SH21B CC: 518 C Tuesday 0830h

The February 2004 Ulysses Encounter With Jupiter I *(joint with SM)*

Presiding: **S T Suess,** NASA Marshall Space Flight Center**; R J Macdowall,** NASA Goddard Space Flight Center

SH21B-01 0830h

Ulysses Magnetic Field Observations During the Jupiter Distant Encounter

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November 2003 through March 2004 is the interval during which Ulysses encounters Jupiter for the second time. The spacecraft remains outside the Jovian magnetosphere at distances in excess of several thousand Jupiter radii. Nevertheless, the Ulysses observations are of interest because they provide an opportunity to study various emissions from Jupiter, including energetic particles, radio signals, dust and neutral atoms, over a wide range of Jovigraphic latitudes and local times. In addition, the observations identify the arrival at Jupiter of large -scale solar wind structures such as compression and rarefactions regions and the Heliospheric Current Sheet (HCS) which are of interest to the in-situ and any remote-sensing observations of Jupiter. The Ulysses magnetic field and solar wind measurements play a key role in identifying these structures throughout the encounter interval. The polarity and direction of the magnetic field allow testing of its effect on the escape of relativistic electrons, dust and other emissions from Jupiter's magnetosphere and their subsequent propagation in the solar wind. The data also contain information about solar wind shocks, waves, discontinuities, the HCS, etc. near 5AU and, in particular, those features impacting the Jovian magnetosphere.

SH21B-02 0845h INVITED

Simultaneous X-ray, Ultraviolet, and Radio Observations of Jupiter's Aurora

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Chandra observations of 40-minute periodicity in X-ray emissions from Jupiter's polar caps during the Cassini-Huygens 2000 Jupiter flyby are reminiscent of the correlation in a near-40-minute periodicity between quasi-periodic radio bursts and energetic field-aligned electron flows on Jupiter's dusk flank as measured by the Ulysses spacecraft in its initial Jupiter flyby. Follow-up observations using both Chandra and Ulysses are inconclusive, but simultaneous HST observations and X-ray spectral data provide tantalizing clues of a possible mechanism.

SH21B-03 0905h INVITED

Ulysses observations of jovian relativistic electrons in the interplanetary space: new results from distant encounter with Jupiter

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Since the first approach by Pioneer 10 in 1972, Jupiter is known to be the source of relativistic electrons that dominate the radiation environment of the entire inner heliosphere during solar quiet periods. Jets of relativistic electrons were observed when the spacecraft got within short distances of a fraction of 1 AU from the magnetosphere. Because it is a point source, one can use the spatial distribution of jovian electrons to figure out the properties of particle propagation such as the diffusion coefficient parallel or perpendicular to the magnetic field. Ulysses' unique out-of-ecliptic trajectory has made it possible to study particle propagation in the latitudinal direction. From the measurements during Ulysses first encounter with Jupiter in 1992 and subsequent polar orbits, it was found that the particle latitudinal transport should be enhanced at high heliographic latitudes relative to that near the solar equator. Twelve years later, Ulysses returns to Jupiter's orbit with a closest encounter with the planet in February 2004. Relativistic electron intensity has been increasing steadily towards Jupiter. In this paper, an analysis of electron measurements made by the HET of COSPIN experiment will be presented. The results will be compared with previous results to find out any solar cycle dependence of the jovian source and the particle propagation in the interplanetary magnetic field. Implication to the propagation of solar energetic particles and cosmic rays will be discussed.

SH21B-04 0925h INVITED

Radio Jupiter Observed From High Northern Latitudes

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Radio observations of Jupiter during the Voyager fly-bys in 1979 and the Ulysses fly-by in 1992 revealed that dramatic changes in morphology occurred in conjunction with seemingly small changes in observer's Jovicentric latitude. Indeed, at sub-observer latitudes outside the nominal equatorial band observable from Earth, several new Jovian radio components were observed. During the later half of 2003 and most of 2004, the Ulysses spacecraft is performing another fly-by of Jupiter, but at a much greater distance (0.8 to 2.0 AU) than during the 1992 fly-by (6 Jovian radii). However, even at these distances, Jupiter is the dominant radio source, permitting synoptic intensity and (occasionally) polarization observations to be made by the Ulysses radio and plasma wave instrument. During this distant fly-by, the Jovicentric latitude excursion is very large, covering the range from about +75 degrees down to -15 degrees while closer than 2 AU to Jupiter. Here we describe low frequency (< 1 MHz) observations made during the northern phase of this fly-by, covering latitudes from +75 degrees to almost the equator, including some intervals at the same latitude but dramatically different local times. Perhaps the most persistent emissions observed at high latitudes are the so-called QP (quasi-periodic) bursts, although their appearance is much more complex than during the first Ulysses fly-by in 1992. Also evident are some broad band features that may be triggered by co-rotating solar wind structures. Coronal mass ejections (CMEs) are another contributor to the variability of Jovian radio emissions and we will show examples of enhanced Jovian emissions correlated with impact of CMEs with the Jovian magnetosphere during the extremely active solar storms of Oct-Nov 2003.

SH21B-05 0945h

Jovian Dust Streams Measurements During Ulysses' 2004 Distant Jupiter Encounter

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Collimated burst-like streams of dust particles were discovered with Ulysses during approach to Jupiter in 1992 and later confirmed with Galileo and Cassini. The streams occurred at approximately monthly intervals (28 +- 3 days) which was explained by the particle interaction with the interplanetary magnetic field. Maximum impact rates were above 1000 per day, impact speeds exceeded 200 km/sec and grain radii were approximately 10 nm. Later Galileo measurements showed that the particles strongly interact with Jupiter's magnetosphere and that they originated from Io. More than ten years after their discovery, Ulysses measured the dust streams again during approach to Jupiter in 2003. Eight dust streams were detected by January 2004, confirming the grain properties, impact rates and monthly periodicity recognized in 1992. The measured impact directions are compatible with a grain origin from the jovian system, and the most distant stream recognized in the latest data occurred at 3.3 AU jovicentric distance. Taken all measurements together - the streams were detected at various jovigraphic latitudes between -35 deg and +75 deg.

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Acceleration, Release, and Propagation of Solar Energetic Ions and Electrons: When, Where, and How? I

Presiding: **R A Mewaldt,** California Institute of Technology**; J T Steinberg,** Los Alamos National Laboratory

SH22A-01 1030h

A Survey of Multi-MeV Electrons in Solar Energetic Particle Events Over a Complete Solar Cycle

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The Proton/Electron Telescope (PET) aboard the Solar, Anomalous, and Magnetospheric Particles Explorer (SAMPEX) satellite has measured light ions and electrons in low Earth orbit, both in the radiation belts and over the polar caps, since launch in July 1992. The instrument includes several channels that sense multi-MeV electrons with strong rejection of background; this enables us to observe these particles even during strong proton-dominated solar energetic particle (SEP) events. During a few events over the last solar activity cycle, notably the October/November 2003 events, we detect electrons with energies above 10 MeV. We will present a survey of SEP electron observations over the SAMPEX mission to date, including fluxes and spectral shapes.

SH22A-02 1045h

Comparing Solar Hard X-ray Emissions and Impulsive Electron Events seen at 1AU

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The Sun frequently accelerates electrons in solar flares and type III radio bursts. Some of the accelerated electrons lose their energy by collisions in the denser, lower solar atmosphere producing hard X-ray (HXR) emissions, while others escape into interplanetary space. Whether the HXR producing and the escaping electrons are accelerated by the same mechanism is not known. We present a combined study of RHESSI

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