Dependence of non-stationary shock structures and electron dynamics on upstream parameters observed by Cluster-II

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Previous observations reveal that suprathermal electrons up to 20 keV are observed at the quasi-perpendicular Earth's bow shock. However, the electron acceleration process at the bow shock is still uncertain. Many simulation studies have indicated that non-stationary structures play an important role for the electron acceleration mechanisms. We investigated the shock structures and electron dynamics in the quasi-perpendicular part of the bow shock by using Cluster data. In our work we focus on the time variation of the shock front. The separation of the spacecraft relative to the scale size of the shock transition is important. The data we used were obtained from Cluster in 2002. Because of small separation distance below 200 km, the temporal evolution of the shock structure can be separated from the spatial variation. The spatial structure is much larger than separation distance in this period. The shock front is a plane over separation distance during this period. We have chosen the critical shock events at quasi-perpendicular shocks. We picked up 29 critical shock crossing events in 2002. In order to determine the shock structure, cross-correlations are computed between spacecraft pairs. We categorized the shock structures into four shock crossing types. In order to analyze the electron acceleration mechanisms the energy spectrum at the shock transition was fitted by a power law function. We will show how emergence of suprathermal electrons is controlled by shock parameters and shock structures.