt plays an important role in the formation of the sub-Alfvénic flows, although in some cases formation of the depletion layer is responsible for observation of the sub-Alfvénic flows at the high latitude magnetopause.

SM52B-0590 1330h POSTER

A New Look at Driven Magnetic Reconnection at the Terrestrial Subsolar Magnetopause

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The physics of flux pileup magnetic reconnection at the terrestrial subsolar magnetopause is addressed. Analytical results for 3D reconnection are reviewed and compared with global magnetohydrodynamics simulations of subsolar magnetopause reconnection under steady, southward IMF conditions. The scaling of the magnetic flux pileup and the reconnection electric field with plasma resistivity are shown to be consistent with scalings predicted by the 3D stagnation point flow annihilation model of Sonnerup and Priest (J. Plasma Phys., 14, 283-294,1975) and Craig et al. (ApJ., 485, 383-388, 1997), implying that the reconnection rate should vanish in the infinite Lundquist number limit. Effects of Hall electric fields are addressed using an analytical 2D stagnation point annihilation model which allows flux pileup to saturate well before the reconnection rate begins to drop; nevertheless, our resistive Hall MHD results predict significant pileup at the subsolar magnetopause even for a purely southward IMF orientation. This result is puzzling, since spacecraft observations typically show no significant pileup of magnetic energy at the magnetopause when the IMF is southward. It thus appears that Hall-induced pileup saturation alone cannot account for the lack of observed magnetic energy pileup during subsolar magnetic reconnection under southward IMF conditions.

SM52B-0591 1330h POSTER

Scaling of Magnetic Reconnection from Asteroids to Earth

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Current sheets are a central feature of magnetospheric structures and play a significant role in the transfer of plasma, momentum and energy from the solar wind. Our recent hybrid (fluid electrons, kinetic ions) simulations for northward IMF demonstrate that magnetospheric structures go through well defined transition points as the magnetic dipole strength is increased in a constant solar wind flow. It was shown that a spectrum of magnetospheric structures exist which can be characterized in terms of the distance ahead of the dipole where the magnetic field pressure balances the solar wind ram pressure (Dp). At low dipole strengths, the magnetosphere is fairly simple and consists of whistler and/or magnetosonic wakes. Increasing the dipole field results in the formation of progressively more complex magnetospheres with a number of different plasma regions separated by various types of waves or discontinuities. When Dp approaches 20 ion inertial length, the resulting magnetosphere exhibits a terrestrial type behavior. Here we examine the effect of the IMF direction on the spectrum of magnetospheric structures. In particular, we are interested in determining whether the direction of IMF has the same dominant controlling factor in magnetospheric structures as it does for the case of the Earth. In order to address this issue, we have performed a series of 2D and 3D global hybrid simulations for varying dipole field strengths in a constant solar wind flow. We show that details of magnetic reconnection and its relative importance to the process of transport is dramatically different for weak dipole fields ($Dp< 5$) than for large Dp cases. In particular, for small Dp the dynamic flow around an obstacle can dominate the flow diversion due to reconnection, resulting in similar magnetospheric structures during both northward and southward IMF.

SM52B-0592 1330h POSTER

Stability and Structure of Superthin Sheets: 2D and 3D Full Particle Simulations

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transition points as the magnetic dipole strength is increased in value. Further, for weak dipole fields, which may be relevant for asteroids and smaller planets, the magnetopause takes the form of a very thin current layer with ρ_i/L 7 where ρ_i is the ion gyroradius and L is the current sheet half-thickness. The properties of such thin current sheets are largely unknown. We have used linear kinetic theory as well as 2D and 3D full particle simulations to study the structure and stability of such thin sheets. Some of the important issues that we address include, (i) what is the lower limit of current sheet thickness in the presence of instabilities such as the lower hybrid drift instability that will broaden the sheet? (ii) Can magnetic reconnection occur in this limit and what form will it take? Thin sheets also enable us to settle important issues regarding the stability of thicker current sheets observed at Earth. The study of such current sheets at has been difficult due to small growth rates, and many important issues remain unresolved. Even using unrealistically small mass ratios, relevant simulations remain out of reach of present computational capabilities. Through our study of thin sheets we will address issues that are of direct interest to the Earth's magnetosphere, using realistic mass ratios. Examples include (i) nonlinear interaction of tearing and lower hybrid drift instability and (ii) saturation mechanism of guide field tearing in three-dimensions.

SM52B-0593 1330h POSTER

The magnetic field structure at the dayside magnetopause

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We studied the plasma and magnetic field structure of the magnetopause with Geotail data. We classified the structure of the magnetic field and the plasma flow at the dayside magnetopause in the magnetopause-normal coordinates. We found that the magnetopause has two patterns of magnetic field structure. One is the case in which the strength of the magnetic field becomes small when Geotail crosses the magnetopause. In this case, the southward magnetic field becomes simply the northward magnetic field. The other is the case in which the strength of the magnetic field is almost constant. In this case, the magnetic field rotates. The position where the magnetosheath plasma with low-temperature and high-density changes into the magnetospheric plasma with high-temperature and low-density does not depend on the structure of the magnetic field. The position is at the magnetosphere side of the magnetopause defined by the magnetic field. Sudden southward or northward plasma flows, which are considered to be magnetic reconnection flows, are frequently observed at the magnetopause. These flows can be observed for these two types of the magnetic field structure.

