

## Characteristics of magnetotail lobe Alfvén waves and its relationship to the ground pulsations: Cluster, DSP and IMAGE chain

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The magnetotail lobe is a region of very low plasma density but stronger magnetic field, compared to the neighboring magnetosheath and plasma sheet. In this region, Cluster spacecraft sometimes observed the low-frequency electromagnetic fluctuations, especially in the region close to the plasma sheet boundary layer (PSBL). First we show the characteristics of those waves using several Cluster lobe events. As a result, the lobe waves show Alfvénic properties and transport their wave energy (Poynting flux) on average toward the Earth along magnetic field lines. Taking into account the fact that all events are associated with auroral electrojet enhancements, the source of the lobe waves might be a substorm-associated instability, i.e., some instability near the reconnection site, or an ion beam-related instability in the PSBL.

Secondly a good conjunction wave event observed by spacecraft and IMAGE magnetometer chain is studied in detail. Double Star Program (DSP) TC1 monitors the plasma sheet where the compressional waves are dominant, while Cluster and DSP TC2 detect the left-hand polarized waves in the lobe. The ground magnetometers show the signature of field line resonance (FLR) around the auroral latitude, while the fluctuations at higher latitude stations show similar circularly polarized waves observed in the lobe region. We discuss what the source of FLR is and how the FLR connect to the circularly polarized waves in open region.