

一次元、二次元および三次元磁場におけるホイッスラーモードコーラス波によって加速される高エネルギー電子のダイナミクス

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Dynamics of energetic electrons accelerated by whistler-mode chorus waves in 1D, 2D, and 3D magnetic field models

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We evaluate the acceleration efficiencies of relativistic electrons under a 1D, 2D, and 3D model magnetic fields. We perform test-particle simulations and analyze nonlinear trapping motions of resonant electrons in each model. As a chorus wave model, we assume that a chorus wave packet generated at the magnetic equator propagates along the magnetic field to higher latitudes. When we perform simulations with the whistler mode wave, the cyclotron resonance with energetic electrons occurs at the similar timing in each model. Although we find relativistic turning acceleration (RTA) [1] to take place in each model, acceleration efficiencies of resonant electrons are different in these models. In terms of the numerical Green's function [2], we find a clear difference in time evolution of the distribution function in energy and equatorial pitch angle. The energy gap between resonant electrons and non-resonant electrons in the 1D model is slightly different from those in the 2D and 3D models. This difference is due to additional oscillations in the velocity phase space, which only occur in the 2D and 3D models. These oscillations occur because the magnitude of the magnetic field changes during one period of relativistic cyclotron motion, affecting the nonlinear trapping conditions of resonant electrons. These oscillations mainly affect number of trapped particles and we find obvious differences in the dynamics of trapped particles among simulations of different magnetic field models.

References:

- [1] Y. Omura, N. Furuya, D. Summers, Relativistic turning acceleration of resonant electrons by coherent whistler-mode waves in a dipole magnetic field, *Journal Geophysical Research*, Vol. 112, A06236, doi:10.1029/2006JA012243, 2007.
[2] Y. Omura, Y. Miyashita, M. Yoshikawa, D. Summers, M. Hikishima, Y. Ebihara, and Y. Kubota (2015), Formation process of relativistic electron