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Fast magnetic reconnection with a moving X-point in resistive MHD

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Fast magnetic reconnection in high magnetic Reynolds number plasmas is one of the most important physical process of explosive phenomena in space and astrophysical plasmas. In recent years, using high-resolution MHD simulations with high magnetic Reynolds numbers, it has been indicated that fast magnetic reconnection may be triggered by the plasmoid instability in a thin current sheet [1]. Moreover, a state-of-the-art high-resolution MHD simulation revealed that some of multiple secondary reconnection are developed as Petschek-like reconnection [2]. However, the detailed structure and dynamics of individual secondary reconnection is not clarified yet.

The objective of this study is to reveal the structure and dynamics of resistive magnetic reconnection with a moving X-point paying attention to the motion of the secondary reconnection. Particularly, we propose an asymmetric reconnection model where a local anomalous resistivity including a shifting motion is added to the two-dimensional Harris equilibrium. A high-resolution MHD simulation for the asymmetric resistive reconnection was performed using the HLLD approximate Riemann solver and analyzed with respect to the structure in detail. Besides, we discussed the possibility of a self-sustaining mechanism of the asymmetric reconnection due to the flow driven by the reconnection itself.

[1] e.g, N. F. Loureiro, et al., Phys. Plasmas, 19, 042303 (2012)
[2] K. Kusano, K. Nakabou, et al., in preparation

Keywords: magnetic reconnection, MHD, anomalous resistivity model