



Decay of nonlinear whistler waves: 1D versus 2D

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Decay of a nonlinear, short-wavelength, and monochromatic electromagnetic whistler wave in low-beta plasma is investigated by utilizing a two-dimensional (2D) fully relativistic electromagnetic particle-in-cell code. It has been shown that the nonlinear (large-amplitude) parent whistler wave decays through the parametric instability in a one-dimensional (1D) system. The present study shows that there is another channel for decay of the parent whistler wave in 2D, which is much faster than in 1D. The parent whistler wave decays into two sideband daughter oblique whistlers with a frequency close to the parent wave and two quasi-perpendicular electromagnetic modes with a frequency close to zero via a 2D decay instability. The two sideband daughter oblique whistlers also enhance a nonlinear longitudinal electrostatic wave via three-wave interaction as a secondary process.