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Plasmoid-dominated turbulent reconnection in a low-β plasma

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In magnetohydrodynamics (MHD), magnetic reconnection has long been discussed by Sweet-Parker (S-P) and Petschek models. It was recently found that a laminar S-P reconnection evolves to plasmoid-dominated turbulent reconnection in a large-scale system. The reconnection rate during the plasmoid-dominated stage is known to be 0.01, regardless of other parameters. Plasma β in the inflow region is extremely low around reconnection sites in a solar corona. However, despite its importance in a corona, many aspects of the plasmoid-dominated reconnection in the low-β regime remain unexplored, partly because of numerical difficulties.

In this contribution, we explore basic properties of plasmoid-dominated reconnection in a low-β background plasma. We have found that the system becomes highly complex due to repeated formation of plasmoids and vertical shocks (SZ & Miyoshi 2011, 2015). The average reconnection rate increases in the $\beta < 1$ regime, in contrast to popular results. We attribute this to compressible effects. Using a compressible S-P theory (Hesse+ 2011), we have proposed a scaling law for the reconnection rate. This prediction was verified by a numerical survey in the 2-D parameter space. We will also discuss the energy balance and the influence of the initial plasma-sheet models.

Reference: Zenitani & Miyoshi, *ApJL* **894**, L7 (2020)

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