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The role of shock reformation at oblique collision-less shocks

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It is well known from ISEE observations that ions reflection is the primary process for high Mach number shocks (Ma$>$2) 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. 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 three shock crossing events at quasi-parallel/perpendicular shocks observed by Cluster. In these events Alfven Mach numbers are 2.9-5.6 and shock angle between upstream magnetic field and shock normal are 40-70 degrees. We identify non-stationary shock front in these events. In addition we can observe the low frequency waves due to backstreaming ions in the upstream region as well. (Meziane et al.,)

We will discuss the relationship between electrons dynamics, shock structure, and micro instabilities in detail.