

Detection of Bernstein Waves at the Earth's Bow Shock

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Until today, various types of waves have been studied both theoretically and observationally at the transition layer of the Earth's bow shock. The quasi-perpendicular region of the shock was particularly studied because of the simple configuration of each composition: reflected ions, incoming ions and incoming electrons. While ion cyclotron waves, whistler waves, ion acoustic waves, etc. have been detected, Bernstein waves had not been found so far, although predicted by theoretical models.

We then analyzed a shock crossing event obtained on 1 July 1996 by the Geotail spacecraft. The spacecraft was located at (8,19,0)Re in the GSE coordinate and the Mach number and the shock angle had been derived to be 14 and 86 degrees, respectively. During the traversal of the shock foot region, electrostatic harmonic waves were detected by the Wave Form Capture instrument. We will show that the observed waves are the Bernstein waves and discuss their excitation mechanism based on linear dispersion relation. We will also consider why this type of wave had not been observed in the past.