R008-21
C 会場 ：11/27　 AM2 （10:30-12:00）
11:45〜12:00

地球磁気圏自律システムとしてのケルビンヘルムホルツ不安定

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Autonomous Kelvin-Helmholtz Vortex-Generating System in the Earth's Magnetosphere

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Recently, a prolonged simultaneous observation of the Kelvin-Helmholtz (K-H) wave on the dawn and dusk magnetopauses by the Magnetospheric Multiscale (MMS) and THEMIS-A (THA) spacecraft has been reported in numerous papers (e.g., Lu et al., 2019). The wave periods vary on both flanks, with similar average periods of 303 ± 107 s for MMS and 266 ± 102 s for THA. The lag time between the variations in the wave periods is close to the wave propagation time from THA to MMS, which suggests that the K-H waves are generated and propagate quasi-symmetrically on both flanks. However, vortex induction between two different rows at dawn and dusk over such a large distance is unlikely.

To address this mysterious induction between these two rows of vortices, we must first understand that Kelvin-Helmholtz instability (referred to as K-H instability) in its initial stage is a linear shear instability (Chandrasekhar, 1968). These linear transverse vortices grow within the shear layers, and once the growth of linearly unstable modes saturates, the vortices shed off from the shear layers and become what are referred to as free vortices. The core lines of these shed free vortices extend along the outermost magnetic field lines. These vortices extend from both the dusk and dawn sides of the magnetosphere and confront each other in both polar regions. Thus, the induction coupling of two different rows of dawn and dusk vortices occurs near the polar regions. However, these vortices do not rotate in opposite directions; instead, they rotate in the same direction to form what is known as an "inverse Karman vortex street." The inverse Karman vortex streets are sustained by propulsive flow related to polar lobe reconnections. Thus, vortex shedding and polar lobe reconnections can be coupled near the magnetospheric polar regions.