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Collisionless Magnetic Reconnection in Large-Scale Electron-Positron Plasmas W. DAUGHTON, H. KARIMABADI, L. YIN, B.J. ALBRIGHT, K. BOWERS, Los Alamos National Laboratory — One of the most fundamental questions in reconnection physics is how the dynamical evolution will scale to macroscopic systems of physical relevance. This issue was recently examined for electron-positron plasmas using 2D kinetic simulations with both open and periodic boundary conditions[1]. The initial phase is distinguished by the coalescence of tearing islands to larger scale while the later phase is marked by the expansion of diffusion regions into elongated current layers that are intrinsically unstable to plasmoid generation. It appears that the repeated formation and ejection of plasmoids plays a key role in controlling the average structure of a diffusion region and preventing the further elongation of the layer. Although the specific details of this evolution are affected by the boundary and initial conditions, the time averaged reconnection rate remains fast and is remarkably insensitive to the system size for sufficiently large systems. In this work, the influence of a guide field and current aligned instabilities are examined in 3D simulations. The mechanism of repeated plasmoid formation identified in 2D is also observed in these large-scale 3D simulations. This dynamic scenario offers an alternative explanation for fast reconnection in large-scale systems.

[1]Daughton and Karimabadi, *Phys. Plasmas* **14**, 072303, 2007

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