



Spatial scales in the quasi-perpendicular collisionless shocks observed by Cluster

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The spatial scale of the collisionless shock is important to study the shocks because it determines which physical process to lead the redistribution of the energy at the shock front. The shock scale is also one of the key parameters to determine the acceleration of the particles in astrophysical shocks. In this paper, we analyze a number of bow shocks observed by magnetic field measurement by Cluster satellites. Several different methods are used to determine accurately the shock normal directions such as based on co-planarity theorem, minimum variance analysis, modelled normal, and timing difference between the satellites. Experimentally derived shock scales based on the accurately estimated shock normal directions and velocity are compared with the electron and ion scales such as inertial length for different plasma conditions (e.g. Mach number) to determine predominant formation process of the shock. Furthermore, the experimental results and comparison with theoretical prediction will be presented.