R008-14
Zoom meeting D ：11/4 AM1 (9:00-10:30)
10:00-10:15

Dependence of Nonlinear Wave Growth of Hiss Emissions on Plasma Simulation Parameters

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A recent particle simulation has successfully reproduced the generation of plasmaspheric hiss emissions with fine structures in accordance with the nonlinear wave growth theory. In this study, we examine the performance of nonlinear growth of hiss emissions under different parameters by running the one-dimensional KEMPO code with a parabolic variation of background magnetic field. We find that as the total number of particles is reduced, the amplitude of hiss emissions increases because of the enhancement of thermal fluctuations. As the density of hot electrons decreases, we find that wave amplitude goes through the nonlinear growth stage with a smaller magnitude. The nonlinear wave growth theory demonstrates that wave only grows when its amplitude is between the threshold magnitude and optimum magnitude. We find that for a lower density of hot electrons, the overlap between the threshold amplitude and optimum amplitude becomes smaller, which leads to no obvious growth of wave amplitude at a specific point. By implementing a bandpass filter, we obtain instantaneous frequencies of hiss emissions with different densities of hot electrons at the same location. We find that the growth of wave amplitude spreads to higher frequency parts for a lower density of hot electrons. As we decrease the gradient of background magnetic field, we find that the threshold amplitude becomes smaller while the optimum amplitude remains unchanged. Based on the various examinations, we obtain a comprehensive understanding of properties of hiss emissions.

Reference:

[1] Hikishima, M., Omura, Y., & Summers, D. (2020). Particle simulation of the generation of plasmaspheric hiss. Journal of Geophysical Research: Space Physics, 125, e2020JA027973. https://doi.org/10.1029/2020JA027973