

Parametric decay instability of Alfvén waves in a strongly relativistic electron-positron plasma

Shuichi Matsukiyo[1], # Tohru Hada[2]

[1] Earth System Sci., Kyushu Univ., [2] ESST, Kyushu Univ

http://www.esst.kyushu-u.ac.jp/CDS/index_j.html

Large amplitude Alfvén waves are known to be unstable against the parametric decay instability. This has been well discussed in relation to generation of the MHD turbulence and energetic particles in the solar wind. Similar process should also exist in high energy astrophysical environment.

In a previous meeting we have reported that, in an electron-positron plasma with the electron cyclotron frequency greater than the plasma frequency, the finite space charge effect leads to new types of decay instabilities involving the Langmuir-like wave. We have also discussed long time evolution of the decay of a relatively small amplitude ($B_p / B_0 = 0.1$) parent wave by performing a particle simulation.

In this presentation we discuss decay of larger amplitude Alfvén waves. First we show that, when the Alfvén wave amplitude is large, there appears a lower limit in the wavelength due to relativistic effect. Then, we study long time evolution of the decay instability using the particle simulation and the bi-coherence analysis. Implications to some fundamental astrophysical processes will be discussed.