



Particle Acceleration and Shock Structures in Shock-Shock Interaction

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Shock-shock interactions occur on various places in space and the interaction can produce high energy particles. For example, two or multiple coronal mass ejections (CME) are released from the Sun sometimes [Li et al., 2011]. In this situation, the preceding shock produces seed particles and the following shocks re-accelerate the seed particles. A CME driven shock can also collide with the Earth's bow shock [Hietala et al., 2011]. This study reported that ions are accelerated by the first Fermi acceleration between the two shocks before the collision. An electron acceleration through an interplanetary-Earth's bow shock interaction was also reported [Terasawa et al., 1997]. The detailed comprehension, however, is still missing due to only few studies.

We have performed one-dimensional full PIC simulations to investigate a shock-shock interaction in which two shocks collide head-on. In a case of quasi-perpendicular shocks, electrons are accelerated by the mirror reflection between the two shocks before the collision. In a case of quasi-parallel shocks, ions can go back upstream and have great effect on the shock structure.

Moreover, we discuss also observational results by mainly using Cluster data. Cluster can observe an interplanetary-Earth's bow shock interaction [e.g. Goncharov et al., 2011]. This can provide us the information of detailed shock structures and the particle acceleration mechanism in such type of shock-shock interaction.