Abstract Submitted
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Phase-space signature of electron diffusion in collisionless magnetic reconnection: A standing electron phase-space hole[1] LI-JEN CHEN, Space Science Center and Center for Integrated Computation and Analysis of Reconnection and Turbulence, University of New Hampshire, WILLIAM DAUGHTON, Los Alamos National Laboratory — The structure and dynamics of the electron layer holds the ultimate mystery of how magnetic reconnection can occur in a collisionless plasma. Results from 2D fully kinetic simulations indicate that the electron crossing orbits within the electron layer is the main cause for the electron motion decoupling from the magnetic flux during collisionless magnetic reconnection with zero guide fields. The key evidence is revealed in a hole structure in the electron phase space that stands in the center of the electron layer. The hole structure starts to emerge at the beginning of the explosive growth phase of reconnection, becomes the most prominent when the reconnection rate peaks, and spatially extends, along the outflow direction, through the entire electron diffusion region. Corresponding to the electron hole are a layer of bipolar electric field embedded in the bipolar Hall electric field within the electron layer, and bifurcations of the electron density and the out-of-plane velocity. Flow diversion, energy conversion, as well as regulation of electric currents in the reconnection layer can be understood in terms of electron crossing orbit dynamics.

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