S001-24
A 会場 ：11/5　 AM2 （10:45-12:30）
11:35～11:50

一様磁化プラズマ中でのホイッスラーモード・トリガードエミッション

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Whistler-mode triggered emissions in a homogeneous magnetized plasma

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We perform a self-consistent one-dimensional electromagnetic particle simulation with a uniform magnetic field and open boundaries [1]. The plasma environment consists of cold electrons, energetic electrons, and immobile ions. The cold electrons are initialized with the bi-Maxwellian distribution function with a small thermal velocity, while the energetic electrons are initialized with subtracted-Maxwellian distribution with relatively large thermal velocities, resulting in a temperature anisotropy. By oscillating external currents with a constant frequency 0.2 fce, where fce is the electron cyclotron frequency, a whistler-mode wave is injected as a triggering wave from the center of the simulation system, and we investigated the process of interactions between the triggering wave and energetic electrons. We find that both rising-tone and falling-tone emissions are triggered through the formation of an electron hole and an electron hill in the velocity phase space consisting of a parallel velocity and the gyro-phase angle of the perpendicular velocities [2]. The rising-tone emission varies from 0.2 fce to 0.4 fce, while the falling-tone varies from 0.2 fce to 0.15 fce. The generation region of the rising-tone triggered emission starts in the downstream region due to the triggering wave and moves upstream generating new subpackets. The generation region of the falling-tone triggered emission also moves upstream generating new subpackets [3]. The simultaneous formation of the electron hole and hill is identified by separating small and large wavenumber components corresponding to lower and higher frequencies, respectively, by applying the discrete Fourier transformation to the wave forms in space. When multiple waves are present as in the present result, it is essential to separate them in wavenumber and frequency for accurate analysis, and only after the separation, the correct resonant currents and relative gyro-phase angles can be obtained for comparison with the nonlinear wave growth theory. Based on the simulation results of the whistler-mode triggered emissions, we conclude that the mechanism of frequency variation of whistler-mode chorus emissions works even in a uniform magnetic field.

[1] Fujiwara, Y., Nogi, T., & Omura, Y. (2022). Nonlinear triggering process of whistler-mode emissions in a homogeneous magnetic field. Earth, Planets and Space, 74 (95).
[2] Nogi, T., Nakamura, S., & Omura, Y. (2020). Full particle simulation of whistler-mode triggered falling-tone emissions in the magnetosphere. Journal of Geophysical Research: Space Physics, 125 (10), e2020JA027953.
[3] Nogi, T., & Omura, Y. (2022). Nonlinear signatures of VLF-triggered emissions: A simulation study. Journal of Geophysical Research: Space Physics, 127 (1), e2021JA029826.