Structure of the magnetopause observed by MMS and its effects on the Kelvin-Helmholtz instability

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How to cause plasma mixing across different plasma regimes has been one of the fundamental problems in the collisionless plasma physics. At a plasma boundary where different plasma regimes are in contact, there often exists a velocity shear and a density gradient. The Kelvin-Helmholtz instability (KHI) has been studied as a promising mechanism to cause the plasma mixing. Although the importance of the density gradient in the plasma transport acress the Earth’s magnetopause has previously been pointed out, the detailed structure of the boundary remains unknown due to lack of high-cadence observations across the magnetopause. Based on high time-resolution observations of ions and electrons as well as simultaneous magnetic field by MMS, we investigated the relations between the density gradient and velocity shear at the magnetopause. Based on the observed structure, we implemented a new initial condition for KHI simulations, and effects of the boundary structure on KHI excitation and subsequent plasma mixing is discussed.

Keywords: magnetopause, boundary layer, Kelvin-Helmholtz Instability, plasma mixing, density gradient, MMS

