Geophysical Research Abstracts
Vol. 14, EGU2012-11219, 2012
EGU General Assembly 2012

Particle acceleration in shock-shock interaction: model to data comparison

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On August 10, 1998, an interplanetary (IP) shock hit the bow shock of the Earth. The quasi-radial interplanetary magnetic field configuration and the advantageously located spacecraft made it possible to analyze in detail the different particle acceleration processes as the shocks approached each other.

After crossing a tangential discontinuity (TD), the spacecraft moved into a flux tube that was filled with a seed population of energetic particles accelerated by the IP shock (phase 1). Since ACE near the L1 point was magnetically connected to the IP shock but not to the bow shock, its measurements could be used to characterize the seed population. Flat flux intensity profiles were observed during the 6–7 hours from the TD crossing to the IP shock crossing. No 'shock-spike' could be identified at the crossing. Wind, located at $X \sim 78\,R_{\mathrm{E}}$, observed several particle bursts coming from the bow shock direction during the first part of the event (phase 2). Later, Wind became continuously connected to both shocks, and measured an increasing flux as well as two counter-streaming populations until the IP shock crossing (phase 3). Geotail was located at the edge of the Earth's foreshock and continuously connected to both shocks. It recorded the highest peak intensity at the IP shock crossing. Furthermore, immediately after the crossing Geotail observed a burst of very high energy particles propagating sunwards (phase 4). Based on the velocity dispersion of the burst and the analysis of the geometry of the two shocks, Hietala *et al.* [2011] claimed that these particles had been released from the magnetic trap between the shocks as they collided.

In the present study we use a global 2.5D test-particle simulation to further investigate particle acceleration in this event. We concentrate on the last hour of the shock-shock interaction, when the IP shock crossed the spacecraft and acceleration phases (3) and (4) were observed. The simulation results confirm that the peak intensity around Geotail's location occurs after the shock crossing due to the shock-shock interaction.

Hietala et al. (2011), J. Geophys. Res. 116, A10105.