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Nonlinear Mirror Mode Structures in the Three-dimensional Model

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The temperature anisotropy (T_per/T_par>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. We analyzed the mirror mode structures in the 3D model which are different from those in the 1D and 2D models. 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. We also introduced the He++ ions in the simulation space. He++ ions form top-flatten velocity distribution functions because of the interaction with the mirror mode structures. The nonlinear magnetic structures formed by mirror instability in the local regions, on the other hand, become stable. We also performed the 2D and 3 D hybrid simulations with the open boundaries. In the open boundary system, the EMIC waves go out from the simulation space and thus we can obtain clearer mirror mode structures. We analyzed the eigen mode of the mirror mode waves in the 3D models.

Keywords: mirror instability, 3D structure, hybrid simulation