EMIC波による放射線帯電子の非線形ピッチ角散乱

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Nonlinear theory of pitch-angle scattering of relativistic electrons by EMIC waves in the inner magnetosphere

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We study the nonlinear interaction between relativistic electrons and a coherent Electromagnetic Ion Cyclotron (EMIC) wave. We assume a coherent rising-tone emission as found in recent spacecraft observations of EMIC waves[1,2]. Considering the frequency variation, we derive the second-order resonance condition for interaction between a relativistic electron and a coherent EMIC wave[3]. The second-order resonance condition controlling nonlinear wave trapping of resonant electrons depends on an inhomogeneity factor S which is a function of the frequency sweep rate, the gradient of the magnetic field, and the wave amplitude. There occurs nonlinear trapping of electrons by the wave potential, if |S|<1. A non-zero value of S induces very effective pitch angle scattering. When an EMIC triggered emission is generated near the equator and propagates toward the high latitude, both the spatial inhomogeneity and the rising-tone frequency results in enhanced precipitation of relativistic electrons with the time scale of EMIC triggered emission (tens of seconds).

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