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3D electromagnetic particle simulations about the low frequency component of BEN observed by Geotail spacecraft

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ESW (Electrostatic Solitary Waves) correspond the upper frequency component of BEN (Broadband Electrostatic Noise) which is frequently observed in space plasma. PIC simulations revealed that ESW are generated from electron beam instabilities. The generation mechanism of the low frequency component of BEN, however, is still unexplained. To clarify whether such low frequency waves are generated, we made statistical analysis on generation conditions of low frequency component of BEN observed by Electric Field Detector (EFD) onboard Geotail spacecraft. According to our statistical analysis, the low frequency component of BEN have two different types of spectrum. These two types of waves are observed in the different region and plasma conditions, therefore, we assumed that there exist two different waves as the low frequency component of BEN. Based on this assumption, we are going to make further analysis on generation conditions of these two types of low frequency component of BEN, and perform a series of three-dimensional electromagnetic particle simulations with different parameters to clarify the generation process of the low frequency component of BEN.

Fig.1 shows the time evolution of $E_{\parallel}$ and $E_{\perp}$ energy and corresponding spatial profiles of E field at different times in the particle simulation based on Geotail EFD analyses. In this simulation, the ambient magnetic field is the x direction. We can find spatial structure alinged in the perpendicular to the magnetic field, which is the spactial structure of ESW. We are going to analyze the low frequency waves in these series of simulations, and find the possible candidates of the low frequency component of BEN,

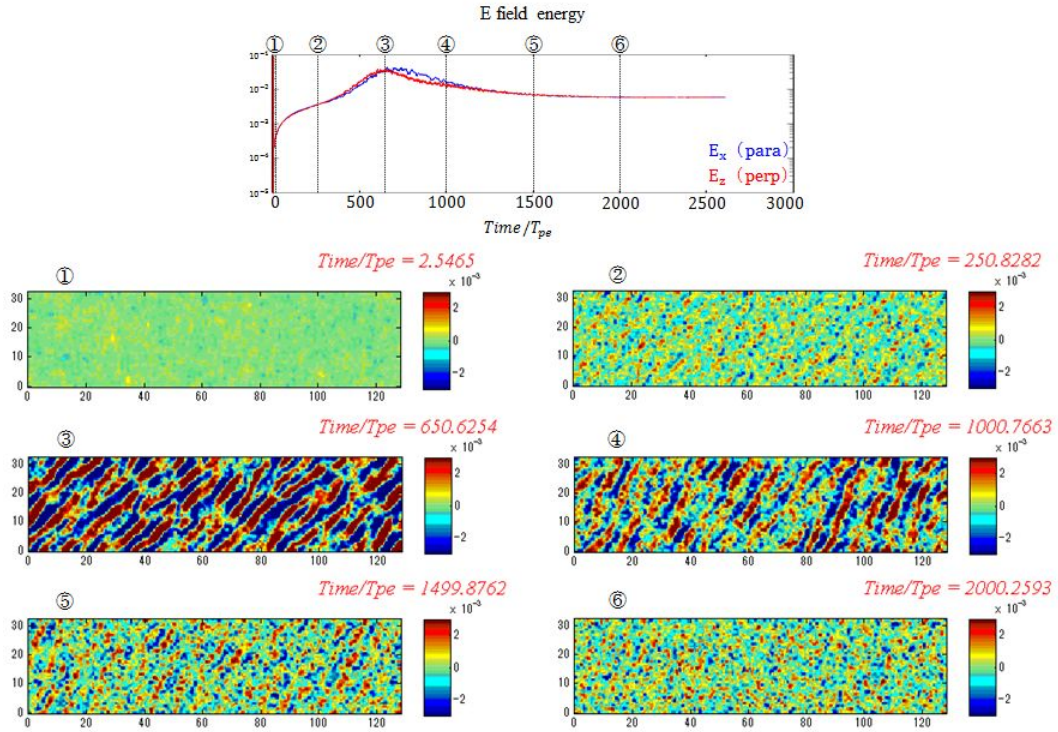

Fig.1: Time evolution of the spatial structures of $\boldsymbol{E}$ field in the particle simulation.