Ion distribution functions in magnetic holes in the solar wind

M. Neugebauer, B. E. Goldstein, and D. Winterhalter
MS 169-506, Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA 91109.

D. B. Reisenfeld
LANL

R. J. MacDowall
Goddard Space Flight Center

Magnetic holes are localized depressions of the magnetic field in the solar wind. We have identified a number of long-duration (>8 minutes) magnetic holes in the otherwise fairly uniform high-latitude solar wind from the south polar coronal hole. Two-dimensional (parallel and perpendicular to the magnetic field) distribution functions were calculated from the Ulysses SWOOPS data using a new procedure to deconvolve the angular distribution of the plasma from the angular smear caused by the instrument resolution. Just outside the magnetic holes the solar wind had the two proton beams with different speeds and the differential flow between the protons and alphas usually seen in the fast solar wind. Inside the holes, however, the secondary proton beam disappeared, the proton temperature perpendicular to the field increased, and the differential streaming velocity of the alpha particles decreased. Langmuir, ion-acoustic, and whistler waves were present in some of the holes and absent in others. This paper briefly summarizes the deconvolution method and presents a sample of results in and adjacent to a few magnetic holes.