Magnetic reconnection in highly relativistic plasma fluids

Ryo Yoshitake[1]; Masahiro Hoshino[2]
[1] Earth and Planetary Sci., Univ of Tokyo; [2] Earth and Planetary Sci., Univ of Tokyo

Magnetic reconnection is thought to be an important plasma physical process in space plasma physical contexts, because it can release vast energy of magnetic field in a short period of time, and strong heating or particle acceleration are expected. Thus, magnetic reconnection is widely accepted as a process where we have to explore into the details in the view of not only solar-terrestrial physics but also high energy astrophysics. We focus on, especially, magnetic reconnections of highly relativisitic regime in this study.

By the theoretical approach, Blackman and Field [1994] compared kinematics of relativistic reconnection of the Sweet-Parker model with that of Petschek configurations and concluded that the reconnection inflow is significantly enhanced because of the Lorentz contraction, which also implies that velocity of the inflow approaches the that of light. On the other hand several studies in counterview were also published [Lyutikov and Uzdensky, 2003; Watanabe and Yokoyama, 2006; etc.]. But because of the difficulty derived from the numerical scheme, these studies have not yet confirmed the relativistic limit. One of our purposes of this study is to make this discussion settled by numerical simulations of highly relativistic conditions. For that purpose, we employ two-fluid plasma model which treats positive charged particles and negative charged ones as independent fluids. This model also resolves the numerical difficulties under highly relativisitic plasma fluids. Using this model we will show the simulation results of magnetic reconnections and discuss its relativsitic effects.