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Voyager at the Heliosphere's Termination Shock: Energetic Particle Observations

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The Voyager 1 spacecraft encountered the termination shock of the solar wind in mid-December of 2004 and entered the heliosheath. Voyager 1 was then 94.0 AU from the Sun and at N34^o heliographic latitude. Since that time until at least day 10 of 2006 (97.8 AU), the spacecraft has remained in the heliosheath. We will describe intensities and angular distributions of ions >40 keV and electrons >26 keV associated with the termination foreshock region, termination shock, and heliosheath. These measurements are from the Low Energy Charged Particle instruments on Voyagers 1 and 2. Notable features observed thus far in the heliosheath particle data from Voyager 1 include: (1) high, relatively smooth intensities devoid of the large, quasi-recurrent fluctuations that characterized intensities in the foreshock region; (2) ion energy spectra from 40 keV to several MeV that are well fit by a power-law in energy with spectral slope ≈-1.5; (3) large reductions in the amplitudes and occurrence rates of anti-sunward, near-azimuthal beaming anisotropies that were routinely seen in the foreshock ion data; and, (4) radial plasma flow speeds, estimated from analysis of low-energy ion angular distributions, that remain less than ∼100 km/s. We are fortunate to be currently receiving heliosheath data from Voyager 1 and solar wind data from Voyager 2, which is now in termination foreshock region. Voyager 2 began measuring low intensities of termination shock precursor protons in late 2004 (75 AU, S26^o). By mid-2005 (77 AU), the intensity of 3-17 MeV protons measured at Voyager 2 reached levels comparable to those observed at Voyager 1 during the latter half of 2002 (85-87 AU). Ion data at Voyager 2 show quasi-recurrent intensity variations and near-azimuthal beaming anisotropies that are directed mainly sunward, opposite to the mainly anti-sunward beaming anisotropies measured in the termination foreshock by Voyager 1.