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

PEM026-23 会場:101 時間:5 月 25 日 10:00-10:15

垂直衝撃波の再形成に関する 2 次元全粒子シミュレーション
On the reformation at perpendicular shock: 2D full PIC simulation

木谷 佳隆 [1*], 梅田 隆行 [1], 荻野 竜樹 [1], 松清 修一 [2]
Yoshitaka Kidani[1*], Takayuki Umeda[1], Tatsuki Ogino[1], Shuichi Matsukiyo[2]

[1] 名古屋大学太陽地球環境研究所, [2] 九州大学総合総合理工学研究院
[1]STEL, Nagoya Univ., [2]ESST, Kyushu Univ.

A full particle-in-cell (PIC) simulation study is carried out on the reformation at a quasi-perpendicular collisionless shock with a relatively low Alfven Mach number (MA=5) and shock-normal angle of 80 degrees. Previous self-consistent one-dimensional (1D) hybrid and full PIC simulations have demonstrated that ion kinetics is essential for the non-stationarity of perpendicular collisionless shocks. These results have shown that reflection of ions at the shock front is responsible for the periodic collapse and redevelopment of a new shock front on a timescale of the ion cyclotron period, which is called the shock reformation. Recent 2D hybrid and full PIC simulations, however, suggested that the shock reformation does not take place in exactly-perpendicular shocks with MA ~ 5. By contrast, another 2D hybrid PIC simulation showed that the shock reformation persists in quasi-perpendicular shocks MA ~ 5. Although these recent two works seem to be inconsistent with each other, this reason is not well understood because of several differences in simulation conditions.

In the present study, we performed a 2D full PIC simulation of a quasi-perpendicular shock to make a direct comparison between quasi- and exactly-perpendicular shocks with almost the same condition. It is found that the time development of the shock magnetic field averaged over the shock-tangential direction shows the transition from the reformation to no-reformation phase, which is consistent with the recent full PIC simulation results of exactly-perpendicular shocks. On the other hand, local shock magnetic field shows the evident shock reformation, and the period of the reformation is changed in the no-reformation phase.

キーワード: 垂直衝撃波, 粒子シミュレーション, 再形成
Keywords: perpendicular shock, PIC simulation, reformation