

The analysis of waves observed in the upstream of the slow-mode shocks in the magnetotail

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The existence of the slow-mode shocks in the magnetotail was confirmed by ISEE mission and GEOTAIL satellite in the 80-90's. But the detailed kinetic structure of the slow-mode shocks has not been known yet. In particular, it is very important for understanding the mechanism of heating cold lobe plasma to know the dissipation process in the slow-mode shocks. Meanwhile, a lot of numerical simulations of slow-mode shocks have been done. In the studies, various waves are excited around shocks through some plasma instabilities. The dissipation in slow-mode shocks is the wave particle interaction with the waves. Omid and Winske[1992] indicated the existence of backstreaming particles in the upstream of slow-mode shocks and the importance of the electromagnetic ion/ion cyclotron instability (EMIIC instability). Analyzing the three-dimensional plasma data and the three-dimensional magnetic field data obtained by the GEOTAIL satellite, Saito et al. [1996] found the existence of a region called the fore-shock region upstream for slow-mode shocks. The fore-shock region is characterized by two-component ions: the cold ions that flow from the upstream region into the slow shock and the backstreaming ions that flow from the slow shock toward the upstream region. They indicated that some electromagnetic waves are generated by EMIIC instability in the fore-shock region. Based on the results of Saito et al. [1996], we have analyzed the magnetic structure around the slow-mode shocks using the three-dimensional magnetic field data with a time resolution of 16 Hz. In some events, we have found wave components that seem to have been excited in the fore-shock region. The waves are circularly polarized with long-period. It is thought that they are Alfvén/ion cyclotron waves generated by EMIIC instability. They are very interesting, because there are few reports that such a low frequency wave was observed directly around the slow-mode shocks. We are going to report the identification of these waves and their dissipation process.