Electromagnetic particle simulation of whistler mode triggered emissions in the equatorial magnetosphere

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We performed a one-dimensional electromagnetic particle simulation with a uniform magnetic field. We studied electromagnetic waves radiating from two orthogonally aligned antennas in a transverse plane. To find generation of whistler mode waves, we drove anntenas by currents oscillating with frequencies below the electron cyclotron frequency. We confirmed the mode of radiated waves in 3 cases: right-hand polarized external currents, left-hand polarized external currents, and the linearly polarized external current. We found that we can generate propagating waves without evanescent waves by right-hand polarized external currents and we applied this setting of external currents in the simulation. We injected energetic electrons during the propagation of the triggering wave and found some triggered emissions after electrons injection. We analyzed the dependency of the triggering wave amplitude and the number of injected energetic electrons in the simulation. By changing the frequency of the driving currents temporally, we simulated propogation of rising or falling tone emissions and analyzed interactions between triggering waves and injected energetic electrons on the basis of the nonlinear wave growth theory [1].

Reference:

[1] Omura, Yoshiharu, Yuto Katoh, and Danny Summers. ” Theory and simulation of the generation of whistler-mode chorus.” Journal of Geophysical Research: Space Physics 113.A4 (2008).

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