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Radio observations in decameter wave band are known to be subject to strong man-made interference signals that make difficult the detection of comparatively weak emissions of cosmic origin. The efficient methods of filtering out the interferences have been recently proposed that utilize the differences in characteristic time scales of the analyzed signals. Those methods, however, restrict the sensitivity of observations by imposing the limitation on the integration time in the post-detector signal analysis procedures. In this paper we demonstrate that effective sensitivity of such observations can be substantially increased by the statistical analysis of tails in the distribution function of short-time-integrated amplitudes. We apply the proposed signal processing technique to the analysis of data obtained in the recent experiment on the search for millisecond-type bursts from exoplanetary magnetospheres. The search was based on the conjecture that auroral regions of magnetized planets can be the sources of powerful radio bursts with characteristic timescales of the order of tens of milliseconds (similar to Jupiter S-burst storms). Although the power of the known by far planetary radio emissions in the Solar system seems to be insufficient for being detected from the distances greater than 2-3 parsec, the detection would be feasible for the so-called "hot Jupiters" (strongly magnetized giant planets located closely to their parent stars) mainly detected by far in optical searches for exoplanets. Our observations have been performed in 1999-2001 at the world-largest decameter radio telescope UTR-2 (Kharkov, Ukraine) used in combination with acousto-optical spectrometer as a receiver system. The observational targets included a list 20 candidate exoplanetary systems known from optical measurements and located not very far (within 15 parsec distance) from the Earth. The proposed statistical method has been tested and tuned with the data from several known radio pulsars recorded in parallel with observations of exoplanetary targets. Despite the absence of the positive result (detection of planetary bursts) by now, the proposed statistical technique allows obtaining an estimate from above on the expected radio flux densities from several known exoplanetary systems.

SM31D MCC: 2002-2004 Wednesday 0900h

Van Allen Lecture *(joint with SA, SH)*

Presiding: **D Baker,** Laboratory for Atmospheric and Space Physics, University of Colorado**; R Strangeway,** Institute of Geophysics and Planetary Physics, University of California, Los Angeles

SM31D-01 0910h INVITED

New Insights Into Magnetospheric Physics From Recent Multi-Spacecraft Observations

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With its four spacecraft traversing the magnetosphere and its environs in a three-dimensional formation at variable separation distances, Cluster is the first mission that permits unambiguous resolution of space and time. By exploiting this unique opportunity, Cluster is rapidly providing fascinating new insights into magnetospheric and solar wind phenomena. Examples are the first determinations of the spatial scales, some of them quite different from expectations, of transient 3D structures, such as the short large amplitude magnetic structures ahead of the parallel bow shock, the perturbations of the bow shock known as hot flow anomaly, the bursty bulk flows in the plasmasheet; the first 3D description of mirror-mode structures in the magnetosheath; the identification of the thickness, structure and and evolution of the magnetopause and magnetotail current sheets, down to ion and electron scales; the localization of the source region of upstreaming ion beams; the identification of different wave modes propagating in different directions at the same frequency; the determination of the source regions of the auroral kilometric radiation using Cluster as a very-long-baseline interferometer. But Cluster is also part of ISTP, which enables Cluster's small-scale observations to be placed into the larger context provided by other ISTP missions and ground-based observatories. A particularly illustrative example is the brief transit by Cluster through the source of the proton beams that cause bright spots in the dayside aurora observed for many hours by IMAGE.

SM31E MCC: 2002-2004 Wednesday 1020h

Magnetotail and Plasma Sheet II

Presiding: **M M Kuznetsova,** NASA Goddard Space Flight Center**; J Buechner,** Max-Planck-Institut für Aeronomie

SM31E-01 1020h

Plasma sheet formation from solar and ionospheric sources

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The population of the plasma sheet with ions is considered in the framework of collisionless particle motions in 3D magnetospheric fields. Simulation results are compared with observations of the near-Earth plasma sheet from the Polar spacecraft, during 2001 and 2002. To support comparison of velocity distributions, large numbers of particle trajectories are initiated in two regions representative of the solar wind source (within the LLBL) and the ionospheric photothermal H+ ion source (outside the plasmasphere). All trajectories run until they either precipitate into the atmosphere or escape from the magnetospheric simulation space, leading to a database of particle characteristics in each volume of the magnetosphere, yielding velocity distributions where sufficient numbers of particles pass through a volume. We report results reflecting steady conditions of modest activity, corresponding to IMF Bz approximately zero. The results exhibit structuring of the magnetospheric plasmas according to source region, with some mixed regions as well. The Polar observations appear consistent with the simulations, while the simulations help us discriminate between solar and ionospheric H+ ions in the Polar measurements.

