Nonlinear Evolution of Mirror Mode Structures: Comparison with the Magnetic Peaks and Dips in the 3D Simulations

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The temperature anisotropy of ions in the magnetosheath drives the mirror instability. At the nonlinear stage of the mirror instability, coalescence of the mirror mode structures takes place. Through the coalescence, the scale size of the mirror mode structure in the transient coalescence of the 3D model (˜40 ion inertial lengths) becomes in good agreement with planetary magnetosheath observations. Furthermore, we analyze the relation between the mirror instability and the magnetic peaks/dips which are curious magnetic structures observed in the magnetosheath. We performed the parametric analyses of 3D simulations to understand whether mirror instability contributes to the magnetic peaks or dips. We have developed the new hybrid simulation model to analyze the coalescence of monochromatic mirror mode structure with the filter using fast Fourier transform. In this model, we select the thermal noise that grows to the coherent mirror mode waves at specific wavenumbers. We study coalescence of the coherent mirror mode waves. We also perform test particle simulations in the monochromatic mirror mode structure to analyze the motion of ions at the nonlinear stage. In these test particle simulations, we model the electromagnetic field constructed by the mirror instability. The motion of the particles which causes the coalescence is analyzed. We present evolution of the velocity distribution function of the particles in the magnetic structure.