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Cluster and Double Star multipoint observations of a plasma bubble

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The processes responsible for the formation and propagation of Bursty Bulk Flows in the Earth's magnetotail, and their relationship to larger scale magnetotail phenomena, are still uncertain. One possible explanation of BBFs is that they are depleted flux tubes, or plasma bubbles (Chen & Wolf, 1993), that convect earthwards under the action of an interchange instability. Here we present an analysis of a plasma bubble, its propagation, and the effect it has on the plasma it is moving through, using the four Cluster and Double Star TC-2 spacecraft.

On 21 September 2005 the Cluster spacecraft were in a multiscale configuration and located in the magneotail near midnight MLT. A few minutes prior to substorm onset three of the four Cluster spacecraft detected magnetic and plasma signatures consistent with a plasma bubble while the fourth missed the bubble but observed the effects of its passage, notably tailward-directed return flows. A feature interpreted to be the same plasma bubble was detected approximately 3 minutes later by the Double Star TC-2 spacecraft, located just outside geosynchronous orbit.

This work is being carried out as part of an International Space Science Institute (ISSI) working group on 'Comparative Cluster- Double Star measurements of the Magnetotail'.