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Turbulent Transport of the Solar Wind Plasma : Full Particle Simulation Study of the Kelvin-Helmholtz Instability

YOSUKE MATSUMOTO[1] and MASAHIRO HOSHINO[2]
[1]*Graduate School of Environmental Studies, Nagoya University*
[2]*Graduate shool of Science, University of Tokyo*

Recent in-situ observations often show the mixing of the solar wind and magnetospheric plasmas in the low latitude boundary layer (LLBL), in which the Kelvin-Helmholtz instability is considered to be unstable. These suggest that LLBL is a candidate for a source of plasmas and the Kelvin-Helmholtz instability plays an crucial role in a new transport mechanism1. Even though numerous theoretical and computational studies have challenged to explain it so far, no one succeeded in transport of plasmas over a K-H vortex size and diffusive process that explains the observations. Hence, the transport mechanism of the solar wind plasma into the Earth magnetosphere in the situation of northward IMF has been a hot topic in magnetospheric physics.
To elucidate the mixing and transport mechanism of the solar wind plasma we carried out two dimensional full particle simulation of the K-H instability. As a result, the strong density strati_cation triggered the strong turbulence which was also found in the two-dimensional MHD simulation[2]. The secondary Rayleigh-Taylor instability was found out to be unstable inside the stratified vortex structure and transport the dense solar wind plasma deep inside the magnetosphere. The resultant mixing area of the two plasmas increased anomalously fast with time in spatially extended area as compared in the uniform density case. We therefore conclude that the density stratification is an important factor for the effective mass transport across the velocity shear layer.
In this presentation, the onset mechanism of the turbulent mixing and transport by the K-H instability will be presented in detail

Keywords: Kelvin-Helmholtz instability; LLBL; turbulence

References

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