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Investigation of Whistler-Mode Chorus Wave in the Earth's Inner Magnetosphere

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Whistler-mode chorus waves play an important role to control electron dynamics in the Earth's radiation belt. We have conducted two-dimensional chorus waves simulations in a dipole magnetic field system to investigate the generation of chorus wave and its temporal evolution along the magnetic field line. We have found that the rising tone element of chorus waves with frequency chirping from low frequency to up to higher than the half electron gyro-frequency is generated at low latitudes. As the chorus wave propagates toward high latitudes, the wave becomes oblique and both the Landau and cyclotron resonance become significant. Two bands chorus waves are thus formed. In addition, we have found that electron holes in the wave phase space, which form due to nonlinear cyclotron resonance, oscillate in size with time during chorus wave subpacket formation. The associated inhomogeneity factor varies accordingly, giving rise to various frequency chirping in different phases of subpackets. Distinct nongyrotropic electron distributions are detected in both wave gyrophase and stationary gyrophase. The nonlinear physics associated with the wave growth and wave frequency chirping has been quantitatively evaluated in the process of chorus wave development. Meanwhile, the electron dynamics due to cyclotron and Landau resonances with waves are quantitively studied.

References
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