# Shock reformation at quasi-parallel shocks observed by Cluster

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It is well known from ISEE observations that ions reflection is the primary process for high Mach number shocks and the backstreaming ions produced low frequency waves in upstream region of oblique shocks. Additionally, cyclic behavior of an oblique shock which is called shock reformation has been investigated using one-dimensional hybrid simulation. The reformation at parallel shock is caused by the interaction of specularly reflected ions with upstream wave. Furthermore, recent simulation studies using particle-in-cell code indicate that electrons dynamics and micro instabilities in shock transition region strongly affect the cyclic behavior of shock front. However, it is not clear how non-stationarity of oblique shocks contributes to dissipation processes in detail. We study dissipation mechanisms in the shock transition region using in-situ data. Especially, our interests are to understand how ions/electrons dynamics are affected by non-stationarity of shock front.

We study a shock crossing event at quasi-parallel shocks observed by Cluster. Alfven Mach number in this event is 2.7 and shock angle between upstream magnetic field and shock normal are 50 degrees. Each satellite separation is several thousands km. Observational data at each s/c show similar structure. However, these data indicate that the shock reforms periodically. We can observe the low frequency waves due to backstreaming ions in the upstream region as well. (Meziane et al.,)

We will discuss the nonstationarity of shock front observed by Cluster.