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Fast magnetic reconnection supported by sporadic small-scale Petschek-type shocks TAKUYA SHIBAYAMA, KANYA KUSANO, ISEE, Nagoya University, TAKAHIRO MIYOSHI, Hiroshima University, GRIGORY VEKSTEIN, University of Manchester — Magnetic reconnection is thought to play a core role in explosive energy conversion. According to the Sweet-Parker theory, it is difficult to conduct magnetic reconnection efficiently in highly conductive plasma. Petschek proposed another reconnection theory. However, numerical simulations suggest that Petschek reconnection is not stable in a system with spatially uniform resistivity. Some mechanism is needed to sustain the localized diffusion region. We perform resistive 2D MHD simulation in a large system with a high spatial resolution, and find that small-scale slow mode MHD shocks predicted by Petschek spontaneously form even under a uniform resistivity. In this process, growth of plasmoids in the current sheet play a role of localizing the diffusion region, and slow mode shocks form next to plasmoids. These plasmoids enhance magnetic reconnection intermittently and repeatedly. As a result, the reconnection rate increases up to 0.02. Furthermore, our simulation suggests that the obtained reconnection rate doesnt depend on the Lundquist number. This is due to a similarity in the evolution of plasmoid in different scale. A part of this study is published in Physics of Plasmas (Shibayama et al. (2015), Physics of Plasmas, 22, 10, 100706).

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