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Plasmoid-dominated turbulent reconnection in symmetric and asymmetric systems

Seiji Zenitani[1], Momoka Yamamoto[1], and Takahiro Miyoshi[2]
[1]Kobe University, Kobe, Japan (zenitani@port.kobe-u.ac.jp)
[2]Hiroshima University, Higashihiroshima, Japan

In magnetohydrodynamics (MHD), magnetic reconnection has been discussed by three theoretical models: Sweet--Parker reconnection, Petschek reconnection, and plasmoid-dominated turbulent reconnection. Among these models, properties of plasmoid-dominated reconnection remain unclear, because it was discovered only recently. In this talk, we explore basic properties of plasmoid-dominated reconnection in a low-beta plasma such as in a solar corona, by using large-scale MHD simulations [1]. We have found that the system becomes highly complex due to repeated formation of plasmoids and shocks. We have further found that the reconnection rate goes higher than previously thought. Next we explore influence of asymmetry in background plasma densities in plasmoid-dominated reconnection. We have found that the average reconnection rate follows Cassak-Shay's hybrid relation [2]. Many signatures become asymmetric across the reconnection layer, and plasmas inside the plasmoids start to swirl in specific directions. Formation processes of these vortices and a potential extension of our numerical survey will be discussed.

References:
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