A Comparison of ULF waves in the inner magnetosphere and Kelvin-Helmholtz instability at the magnetopause

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Global ultra low frequency (ULF) pulsations are MHD plasma waves, that are observed in the magnetopause and on the ground. Several authors have shown that conditions in the solar wind are well correlated with ULF pulsations observed in the magnetosphere [Mathie and Mann, 2001]. ULF pulsations could be excited by Kelvin-Helmholtz (K-H) surface waves at the magnetopause, which is driven by the solar wind. Especially, the toroidal ULF wave dominantly occurs on the flankside in the inner magnetosphere, which is likely associated with the KH instability [Liu et al., 2009]. However, few studies examine whether the Kelvin-Helmholtz instability at the magnetopause is the source of ULF pulsations in the inner magnetosphere via in-situ observations.

We compared magnetic disturbances relating to K-H instability at the magnetopause to ULF perturbations in the inner magnetosphere between 09:21-11:27 UT on September 8, 2015, using data observed by MMS and VAPs satellites, when MMS and VAPs were located at the same local time in the dusk side (MLT˜15 h). When MMS crossed the low-latitude boundary layer between 09:20-10:07 UT, it observed KHI waves with the dominant frequency of 13 mHz. When MMS were located at the magnetosheath between 10:07-11:27 UT, the magnetic perturbations have broadband frequency range (10-25 mHz). VAPs-A, which was located at L˜5.5 at 10:00-11:00 UT, observed monochromatic Pc4 pulsations in both the radial and azimuthal components of the magnetic field at the dominant frequency of 12mHz and of the electric fields at the dominant frequency of 23 and 4 mHz.

We derived Poynting flux from the magnetic and electric field data from MMS. Poynting flux shows that the wave energy of the magnetic disturbances observed by MMS propagate southward at the LLBL and duskward at the magnetosheath. In this presentation, We will discuss relationship between KHI and ULF in the inner magnetosphere.