SM52B-0594 1330h POSTER

Response of the Geosynchronous Magnetic Field at the Sub-solar Region to Variations in Interplanetary Magnetic Field Orientations and Changes in Solar Wind Dynamic Pressure

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The magnetic fields Ht at the geosynchronous orbit near the dayside sub-solar region are compared with the up-stream solar wind dynamic pressure (Dp) and north-south component of interplanetary field (Bz) in GSM coordinates based on the 90-second resolution of data observed by WIND, ACE, GOES 8 and 10 satellites for the period 1999-2000. The corrections due to the changes of the latitudinal positions of GOES have been made. There are at most two events selected (one for each GOES) each day when GOES 8 and 10 reach their maximum values of magnetic field strength near the sub-solar region. A total of 507 events are selected such that the up-stream solar wind and IMF data are carefully compared with GOES data so that a proper adjustment for the time delay due to solar-wind propagation from the upstream positions to that of GOES is included. It is found that the well-known results of Ht = a*sqrt(Dp)+b are confirmed for both polarity of Bz where a=30.2, b= 80.2, Ht in nT and Dp in nPa. However, the reduction in Ht due to the negative Bz is not found in our statistical study. Using the magnetopause model of Chao et al. (2002) and Shue et al. (1998), we estimate that the sub-solar distance of the magnetopause, Rmp, reduces about 1 Re on the average for southward Bz when Rmp is in the range of 7 to 10 Re.

SM52B-0595 1330h POSTER

Ion cyclotron waves in the high altitude cusp: CLUSTER observations at varying spacecraft separations

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We have analysed high-resolution Cluster FGM data (22 vectors/s) during three high-altitude cusp crossings on 17th of March 2001, 2nd and 9th of March 2002. The Cluster separations for these crossings varied between 70 - 600 km and therefore provided an unique opportunity to study wave properties at different length scales. After entering the cusp Cluster observed significant level of magnetic field fluctuations with the highest frequencies scaling as a function of the local ion cyclotron frequency (IC). The waves close to local IC frequency appeared at two types of plasma boundaries: higher amplitude (2-5 nT) incoherent wave packets were observed at regions of enhanced plasma flow, and smaller amplitude (< 0.5 nT), more coherent wave trains were observed at shear flow-stagnant plasma boundary. Sometimes also the first and second harmonic of the dominant frequency were present. Surprisingly the cross-correlation coefficients between spacecraft pair were poor for all crossings indicating that these waves were very locally generated and possibly some wave-particle interactions took place, damping the waves before other spacecraft were able to observe them. Both left-and right-handed waves were observed, and there were no correlation between ellipticities and wave propagation angles with respect to the background magnetic field.

SM52C MCC: 2002-2004 Friday 1340h

The Role of the Plasmasphere in Ionospheric and Magnetospheric Dynamics II *(joint with SA, AE)*

Presiding: **M Moldwin,** University of California, Los Angeles**; J Foster,** Millstone Hill Observatory

SM52C-01 1340h INVITED

Some Questions Concerning the Coupling of the Plasmasphere to the Ionosphere and Other Regions

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This talk is intended to touch upon, and hopefully stimulate interest in, a number of questions that have arisen during past experimental work on the plasmasphere or underlying ionosphere. During disturbed periods, substantial amounts of plasma appear to be lost from the plasmasphere by interchange fluxes with the ionosphere. What is the mechanism of this loss and what is its effect on the ionosphere? What mechanisms establish and control the properties of the plasmapause boundary layer or plasmapause region? How could the development of a new plasmapause boundary be observed with, say, kilometer scale resolution and on a time scale of minutes? Is there a combination of ground based radar and rocket experiments that could accomplish this? Irregular density structure frequently appears in the plasmapause region. How and when do these irregularities form, and what role does the ionosphere play in their formation? At times, but possibly only in the early stages of disturbance, a steep plasmapause boundary is detected at altitudes of a few thousand km. How do the properties of the plasmasphere boundary layer, or plasmapause region, vary as a function of distance along the field lines from the equator to the ionosphere? Limited evidence suggests that the low and high altitude convection flows of eroded plasmasphere plasma may be at least partially decoupled along field lines near the dayside magnetopause. What role do turbulent electric fields play in this process?

SM52C-02 1400h INVITED

Studying the connection between the ionosphere and plasmasphere using GPS observations

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Studying plasmaspheric dynamics during and after magnetic storms provides information on how the plasmasphere responds to and influences storm evolution, and provides insight into magnetosphere-ionosphere coupling. Understanding the source and loss processes of ring current and radiation belt particles requires a dynamic picture of the plasmaspheric mass density, which modifies those populations by particle-particle and indirectly by wave-particle interactions. Studies using plasmaspheric measurements from the IMAGE satellite and ionospheric total electron content measurements from ground-based GPS receivers have demonstrated a striking correlation between stormtime density enhancements in the ionosphere and plasmaspheric drainage plume structure caused by enhanced magnetospheric convection. We describe how the continuous dual-frequency L-band transmissions from 27 Global Positioning Satellites (1.2 and 1.5 GHz), orbiting at about 4 Earth radii, are important observational tools for studying the plasmasphere and ionosphere as a coupled system. Total electron content measurements from ground-based GPS receiver networks are complementary to measurements obtained from zenith-viewing GPS receivers in low-Earth orbit, currently available from a variety of altitudes both within and above the ionosphere. We will report on observed trends such as the plasmaspheric content versus latitude, how this evolves over several hours during a magnetic storm, apparent refilling of the plasmasphere after a storm, and how the plasmasphere structure correlates with ground and space-based GPS measurements of the ionosphere. Since GPS measurements of the plasmasphere are fairly new, we will discuss the measurement system itself, limitations and possible new directions.

SM52C-03 1420h INVITED

On the Relation Between the Ring Current and Sub-Auroral Electric Fields and the Plasmasphere

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