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Interaction of Electron Holes with Ion Density Perturbations[1]

DAVID L. NEWMAN, MARTIN V. GOLDMAN, NARESH SEN, HAIHONG CHE, University of Colorado — Kinetic simulations show that electron phase space holes in a homogeneous ion background can persist for long times with little change in speed, shape, or size. Spatial perturbations in the ion density change this situation: Short-scale ion perturbations comparable in length to the size of the holes themselves can degrade the coherence of individual holes. Ion perturbations with much longer scale lengths, however, have a quite different effect, causing holes to accelerate toward density maxima with little degradation. This latter behavior may account for the correlation between the hole spatial location and the location of density maxima observed in two recent 2-D Vlasov simulation studies: In the first case, the perturbations are due to ion-Bernstein waves near double layers in Earth's auroral zone [N. Sen, Ph.D. Thesis, Univ. of Colorado, 2009]. In the second case the density maxima are due to lower-hybrid waves in Buneman-unstable current channels [D. L. Newman and M. V. Goldman, 2008 Fall AGU Meeting, SM31B-1735] inferred from the separatrix region in published PIC simulations of magnetic reconnection. The detailed nature of the interaction of holes and various scale density perturbations will be addressed using 1-D and 2-D Vlasov simulations.

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