

Formation Mechanism of Petschek-type Reconnection Region in Uniform Resistivity Plasma

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Magnetic reconnection is the explosive energy conversion mechanism of solar flare and magnetospheric substorm. It is, however, still not clear how to explain the fast and explosive energy conversion in the highly conductive plasma of the solar corona or magnetotail. Petschek model is a steady state reconnection model, which can explain fast reconnection. But Kulsrud 2001 argues that Petschek model cannot maintain the diffusion region structure in plasma with uniform resistivity.

We conducted numerical experiment of magnetic reconnection in high Lundquist number (low resistivity) regime and discovered Petschek-type diffusion region appear in a time dependent manner even with uniform resistivity (Shibayama et al. 2015). Furthermore, we developed local model with plasmoid, which allows a formation of quasi-steady Petschek-type fast reconnection in uniform resistivity. In this model, asymmetry of diffusion region between plasmoids restrict the motion of X-point and flow stagnation point. As a result, diffusion region is localized nearby a plasmoid. Reconnection rate is determined by the Petschek-type diffusion region, not by the Sweet-Parker scaling. We can develop a new reconnection regime with Petschek-type model.

Keywords: Magnetic reconnection, MHD, Solar flare

