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Ion kinetics and long-time evolution of current-carrying instabilities in low temperature plasma sources[1] CAMERON TREECE, KENTARO HARA, Texas A&M University — Ion kinetics and time evolution of bulk plasma properties in the nonlinear saturation regime of a collisionless current-carrying instability are presented using a 1D Vlasov-Poisson simulation. Such instabilities are considered to be responsible for the anomalous electron transport in hollow cathode plumes, and the high-energy ions due to the generation of plasma waves can cause cathode erosion, which may limit the lifetime of space propulsion missions. The ratio of initial electron bulk velocity to initial electron thermal velocity, which we define as the electron Mach number, ranges from 1 to 2.5. Argon ions are used, and the initial electron temperature is 2 eV while the initial ion temperature is 0.2 eV. The simulation domain employs periodic boundary conditions and allows for multiple wave modes to be excited. The production of backstreaming high-energy ions is observed when the electron Mach number is greater than 1.3, which agrees with previous theories. Simulation results show that bulk plasma properties continue to evolve in time during nonlinear saturation. The data set can be used to provide kinetic corrections to existing fluid simulations of hollow cathode discharge.

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