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Three-dimensional plasmoid-mediated reconnection in Hall magnetohydrodynamics YI-MIN HUANG, AMITAVA BHATTACHARJEE, Princeton University — The plasmoid instability is known to mediate the transition to fast reconnection in collisional plasmas described by resistive magnetohydrodynamics (MHD). Due to the plasmoid instability, the reconnection layer becomes a chain of plasmoids connected by secondary current sheets in 2D and self-generated turbulent reconnection in 3D. For many large-scale systems of interest, e.g., the solar atmosphere, the transition may occur in the collisional regime at the early phase, but become collisionless as the current sheet fragmentation proceeds. It is crucial to capture this change in physics regimes during the transition. The Hall MHD model is generally considered the middle ground between the collisional MHD and the collisionless plasmas modeled by kinetic particle-in-cell(PIC) simulations. However, although Hall MHD captures some key physics of collisionless reconnection, it often leads to single-X-line reconnection in 2D after the onset of the plasmoid instability, significantly different from PIC simulation results. In this work, we will present the results of 3D Hall MHD simulations. We show that single-X-line reconnection is less likely in 3D compared to that in 2D. We will contrast the 3D Hall MHD results with the corresponding resistive MHD results and discuss the implications.

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