相対論磁気リコネクションの流体・磁気流体シミュレーション研究

銭谷 誠司 [1]
[1] NASA/GSFC

Fluid and Magnetofluid Modeling of Relativistic Magnetic Reconnection

Seiji Zenitani[1]
[1] NASA/GSFC

Magnetic reconnection draws recent attention in high-energy astrophysical settings. Since the relativity plays an important role in those sites, relativistic extension of magnetic reconnection have been investigated over the last decades. Although relativistic MHD theories have been discussed (e.g., Lyubarsky 2005) and particle-in-cell simulations (e.g., Zenitani & Hoshino 2007) revealed important features such as nonthermal particle acceleration and plasma instabilities, there is a huge gap between these two approaches.

In this poster we will overview our recent challenges to bridge this gap: we study relativistic magnetic reconnection system by using fluid and magnetofluid models. First, we newly developed a relativistic two-fluid code, which considers both electron and positron fluid motions. Using an inter-species friction force as an effective resistivity, we successfully simulated a nonlinear development of relativistic two-fluid reconnection in a large system. Second, applying recent progress in numerical schemes, we carry out relativistic MHD simulation of magnetic reconnection. Thanks to the shock-capturing code and our exotic parameters, we find a variety of new structures in and around the plasmoid. Using these models, we obtain a state-of-art picture of the relativistic Petschek reconnection. The slow shock angle, the energy budget, parameter dependences, implications for the relativistic reconnection theories, and implications for nonrelativistic reconnection physics will be discussed.