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Current disruption and its spreading in collision-less magnetic reconnection[1] NEERAJ JAIN, JOERG BUECHNER, Max Planck Institute for Solar System Research, 37191, Katlenburg-Lindau, Germany, SETH DORFMAN, University of California, Los Angeles, CA 90095, USA, HANTAO JI, Princeton Plasma Physics Laboratory, Princeton, New Jersey, USA, A. SURJALAL SHARMA, Department of Astronomy, University of Maryland, College Park, MD, USA, MAX-PLANCK/PRINCETON CENTER FOR PLASMA PHYSICS COLLABORATION
— Recent magnetic reconnection experiments (MRX) [Dorfman et al., Geophys. Res. Lett. 40, 233 (2012)] have disclosed current disruption in the absence of guide field. During current disruption in MRX, current density and total out-of-reconnection-plane current drop simultaneous with a rise in out-of-reconnection-plane electric field. Here we show that current disruption is an intrinsic property of dynamic formation of X-point configuration of magnetic field in magnetic reconnection, independent of the model used for plasma description and of dimensionality (2-D or 3-D) of reconnection. An analytic expression for the current drop is derived from Ampere's equation and its predictions are verified by 2-D and 3-D electron-magnetohydrodynamic (EMHD) simulations. Three dimensional EMHD simulations show that the current disruption due to localized reconnection spreads along the direction of electron flow with a speed which depends on the wave number of the perturbation. The implications of these results for MRX and other reconnection experiments will be presented.

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