

R006-20

Zoom meeting B : 11/1 PM2 (15:45-18:15)

16:45~17:00

Role of nonlinear WPI in energetic electron precipitation by oblique chorus emissions in the outer radiation belt

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Energetic electron accelerations and precipitations in the Earth's outer radiation belt are highly associated with wave-particle interactions between whistler mode chorus waves and electrons. We perform test particle simulation to investigate electrons interacting with both parallel and obliquely propagating whistler mode chorus emissions at L=4.5. We build up a database of the Green's functions, which are treated as results of the input electrons interacting with one emission, for a large number of electrons. The loss process of electron fluxes interacting with consecutive chorus emissions is traced by applying the convolution integrals of distribution functions and the Green's functions. By checking the resonance condition and resonant energy, we find that the nonlinear scattering via cyclotron resonance is the main process that pushes energetic electrons into the loss cone in both parallel and oblique cases. Our simulation results show that obliquely propagating chorus causes more energetic electron precipitation than parallel propagating chorus because of the combination of nonlinear trapping via Landau resonance and nonlinear scattering via cyclotron resonance. The precipitation rates at 200keV to MeV of the oblique case agree with observations, while the precipitation rates at MeV of the parallel case is much lower than observations.

We propose a 2-step precipitation process for oblique chorus emissions that contributes to more electron loss: (1) During the first chorus emission, the nonlinear trapping of Landau resonance moves an electron near the loss cone. (2) During the second emission, the nonlinear scattering of cyclotron resonance scatters the electron into the loss cone.

References

- [1] Hsieh Y.-K., Kubota, Y., & Omura, Y. (2020). Nonlinear evolution of radiation belt electron fluxes interacting with oblique whistler mode chorus emissions. *Journal of Geophysical Research: Space Physics*, 125, e2019JA027465. <https://doi.org/10.1029/2019JA027465>
- [2] Hsieh Y.-K., Kubota, Y., & Omura, Y. Energetic electron precipitation induced by oblique whistler mode chorus emissions, Submitted to *Journal of Geophysical Research: Space Physics*.