Mirror-mode Structures in the Magnetosheath : 3D Hybrid Results

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The temperature anisotropy (T*?*/T*k* >1) of ions in the magnetosheath drives the mirror and L-mode electromagnetic ion cyclotron instabilities. We performed three-dimensional (3D) hybrid simulations to study the competing process between these instabilities. Mirror instability becomes dominant by two reasons: the large volume of the mirror mode waves in the 3D wavenumber space and the quick dissipation of the L-mode EMIC waves due to nonlinear evolution [1]. We analyzed the relation between the mirror instability and the magnetic peaks and decreases which are peculiar magnetic structures observed in the magnetosheath and the heliosheath. We performed parametric analyses of the 3D simulations to understand whether the mirror instability contributes to the magnetic peaks or decreases. The magnetic decrease-like structures in the local regions become stable because of the existence of He++. We also analyzed the competing process of these instabilities in 2D and 3D open boundary systems. Comparing with the results in the periodic boundary model, we found the other reason for the dominance of the mirror instability. In the open boundary systems, because of the propagation of EMIC waves, we can obtain the clearer non propagating mirror mode structures. We found the difference of the eigen mode of the mirror mode waves between the 2D and 3D models. We performed the parametric analyses and discussed the stability of these structures comparing with the observations in the magnetosheath.

References

[1] Shoji, M., Y. Omura, B. T. Tsurutani, O. P. Verkhoglyadova, and B. Lembege (2009), Mirror instability and L-mode electromagnetic ion cyclotron instability: Competition in the Earth’s magnetosheath, J. Geophys. Res., 114, A10203, doi:10.1029/2008JA014038.