

Geotail observations of two-component protons in the midnight plasma sheet

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Through the effort to obtain clues toward understanding of transport of cold plasma in the near-Earth magnetotail under northward IMF, we find that two-component protons are observed in the midnight plasma sheet under northward IMF by the Geotail spacecraft. Since the two-component protons are frequently observed on the duskside during northward IMF intervals but hardly on the dawnside, those found in the midnight plasma sheet are thought to come from the duskside. The cold proton component in the midnight region occasionally has parallel anisotropy, which resembles that in the tail flank on the duskside. The flows in the plasma sheet with two-component protons were quite stagnant or slightly going dawnward, which supports the idea that the observed two-component protons in the midnight region are of duskside origin. Because the two-component protons in the midnight plasma sheet emerge under strongly northward IMF with the latitudinal angle larger than 45 degrees, and because the lag from the strongly northward IMF to the emergence can be as short as a few hours, we suggest that prompt plasma transport from duskside to midnight region occurs under strongly northward IMF. We propose that the dawnward flows result from viscous interaction between the high-latitude portion of the plasma sheet and the lobe cell. In addition, we also suggest that gradual cooling of hot protons under northward IMF is a global phenomenon in the near-Earth magnetotail.