ULYSSES SCIENTIFIC RESULTS: FALL 1997

SOLAR WIND (SWOOPS: J. Gosling)

The transition from continuous high speed wind at about 750 km/sec to alternating high and low speed winds has been observed to take place near 20 degrees north latitude. The transition out of the high speed polar wind occured over a latitude range of only 20 degrees. The observed wind speed variations at low latitude are small,i.e., there is little difference between the fastest and slowest streams. These observations are consistent with the Heliospheric Current Sheet having a very low inclination so that the variation in heliomagnetic latitude is small. The interacting fast and slow streams give rise to reverse shocks observed near 20 degrees latitude consistent with the Pizzo model based on a tilted magnetic dipole. However, at lower latitudes, few reverse shocks are seen and mostly forward shocks are present. The reason for this discrepancy is unknown.

MAGNETIC FIELD (MAG: R. Forsyth, E. Smith)

The transition from polar to low latitude solar wind structure is seen as a rapid decrease in the level of Alfven waves and the reappearance of inward magnetic field polarities indicating penetration below the heliospheric current sheet. Corotating Interaction Regions and Rarefaction Regions are again being observed. However, even at low latitudes, the positive or outward magnetic field polarity is still much more dominant implying a very low inclination of the current sheet. A magnetic field and plasma signature has been found inside a coronal mass ejection that is similar to that previously seen only in the Earth's distant magnetic tail. It consists of a pair of shocks, propagating in the slow mode, surrounding an embedded current sheet across which the magnetic field reverses direction. This signature is considered to be indicative of magnetic merging of oppositely-directed magnetic fields within the CME which has been hypothesized in the past but not observed previously.

PICK-UP IONS AND THE INTERSTELLAR MEDIUM (SWICS: G. Gloeckler)

Observations of pick-up ions have been used to infer elemental and isotopic abundances in the Local Interstellar Cloud with densities : n(1H) = 0.2, n(4He) = .024 and n(3 He) = 5.6 x 10-6 cm-3. The ratio of the two helium isotopes is related to the abuncance of 3He in the protosolar cloud 4.5 BY before the present and has consequences for conditions after the Big Bang. The effect of CIR shocks on ion acceleration shows that both solar wind ions and pick-up ions are being accelerated. The stream interface between interacting slow and fast streams at low latitudes is being identified using changes in ion abundances and the freezing-in temperature inferred from the heavy ion charge states.

COSMIC DUST (DUST: B. Gustafson)

Analysis of dust observations indicates that the dust near the ecliptic is heavier than at higher latitudes. A gap exists in the mass distribution with particles of a certain mass, corresponding to the beta meteoroids, being missing.

HALE-BOPP PLASMA TAIL (IDS: J. Brandt)

The plasma tail of the comet was found to be surprisingly structure-less at high latitude. A tail disconnection was observed on may 7-8, 1997. According to corresponding WIND data, Hale-Bopp was near the heliospheric current sheet at the time. The disconnected tail was very long, 30 million km in length, and quickly came up to the solar wind speed of 520 km/sec.

REPEATING GAMMA RAY BURSTS (GRB: K. Hurley)

There is a class of gamma ray bursts at relatively low energies that repeat, but are not periodic,whereas, those at higher energies do not repeat. Combined Ulysses, WIND and GRO observations have led to three possible associations with supernova remnants or SNRs. The relative motion of Ulysses leads to several annulae for the location of the repeating GRBs which agrees with the location determined by the XTE. It is difficult, however, to identify an optical counterpart to the source because of obscuration by dust and gas. It is hoped that the source may be identifiable in IR observations.

ENERGETIC PARTICLES (COSPIN: H. Kunow, T. Sanderson, R. Marsden)

The galactic cosmic rays exhibit radial and latitudinal gradients of 0.3%/ deg and 3.5%/AU, respectively. Recent observations of the energetic particle peaks associated with corotating interaction regions/ CIRs show them to be irregular and not periodic as seen previously. This feature reflects the changing character of the CIRs during this phase of the solar cycle. Energy spectra from two instruments (HISCALE and LET) over an extended range are better represented as a function of energy than as a function of velocity. This finding favors shock drift acceleration as the basic mechanism.