

Geotail Observations During Extreme Solar Events: An Extremely Fast Interplanetary Shock on 29 October 2003

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Collisionless shocks are believed to appear in various astrophysical environments. The heliosphere is an ideal ‘laboratory’ to make detailed studies of physics of collisionless shocks owing to its accessibility for in situ observations. Since velocity jumps obtainable in heliospheric shocks are regulated by the solar wind velocity, they are usually less than several hundred km/s. However, several times over one solar cycle, the sun provides very energetic explosions, from which velocity jumps can reach 1000 km/s or more. The season of October-November 2003 was such an solar active period, during which several strong interplanetary shocks (IPSs) were created.

The topic of this paper is a very fast IPS arrived at 06:09:40 UT on 29 October 2003 at the position of GEOTAIL upstream of the earth’s bow shock. Since this IPS has been regarded as the fastest among IPSs for which in situ measurements were conducted^{1,2}, detailed studies of this IPS must be quite important for the further understanding of collisionless shock phenomena, especially their interaction processes with earth’s magnetosphere. During this event the intensity of high energy solar energetic particles (> several to several tens of MeV) was quite high, causing a serious background problem for plasma particle measurements on GEOTAIL as well as on the other spacecraft. The magnetic and electric field measurements, as well as the plasma wave measurement aboard GEOTAIL, on the other hand, were free from such a background problem. We will discuss how to obtain a reliable estimate of the local plasma parameters from these measurements.

Keywords: CME; interplanetary shocks; particle acceleration.

References

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