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Fast magnetic reconnection and particle acceleration in pair plasmas NAOKI BESSHO, A. BHATTACHARJEE, Center for Integrated Computation and Analysis of Reconnection and Turbulence, University of New Hampshire — Magnetic reconnection without a guide field in both non-relativistic and relativistic regimes has been studied in pair plasmas by 2D PIC simulations. We have found that in both regimes, particle acceleration enhances reconnection rates by an interesting feedback effect. Reconnection rates in the impulsive phase become of the order of 1 when the background density in a Harris sheet equilibrium is of the order of 0.01 of the density in the current sheet. Fast reconnection becomes possible not only because of increase of the time derivative part of the inertial term in the generalized Ohm's law, but also by a positive feedback on the pressure tensor term, bootstrapped by particle acceleration that produces a reduction in the particle density in the diffusion region. In this impulsive phase, the extension of the diffusion region along the outflow region is accompanied by a broadening of the width of the current sheet in the inflow region, keeping the aspect ratio small and sustaining a large reconnection rate. The collisionless resistivity originating from non-ideal terms in the generalized Ohm's law becomes large and nearly spatially uniform along the diffusion region even after the extension of the diffusion region, and can account quantitatively for the fast reconnection rate. We will compare and contrast this with reconnection and particle acceleration in hydrogen plasmas.

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