THE APPARENT LAYERED STRUCTURE OF THE HELIOSPHERIC CURRENT SHEET: MULTI-SPACECRAFT OBSERVATIONS

CLAIRE FOULLON 1,2, B. Lavraud 3,4, N.C. Wardle 1,2, C.J. Owen 1, H. Kucharek 5, A.N. Fazakerley 1, D.E. Larson 6, E. Lucek 7, J.G. Luhmann 6, A. Opitz 3,4, J.-A. Sauvaud 3,4, R.M. Skoug 8

1. Mullard Space Science Laboratory, University College London, Holmbury St. Mary, Dorking, Surrey, RH5 6NT, U.K.
2. Present address: Centre Centre for Fusion, Space and Astrophysics, Department of Physics, University of Warwick, Coventry CV4 7AL, U.K. (e-mail: claire.foullon@warwick.ac.uk)
3. Centre d'Etudes Spatiales des Rayonnements (CESR), Université de Toulouse (UPS), Toulouse, France
4. Centre National de la Recherche Scientifique, UMR 5187, Toulouse, France
5. Space Science Center and Department of Physics, University of New Hampshire, Durham, NH 03824, U.S.A.
6. University of California, Space Sciences Laboratory, 7 Gauss Way 7450, Berkeley CA 94720-7450, U.S.A.
7. Blackett Laboratory, Imperial College London, Prince Consort Road, London, SW7 2AZ, U.K.
8. Los Alamos National Lab, MS D466, Los Alamos, NM 87545, U.S.A.

Multiple current sheet crossings are ubiquitous features of the solar wind associated with high-beta plasma sheets, notably during the passage of the heliospheric current sheet (HCS). As the HCS is being convected past near Earth, we attempt to resolve spatial scales and temporal variations of the apparent layered structure of the HCS, including adjacent large scale field reversals. We use several spacecraft for good spatial and cross-scale coverage, spanning 550 RE across and 900 RE along the Sun-Earth line: STEREO, ACE and Cluster. The multi-spacecraft magnetic and plasma observations within the leading edge of the sector boundary are consistent with (i) a broad multi-layered structure; (ii) occasional non-planar structures and Alfvénic fluctuations; (iii) various stages of transient outflowing loops formed by interchange reconnection. By comparison of the observations at each spacecraft, we obtain a synthesis of the evolution between the patterns of loops, and hence of the transient outflow evolution along the sector boundary. In particular, we present circumstantial evidence that a heat flux dropout, traditionally signaling disconnection, can arise from interchange reconnection and scattering. Moreover, the inter-spacecraft comparison eliminates ambiguities between interpretations of electron counterstreaming. Overall, the sector boundary layer remains, locally, a steady structure as it is convected in the solar wind across a radial heliospheric distance of 560-580 RE. However, non-planar structures on the Cluster spatial scale indicate that on the broader scale we are not following the evolution of single loops but more likely a bunch of loops with variable properties.

Heliospheric Current Sheet, Slow Solar Wind

Claire Foullon, Centre for Fusion, Space and Astrophysics, University of Warwick, UK, tel: +44(0)2476150211, fax: +44(0)2476523672, e-mail: claire.foullon@warwick.ac.uk