Ee-005 Room: C402 Time: June 26 14:00-14:15

Two-Dimensional Electromagnetic Simulations of Electrostatic Solitary Waves in Open Systems

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We present computer experiments of electrostatic solitary waves (ESW) observed by Geotail spacecraft in the magnetotail. We performed two-dimensioanl electromagnetic simulation of an electron beam instability with open boundary conditons. Through the spatial evolution of electron beam instability, we can observe the structure of bipolar waves isolated in the direction parallel to the external magnetic field and uniform in perpendicular to the external magnetic field. These electrostatic waves generated in the present simulation

correspond to ESW observed by Geotail in PSBL. We also analyze the two-dimensional structure of electromagnetic waves in the system and discuss the possible generation of electromagnetic waves through the spatial evolution of ESW.

We present computer experiments of electrostatic solitary waves (ESW) observed by Geotail spacecraft in the magnetotail. ESW are considered to be generated by electron beam instabilities. We performed computer simulation of an electron beam instability with open boundary conditons. We observed the spatial evolution of the electron beam instability, and found formation of ESW through coalescence of a series of electrostatic potentials excited by the electron beam instability.

There have been many simulation studies on ESW observed in various places of Earth's magnetosphere. These simulation studies were done with periodic boundary conditions. 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 uniform periodic systems and physical phenomena are rather localized in space. In the present study, we performed two-dimensional electromagnetic particle simualtions in a open system.As the simulation model, we assume that there exists only warm background electron in the system at initial condition. We assume a constant bump-on-tail distribution function

at a boundary, which is considered as the velocity distribution function in the plasma sheet boundary layer (PSBL) where ESW are often observed. Since electron beams in PSBL result from acceleration by a magnetic reconnection process, sourse of electron beams are localized in space. We inject a cold electron beam from a boundary, an the bump-on-tail distribution consists of both

a cold electrom beam and warm background electron.

The simulation system is taken in the x-y plane with both open boundary in the x direction and periodic in y. There is the external (static) magnetic field in the x direction, and the electron beam drifts along the external magnetic field. As time goes on, the particles with positive velocity come into the system, and the bump-on-tail instability developes to a series of electrostatic potentials which trap beam electron. As the electron beam propagates in the system, potentials become isolated through coalescence.

Through the spatial evolution of the bump-on-tail instability, we can observe the structure of bipolar waves isolated in the direction parallel to the external magnetic field and uniform in perpendicular to the external magnetic field. These electrostatic waves generated in the present simulation

correspond to ESW observed by Geotail in PSBL. We also analyze the two-dimensional structure of electromagnetic waves in the system and discuss the possible generation of electromagnetic waves through the spatial evolution of ESW.