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地球放射線帯の電磁イオンサイクロトロン波トリガードエミッションによる相対論的電子マイクロバースト
Relativistic electron microbursts induced by EMIC triggered emissions in the Earth's radiation belts

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Pitch angle scattering of relativistic electrons arising from the anomalous cyclotron resonance with left-hand polarized electromagnetic ion cyclotron (EMIC) waves contributes to the sharp decrease of the relativistic electron flux in the outer radiation belt in the main phase of magneticstorms. We have derived the second-order resonance condition for interaction between a relativistic electron and a coherent Electromagnetic Ion Cyclotron (EMIC) wave with a variable frequency [1]. We perform test particle simulations of relativistic electrons interacting with EMIC waves with a fixed frequency and a rising-tone frequency such as EMIC triggered emissions [2] observed in the inner magnetosphere. Trapping of resonant electrons leads to rapid and efficient pitch angle scattering of relativistic electrons, resulting in bursty precipitation of relativistic electrons. The efficiency of the pitch angle scattering depends on the gradient of the magnetic field, the frequency sweep rate, and the wave amplitude. Although resonant electrons may not be scattered into the loss cone in a single passage through the wave packet. repeated interactions with a series of wave packets through the bounce motion between the mirror points result in scattering of relativistic electrons into the loss cone. The time scale of precipitation of a relativistic electron by a single passage through the wave packet is about 0.03 seconds, while the bounce time period is about 0.2 second. Test particle simulations with a large number of electrons demonstrate strong precipitation takes place over 1 ? 3 seconds, corresponding to relativistic electron microbursts observations.

[1] Omura, Y., and Q. Zhao (2012), Nonlinear pitch angle scattering of relativistic electrons by EMIC waves in the inner magnetosphere, J. Geophys. Res., 117, A08227, doi:10.1029/2012JA017943.
[2] Omura, et al. (2010), Theory and observation of electromagnetic ion cyclotron triggered emissions in the magnetosphere, J. Geophys. Res., 115, A07234, doi:10.1029/2010JA015300.

キーワード: 放射線帯, 電磁イオンサイクロトロン波, トリガードエミッション, 電子降下, 相対論的電子, 波動粒子相互作用
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