Abstract Submitted
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Particle-in-cell simulations of ion acoustic turbulence and energy exchange between ions and electrons in collisionless plasmas[1] JIAN CHEN, ALEXANDER V. KHRABROV, IGOR D. KAGANOVICH, Princeton Plasma Physics Laboratory, HEPING LI, Tsinghua University — We report a one-dimensional particle-in-cell (1D PIC) simulation of ion acoustic turbulence (IAT) and energy exchange between ions and electrons in collisionless plasmas. We used a condition for the ramp-up phase in the tokamak startup, but similar physics should apply to, for example, a plume of the hollow cathode at low pressures. During a typical current ramp-up stage in tokamak, plasma is collisionless; and electrons and ions keep accelerating in the inducted toroidal electric field. In this study, making use of a 1D electrostatic PIC code EDIPIC, we observed an anomalous rate of the energy exchange between ions and electrons due to IAT. From the simulations, a quasi-periodic pattern of IAT is observed with IAT on and off all the time. IAT causes the heating of electrons and ions, increase of the friction force and decrease of the relative velocity between ions and electrons. The ion temperature rise damps the instability until relative velocity increases and IAT reemerges. Surprisingly, we observed that only one soliton with a hole structure in the ion phase forms during the decay phase of IAT.

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