

## Hybrid simulation of EMIC falling tone emission

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Theoretical study suggest the existence of electromagnetic ion cyclotron (EMIC) falling tone emissions, as well as the EMIC rising tone emissions. We develop self-consistent hybrid simulation code with parabolic ambient magnetic field with longitudinal electric field. We successfully reproduce a helium band falling tone EMIC emission in the simulation space. In upstream region of the wave propagation, we find electromagnetic proton hill predicted in the nonlinear wave growth theory. The proton hill results in nonlinear resonant current causing falling frequency in the upstream region. Cold ion density modulation is induced by forward and backward propagating oxygen band EMIC waves. The linear growth of the helium band EMIC wave is also enhanced due to the spatial inhomogeneous density distributions, and then helium band waves are modulated in density modulation scale. The strong trapping takes place due to the packeted waves. The trapped particle guided by the increasing resonance velocity in the upstream region, the proton hill appears in the distribution function.