Eh-013 Room: C311 Time: June 11 14:30-14:45

A Simulation Study on Generation Mechanism of Electrostatic Solitary Waves in One-Dimensional Open Systems

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We performed computer simulation of an electron beam instability in a open system where an electron beam is injected locally from the boundary. We find formation of electrostatic solitary waves through coalescence of electrostatic potentials excited by the electron beam instability.

There have been a number of simulation studies on electrostatic solitary waves that were observed in the plasma sheet boundary layer, auroral zones,magnetopause boundary layer, magnetosheath and foreshock regions. In these simulation studies,nonlinear evolution of electron beam instabilities

are studied by starting the particle simulations with periodic boundary condtions. In such periodic systems, unstable velocity distribution functions

are assumed to exist uniformly in space. In real space plasmas, however, there exists no uniform system such as the uniform periodic systems. Wave-particle interactions of the electron beam instabilities do not take place uniformly. Since electron beams result from acceleration by electric fields that appear in a shock transition or a magnetic reconnection process, sources of electron beams are localized in space.

In an attempt to study spatial development of the electron beam instability from a localized source, We have performed one-dimensional electrostatic particle simulations with open free boundaries at both ends of the system. We inject an electron beam from the left boundary, and study the spatial evolution of the electron beam instability from the left to the right. The initial velocity distribution (t= 0) in the system is a

Maxwellian distribution function uniformly

distributed in space. We assume a constant

bump-on-tail distribution function as an influx from the left boundary. As time goes on, the particles with positive velocities come into the system, and the bump-on-tail instability develops to form a series of electrostatic potentials that trap the electron beam. As the electron beam

propagates from the left to the right, the

potentials becomes isolated through coalescence. The spatial scales of the solitary potentials and the distances between them increase gradually as the electron beam moves farther away from the

source region. It has been confirmed that ESW

similar to those found in a uniform periodic

system are also generated in the open system. The nonlinear evolution of the electron beam instability strongly depends on the temperature of the background thermal electrons. For cold electrons, we do not find formation of ESW. A strong diffusion of the electron beam occurs along with generation of Langmuir waves with different

phase velocities.