# Formation of Cold Dense Plasma Sheet: Double Lobe Reconnection vs Kelvin-Helmholtz Instability

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The formation of the cold dense plasma sheet under northward IMF conditions is one of the most important unsolved problems in the Earth's magnetosphere. Two major candidates, (1) high latitude reconnections in both hemispheres which capture the magnetosheath plasma (double lobe reconnection) and (2) the Kelvin-Helmholtz instability at the flank magnetopause, have been discussed to account for the transport of the magnetosheath plasma to the magnetosphere and the resulting formation of the cold dense plasma sheet. However, their relative importance in the formation of the cold dense plasma sheet is presently unknown.

In this paper, we discuss either the double lobe reconnection or the Kelvin-Helmholtz instability is the dominant process for the formation of the cold dense plasma sheet under northward IMF conditions, using the GEOTAIL observation of the cold dense plasma sheet in the dusk flank region. We observed the cold dense plasma sheet in the dusk flank region which is characterized by the ion velocity distribution functions consisting of cold and hot components, and the electron velocity distribution functions consisting of a single cold component without a hot component. It is suggestive that the double lobe reconnection is responsible for the plasma transport across the magnetopause which results in the formation of the cold dense plasma sheet, since the absence of the hot electron component cannot be explained merely by the Kelvin-Helmholtz instability. The observed cold dense plasma sheet bordered by the hot tenuous plasma sheet indicates that the hot ion component coexisting with the cold ion component is supplied by the gradient/curvature B drift of the hot tenuous plasma sheet. Furthermore, we found the cold dense plasma sheet observed just inside the Kelvin-Helmholtz unstable magnetopause. These results indicate that the double lobe reconnection and the Kelvin-Helmholtz instability are not exclusive mechanisms but can take place simultaneously.