

DSP and Cluster observations of a plasma sheet thinning event in the night-side magnetosphere

IANNIS DANDOURAS¹, HENRI REME¹, CLAIRE VALLAT¹, GEORGE K. PARKS²,
JINBIN CAO³ and CHRIS CARR⁴

¹*Centre d'Etude Spatiale des Rayonnements, CNRS/UPS, Toulouse, France*

²*Space Sciences Laboratory, University of California, Berkeley, USA*

³*Center for Space Science and Applied Research, Beijing, China*

⁴*Blackett Laboratory, Imperial College, London, UK*

Since early 2004, the Chinese spacecraft Tan Ce 1 (TC 1), first component of the Double Star mission DSP, is on an equatorial elliptical orbit (13.4 R_E apogee), allowing the study of the dynamics of the Earth's Magnetosphere, in conjunction with the four European Cluster spacecraft (19.6 R_E apogee). The Cluster and Double Star spacecraft orbits are such that the spacecraft are almost in the same meridian, allowing conjugate studies of the propagation of energy release phenomena in the magnetotail. On September 14, 2004, TC 1 spacecraft was in the central plasma sheet, close to local midnight at $R \approx 13 R_E$. Almost simultaneously with the development onset of a negative bay in the AL activity index, the HIA instrument onboard TC 1 started detecting an anti-earthward ion flow, associated with a decrease of the plasma density. HIA (Hot Ion Analyzer) is an ion spectrometer, identical to the HIA sensor of the CIS instrument on-board the 4 Cluster spacecraft, that measures the 3D distribution functions of the ions between 5 eV/q and 32 keV/q without mass discrimination. Following this anti-earthward ion flow detection the spacecraft entered into the lobe, due to the plasma sheet thinning, and at ~ 10 UT the spacecraft re-entered into the plasma sheet, which was expanding with $\sim 300 \text{ km s}^{-1}$. Plasma sheet expansion was accompanied by strong tailward and then earthward plasma flow ($\sim 500 \text{ km s}^{-1}$). The FGM (FluxGate Magnetometer) experiment onboard TC1 observed a dipolarisation of the magnetic field during the plasma sheet expansion. During this plasma sheet thinning event the Cluster spacecraft were continuously in the northern lobe, also close to local midnight, at $R \approx 11.5 R_E$. One hour later they entered into the plasma sheet, at $R \approx 12.5 R_E$, where they observed in the boundary a strong earthward plasma flow ($\sim 500 \text{ km s}^{-1}$), followed by tailward flow. These observations, and the plasma distributions responsible for these high velocity moments, will be examined and discussed in terms of substorm development.

Keywords: Magnetotail; Plasma Sheet; Substorms; Double Star; Cluster.