

Cluster and TC1 five point observations of an FTE on Jan. 4, 2005

J. Wang(1), Z.Y. Pu(1), M.W. Dunlop(2), X.G. Zhang(1), Y. Wei(3), X.Z. Zhou(1), S.Y. Fu(1), C. J. Xiao(4), Q.G. Zong(5), Z.X. Liu(6), C. Carr(7), E. Lucek(7), H. Reme(8), A. Fazakerley(9), P. Daly(10), Escoubet(11)

(1)Institute of Space Science and Apply Technology, Peking University, Beijing, China, (2)Space Sciences Division, SST, Rutherford Appleton Laboratory, UK, (3)Institute of Geology and Geophysics, Chinese Academy of Science, Beijing, China, (4)National Astronomy Observatories, Chinese Academy of Science, Beijing, China, (5)Center for Space Physics. Boston University, Boston, USA, (6)Center for Space Science and Application Research, Chinese Academy of Science, Beijing, China, (7)Space and Atmospheric Physics Group, The Blackett Laboratory, Imperial College, London, UK, (8)CESR/CNRS, Toulouse, France, (9)Mullard Space Science Laboratory, Univ. College London, (10)Max-Planck-Institut fuer Sonnensystemforschung, Katlenburg-Lindau, Germany, (11)ESA/ESTEC, Noordwijk, The Netherlands

Observations of an FTE signature at the dayside magnetopause are reported, which is consecutively observed on Jan.4, 2005 by each of five spacecraft comprising the Double Star TC1 spacecraft and the Cluster quartet, while the spacecraft were traversing through the northern-dusk magnetopause. The GSE locations of Cluster and TC1 were $\sim(3.91, 12.03, 5.01) R_E$ and $(4.33, 12.50, 1.93) R_E$ (GSE), respectively. The event occurred as a magnetosheath FTE at the first Cluster spacecraft at about 07:13 UT on 04 01 2004 and crossed each of the others within 2 minutes. The spatial separations between the Cluster spacecraft were of the order of 200 km and the relative TC1 location was at $\Delta X \sim 0.42 R_E$, $\Delta Y \sim 0.47 R_E$, and $\Delta Z \sim 3.08 R_E$. The TC1 signature occurred about 110s after Cluster. deHoffmann- Teller (H-T) analysis of the signatures implies that the associated flux ropes observed by Cluster and TC1 were moving with similar velocities eastward and northward, consistent with the polarity for the observed FTEs and the spacecraft locations. The orientation of the flux rope can also be computed and is found to be similar at each spacecraft. Reconstruction of the flux rope signature suggests that they contained approximately equal amounts of magnetic flux. The 3-D distributions of thermal ions in the two FTEs were also similar. The distance of TC1 perpendicular to the plane containing the axis of flux rope observed by Cluster and its H-T velocity is much smaller than the cross-section dimension of the flux ropes observed by both Cluster and TC1. These findings strongly suggest that Cluster and TC1 encountered the magnetosheath branch of the same flux tube at two different positions along its length and this is borne out by computation of the expected time delay between the spacecraft based on the estimated orientation of the tube. Four-spacecraft timing is used to confirm the H-T velocity calculation. Several approaches are used to

estimate the axis orientation of the flux rope, so that the large-scale configuration of the flux rope is well postulated based on the five-point measurements.