R008-23
Zoom meeting D ：11/4 PM1 (13:45-15:30)
15:00〜15:15

ホイッスラーモード・ライジングトーン波の非線形絶対不安定性の必要条件

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Necessary conditions for nonlinear absolute instability of whistler-mode rising-tone emissions

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We have conducted simulations of whistler-mode rising-tone emissions triggered by a wave with a constant frequency transmitted from the equator [1]. Counter streaming resonant electrons interact with the triggering wave, being organized in their gyro-phases forming resonant currents that can modify the wave phase and amplitude resulting in a new wave at higher frequency. An absolute instability should occur to generate the new wave at higher frequencies. With a triggering wave higher than the threshold wave amplitude, a new wave grows as an absolute instability at progressively higher frequencies. The wave grows to a level close to the optimum wave amplitude as an absolute instability near the magnetic equator [2]. We have found that it is necessary for the triggering source point of a rising-tone emissions to move upstream from the equator. The velocity of the source point is given by the sum of the resonance velocity and the group velocity of triggering waves. For the typical energy range of electrons generating chorus emission is about 10 - 30 keV, which gives resonance velocity with its magnitude comparable to that of the group velocity but with the opposite sign. Therefore, the source velocity is can remain relatively small values keeping the source region near the equator. For the wave frequency below half the cyclotron frequency, the source velocity is negative, resulting in the upstream motion of the source point which is favorable for an absolute instability at the equator. When the frequency becomes higher than half the cyclotron frequency, the source point moves to the downstream region, and the absolute instability of a rising tone is terminated in the downstream region.

References
[1] Nogi, T., & Omura, Y., Nonlinear signatures of VLF triggered emissions, submitted to J. Geophys. Res. Space Phys. 2021.
[2] Omura, Y., Nonlinear wave growth theory of whistler-mode chorus and hiss in the magnetosphere, Earth, Planets and Space, (2021) 73:95.
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