Abstract Submitted
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Kinematic determination of Electron-Hole velocities[1] IAN H HUTCHINSON, C ZHOU, PSFC, MIT — Coherent self-sustaining BGK potential structures, like the electron holes that often form during nonlinear electrostatic instabilities and are frequently observed in space plasmas, have "kinematic" momentum conservation properties that determine their velocity. The electron and ion momentum, both internal and external to the hole, must be included. Momentum changes arise from hole acceleration and from hole depth growth, by energization processes we call jetting; and these must balance any additional external forces on the particles. Comprehensive analytic expressions for the contributions have been calculated for holes of arbitrary localized potential form. Using these, we can deduce velocity changes in various interesting situations such as the self-acceleration of electron holes during formation, the circumstances under which holes accelerate at the rate of the electrons in a background electric field, the influence of the ion stream pushing and pulling holes to higher or lower speeds, and the trapping of hole velocity between the velocity of two ion streams. The predictions are in excellent quantitative agreement with targeted PIC simulations. The kinematic theory thus explains why isolated holes behave the way they do.

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