URL: http://tem692.gsfc.nasa.gov

SM31E-02 1035h

Statistical properties of cold ion populations in the plasma sheet: GEOTAIL observations

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Recent GEOTAIL observations have revealed that there sometimes exists cold ion component that has density comparable to the "ordinary" hot plasma sheet component even in the central plasma sheet [Seki et al., *Nature*, 2003]. It is also reported that during extended intervals of northward IMF, plasma entry from the magnetosheath through LLBL seems to be enhanced and the ion distribution functions show the 2-composition structure in the dawn-side plasma sheet [e.g., Fujimoto et al., *ASR*, 2002]. These dense ions can be transported into the inner magnetosphere under certain solar wind conditions [Thomsen et al., *JGR*, 2003]. In this study, conditions for cold ion existence in the plasma sheet are investigated based on statistics of 4 years of GEOTAIL data in the central plasma sheet ($-5 < X_{GSM} < -35$, $|Y_{GSM}| < 15$ R_E), aiming at getting clues to supply and transport mechanisms of these cold populations.

The results show that the observational probability of the cold ion population having density above 0.1 [1/cc] is about 0.25 and decreases with increasing tailward distances. In the near-Earth regions of $X_{GSM} > -15$ R_E, the probability goes up to 0.42. The observation also shows that there are two types of cold ion events in the plasma sheet: One is the detection of a dense sheath-like ion component primarily seen in the flank regions, and the other is observations of the colder component with a moderate density. The latter type of the cold population often has the velocity along the local magnetic field, which may suggest the direct supply of the ionospheric ions. The former type has properties similar to cold dense plasma sheet observations reported by previous studies, and primarily seen during/after the northward IMF periods. The cold dense ion observations in the GEOTAIL is often coincide or followed by the dense plasma observations by the Los Alamos Magnetospheric Plasma Analyzer (MPA) at the geosynchronous orbit.

SM31E-03 1050h

Ion Dynamics of the Inner Tail and Reconnection Signatures

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During active times, the magnetotail current layer thins to below the thermal ion gyro radius, over a large distance from just past the transition to dipolar field lines to beyond $20R_E$. These scales and the simultaneous presence of cold lobe ions, current-carrying hot central plasmasheet ions, as well as highly energized ions create an environment rich in ion-kinetic effects that often dominate the dynamics of the tail. While crucial, ion-kinetic physics is not contained in local or global fluid (MHD) descriptions. It is argued that the ions also play a larger role than previously assumed in communicating perturbations earthward. Our 3-D hybrid simulations (kinetic ions, electron fluid) have demonstrated that earthward transport of energetic, essentially unmagnetized ions is fast and efficient, and can be associated with a large heat flux that initially is located close to the neutral sheet. Both the energetic ions and parallel currents can arrive long before the dipolarization front on what corresponds to relatively low-latitude field lines. Understanding the characteristics of these ions has recently become of greater interest, considering improved methods of monitoring and imaging near-Earth and precipitating energetic ions. However, in previous studies we used a traditional equilibrium, which does not provide a good description of the inner tail. Using techniques that generate numerical equilibria, we have now improved our model by including the transition to the dipolar region. We discuss the stability of these equilibria and present results that show the passive and active impact of the near-Earth region on reconnection signatures.

SM31E-04 1105h

Multispacecraft Observations of Energetic Electron Anisotropies in the Plasma Sheet using CLUSTER/RAPID Data

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We have used the Research with Adaptive Particle Imaging Detectors (RAPID) experiment onboard the four-spacecraft CLUSTER constellation to study the anisotropies of energetic (E>20 keV) electrons in the

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