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Alternative interpretation of results from Kelvin-Helmholtz vortex identification criteria

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The tail-flank magnetopause is known to be potentially subject to the Kelvin-Helmholtz instability (KHI), by which fluctuations of the boundary are amplified and may develop into rolled-up vortices downstream of the terminator. These rolled-up vortices may contain lower density but faster than sheath (LDFTS) plasma from the magnetospheric side of the magnetopause: the plasma is accelerated in the vortices so that pressure balance is maintained. Consequently, LDFTS plasma has been regarded as a marker of magnetopause vortices. However, observations of LDFTS plasma at the magnetopause far upstream of the terminator suggest that KH-vortices are not the only explanation for its appearance.

We present two alternative explanations for LDFTS plasma observations: (1) the presence of a plasma depletion layer, which, by definition, contains lower density plasma than the magnetosheath proper that is additionally accelerated by the release of magnetic tension and by magnetic pressure gradient forces; (2) the pattern of velocity disturbances that is associated with magnetopause surface waves, by which spacecraft-observed sheath plasma of higher/lower density is further decelerated/accelerated in the direction of the magnetosheath flow.