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New Route to Shallow Electron Phase-Space Holes via a "Velocity-Notch" Instability* DAVID L. NEWMAN, MARTIN V. GOLDMAN, University of Colorado — Properties of weak bipolar fields observed in space are found to be consistent with a theory for shallow electron phase space holes.[1] Here, we show that shallow phase space holes can develop *dynamically* as a result of trapping during the saturation of a new electron "velocity-notch" instability. This instability occurs when there is a "notch" of width Δv and density deficit Δn in a unimodal electron velocity distribution with density n_{e0} and thermal speed v_{e0}, provided $\Delta v/v_{e0}$ is sufficiently smaller than $\sqrt{\Delta n/n_{e0}}$. In the narrow-notch limit, the growth rate is the *plasma frequency of the missing notch electrons.* The nonlinear saturation of this instability is studied using Vlasov simulations initiated with two different classes of electron distributions: Spatially uniform electron distributions with a shallow velocity notch result in holes whose form depends on the degree to which the instability threshold is exceeded. Distributions initialized with a *spatially local* temperature enhancement develop a notch in velocity due to time-of-flight effects. This notch becomes progressively narrower until the instability threshold is crossed. The bipolar fields in the simulations are compared with those corresponding to the weak potential solutions $\phi = \phi_{\max}\text{sech}^4(\text{x}/\alpha)$ from theory.[1]

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[1] M. V. Goldman, *et al.*, this meeting.

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