Abstract Submitted
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Particle-in-cell simulations of electron acceleration involving magnetic islands in hydrogen and pair plasmas NAOKI BESSHO, LI-JEN CHEN, AMITAVA BHATTACHARJEE, Center for Integrated Computation and Analysis of Reconnection and Turbulence (CICART), University of New Hampshire, Durham, NH 03824 — Motivated by Cluster observations of energetic electrons in magnetic islands (Chen et al., Nature Physics, 4, 19, 2008), we have studied electron acceleration in reconnection by means of 2D PIC simulations. In electron-ion plasmas, we have identified a number of possible acceleration mechanisms involving magnetic islands. These include acceleration due to (i) the out-of-plane electric field around X-lines, (ii) the in-plane electric field that energizes electrons trapped in the islands, and (iii) the coalescence of small islands producing larger islands. During process (iii), we demonstrate that despite the dominance of electron acceleration and heating, there can be cooling of electrons as well. We have found qualitative agreement between our simulations and certain aspects of the Cluster observations as far as density and magnetic field structures are concerned. We have also carried out a comparative study of electron acceleration in pair (electron-positron) and hydrogen plasmas. In large pair-plasma systems, the diffusion region exhibits significant stretching with more secondary instability, magnetic island generation, and coalescence. The commonality and differences between acceleration mechanisms in both types of plasmas will be discussed.

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