Abstract Details

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Title: Nonlinear Evolution of Buneman Instability

Abstract:

The Buneman instability takes place in a current driven system wher electron and ion beams drift at different velocities. The Buneman inst one of the most fundamental instabilities in the magnetosphere, beca electrons and ions are accelerated in the opposite direction by inducti electric field due to the dynamic variation of the magnetosphere asso with substorms. We performed a complete survey of linear property c Buneman instability over the whole parameter space of electron and i thermal velocities normalized by the relative drift velocity between th electron and ion beams. We categorized the unstable parameter spac three regions depending on the characteristics of the linear properties the original Buneman instability region with relatively cold electrons a ions, the ion acoustic wave instability region, and Langmuir wave inst region. We performed electrostatic particle simulations of these instab for different sets of electron and ion thermal velocities with the real m ratio. We traced the instabilities for a long period of time well beyond linear growth and saturation stage. In the nonlinear stage, we found different types of potential structures, i.e., isolated electron holes, isc ion holes, double layers, and electron acoustic solitons. Nonlinear evc of ion acoustic waves result in formation of ion holes and double layer Unlike the ion holes, a double layer forms a distinct potential gap that accelerates electrons which generate a series of small scale electrons The electron holes correspond to positive isolated potentials, while th electron acoustic solitons show negative isolated potentials. The elect holes are generated through repeated coalescence of continuous pote that trap part of electron velocity distribution. On the other hand the acoustic solitons appear only rarely when a special condition is satisfi nonlinear kinetic processes leading to formation of the electron acous solitons will be discussed in detail.

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Co-Authors