

Study of electrostatic plasma waves near the earth's bow shock via Geotail observations

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Earth's bow shock is very turbulent region. Many kinds of intense plasma waves are observed in its region. They are mainly classified into the Broadband Electrostatic Noise (BEN), Electrostatic quasi-monochromatic (EQM) wave, Langmuir wave and Magnetic Noise Burst (MNB). They are believed to be generated by electron beams which are accelerated in the transition region such as bow shock transition region. However, detailed features and generation mechanisms on plasma waves are still unclear, because observed plasma wave features change very quickly in the bow shock region.

We focus on the frequency range of hundred Hz up to few kHz. In this frequency range, we can mainly observe the EQM wave and Electrostatic Solitary Wave (ESW). Frequency and electric field amplitude of the EQM waves are quickly changed in the time scale of a few tens to a few hundred milliseconds. Propagation vector of the EQM waves are parallel to the ambient magnetic field and the EQM waves are purely electrostatic. Important point is that there is no normal electrostatic wave mode which propagates parallel to the ambient magnetic field in this frequency range. Additionally, we can observe the feature that the EQM waves are transformed to the ESW in the few tens seconds. It is well known that early stage of evolution of the bipolar waveform is the monochromatic waveform from computer experiments results. We conceive that these observed features suggest that the spacecraft observes them in the region close to their generation source. In the present study, we will discuss about generation region of the EQM wave and ESW in the view point of the electron beam instabilities in the transition region of earth's bow shock and the EQM wave and ESW.

The Geotail spacecraft crosses the earth's bow shock about two times a week on its orbit since November 1994. In the previous studies, waveform observation of plasma waves in the earth's bow shock has not been conducted. However, Geotail spacecraft has the capability to observe the wave form of plasma waves. In order to make clear the generation mechanism of plasma waves in the bow shock region, we are due to do discussion about analyses such as comparison of intensity of plasma waves and several plasma parameters such as flow speed, temperature and density of plasma with the aid of plenty datasets of the Geotail spacecraft.