U054-079 **Room: Ocean B** **Time: May 17 15:30-15:45**

Computer simulations of electrostatic solitary waves in space plasmas

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Electrostatic Solitary Waves (ESW) were first observed by the GEOTAIL spacecraft in the magnetotail. ESW are bipolar electric pulses longitudinal to the ambient magnetic field. The previous theoretical works have shown that ESW can be modeled as electron phase-space density holes which are Bernstein-Greene-Kruskal (BGK) modes, i.e., one-dimensional equilibrium solutions to the time-independent Vlasov-Poisson equations.

Electron two-stream and bump-on-tail instabilities are considered to be the most probable generation mechanisms for ESW observed in various regions of the magnetosphere. In order to study nonlinear evolution of the electron two-stream instability in a two-dimensional system, we performed two-dimensional particle-in-cell simulations for various sets of electron cyclotron frequencies and initial electron thermal velocities, and found that the nonlinear evolution falls into four groups.

Under a very weak ambient magnetic field such that the electron cyclotron frequency is smaller than the bounce frequency of electrons trapped by electron holes, the electron holes become unstable as reported in previous simulations. When the electron cyclotron frequency is larger than the bounce frequency, the stability of electron holes is controlled by their amplitude. In the case of the cold two-stream instability where the potential energy of excited electrostatic waves becomes larger than the thermal energy of background electrons, electron holes decay into electrostatic whistler waves. On the other hand, in runs with high initial electron thermal velocities, the two-stream instability develops to form electron holes. When the electron cyclotron frequency is much larger than the electron bounce frequency, we found the formation of stable one-dimensional electron holes through coalescence. When the electron cyclotron frequency is smaller than twice the bounce frequency, we found formation of two-dimensional electron holes isolated in both directions parallel and perpendicular to the ambient magnetic field.