Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

PEM026-02 会場:101 時間:5 月 24 日 14:30-14:45

3 次元モデルにおける非線形ミラーモード磁場構造
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 instability. We performed two-dimensional (2D) and three-dimensional (3D) hybrid simulations in open boundary models to study the nonlinear mirror mode structures. In the open boundary systems, because of the propagation of EMIC waves, we can obtain the clearer non propagating mirror mode structures. We analyzed the relation between the mirror instability and the magnetic peaks and dips which are peculiar magnetic structures observed in the magnetosheath. In the 2D open boundary model, we obtain the clear magnetic dips at the nonlinear stage. The magnetic structures become larger in the parallel directions rather than the perpendicular directions. In the 3D model, on the other hand, the mirror instability makes the magnetic peaks structures with the same parameters. We obtain the cigar-like magnetic peaks structures, because of the nonlinear evolution of mirror instability and the symmetric structure in the perpendicular directions. We also performed parametric analyses on the ion beta in both 2D and 3D models. We find that the magnetic peaks also arise in the 2D high beta case as shown in the Cluster observations. Considering the pressure balance between the magnetic field and plasma, we show how the ion beta dependence of the magnetic structures appears. In all parameters, we obtain the magnetic peaks in the 3D models.
Keywords: Mirror instability, Magnetic peak, Magnetic dip, 3D hybrid simulation