# Nonlinear Damping of Oblique Whistler Mode Waves Via Landau Resonance

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Nonlinear trapping of electrons via Landau resonance is an important mechanism of oblique whistler mode wave-particle interactions. Electrons trapped by Landau resonance gain energies from waves. The Landau resonance velocity becomes very close to the group velocity of nearly parallel whistler mode waves at frequencies around half the electron gyrofrequency, resulting in a long interaction time and possible wave damping. We perform test particle simulations with parameters at L = 5 and a small wave normal angle 10 degrees to study the wave-particle interactions via the Landau resonance. Analyzing the wave electric fields and the resonant currents formed by electrons undergoing Landau and cyclotron resonances, we show that effective wave damping occurs near half the electron gyrofrequency. This nonlinear wave damping is contributed by Landau resonance rather than cyclotron resonance. Furthermore, we confirm that this damping is dominated by perpendicular components of the wave electric field and perpendicular resonant currents. The simulation results indicate that nonlinear damping via Landau resonance is one of the mechanisms dividing chorus emissions into the upper band and the lower band.

Keywords: whistler mode waves, wave-particle interaction, relativistic electrons, Landau resonance

 