

Study of waves in the magnetotail region with Cluster and DSP

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The study of the neutral sheet is of fundamental importance in understanding the dynamics of the earth's magnetosphere. From the earliest observation of the magnetotail, it has been found that the neutral sheet frequently appears to be in motion due to changing solar wind conditions and geomagnetic activity. Multiple crossings of the neutral sheet by spacecraft have been attributed to a flapping motion of the neutral sheet in the north-south direction, to a wavy profile either along the magnetotail or the dawn-dusk direction. However, the exact origin and mode of these waves were not well understood before the CLUSTER era due to the difficult to separate the temporal and spatial variations. Recently, the neutral sheet has been studied extensively using measurements of four CLUSTER spacecraft. The CLUSTER observations have revealed that the flapping motions of the earth's magnetotail are of internal origin and that kink-like waves are emitted from the central part of the tail and propagate toward the tail flanks. In this paper, we present such wavy neutral sheet oscillations observed by the CLUSTER. The latest results from Double Star mission are also discussed here. Other interesting waves in the magnetotail are found in the ULF range. We will present one conjunction event between Cluster, TC1 and ground stations from the AARI chain in northern Russia. All spacecraft and the ground based magnetometers showed ULF wave activity at a period of approximately 5 minutes during fast Earthward flow. We further analyze the flow channel and these ULF waves, using the magnetometer and plasma data from Cluster and TC1. We will identify the wave modes and will look into the wave generation mechanism and the flow breaking between Cluster and TC1.