

On the dissipation region in relativistic pair plasma reconnection

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Magnetic reconnection is an important process of magnetic dissipation, plasma heating and particle acceleration. Relativistic magnetic reconnection in pair plasmas has received attention in astrophysical contexts (pulsar winds, AGNs and magnetars etc.), but underlying mechanism is far from understood as well as the standard non-relativistic reconnection.

In this paper, by using particle-in-cell simulations, we investigate the properties of the dissipation region in relativistic magnetic reconnection in detail. One topic is the current sheet expansion in the relativistic drift-speed limit. Contrary to the non-relativistic picture, the current sheet becomes thicker as the system evolves, because the current intensity has an upper limit. It seems that the reconnection system regulates the current sheet thickness to satisfy the required current.

The other topic is the reconnection rate. It has been widely argued that Hall physics plays an essential role (the GEM reconnection challenge), but reconnection in non-relativistic pair plasma shows a counter-evidence [Bessho & Bhattacharjee 2005]. Instead, although its physical interpretation needs refinement, the off-diagonal part of pressure tensor seems to be favorable. Based on a complete decomposition of relativistic pressure tensor, we will discuss the origin of reconnection electric field which maintains fast reconnection rate.