Geophysical Research Abstracts
Vol. 13, EGU2011-13490, 2011
EGU General Assembly 2011

EMIC wave packet generation: Results of nonlinear hybrid particle-in-cell (PIC) simulations

Maria E. Usanova (1), Konrad Sauer (1), Ian R. Mann (1), Richard D. Sydora (1), and Dietmar Krauss-Varban (2)
(1) University of Alberta, Canada , (2) University of California, Berkeley, USA

Electromagnetic ion cyclotron (EMIC) waves are transverse plasma waves generated by anisotropic proton distributions with Tperp>Tpara. Minor ion species affect the wave spectrum splitting it into multiple bands below the ion cyclotron frequency. EMIC waves are believed to play an important role in the dynamics of the ring current and radiation belts. Therefore, understanding mechanisms defining their main characteristics is of great importance. One of the mysteries of EMIC waves is their repetitive wave packet structure often observed on the ground. Earlier theories suggested that EMIC wave packet generation might occur during their propagation along the magnetic field line and their bouncing between conjugate hemispheres (bouncing wave packet model), or by the modulation of the source region plasma by lower frequency waves on a time-scale of the wave packet repetition period. We present results of kinetic hybrid PIC simulations of EMIC instability and show that sustained EMIC wave packets develop self-consistently through the instability evolution and appear after wave saturation and wave number shift as quasi-stationary nonlinear structures. Kinetic linear theory of stationary structures shows that in anisotropic plasmas two types of stationary waves and related oscillitons may exist. One can be generated in a proton-electron plasma for wave propagation parallel to the background magnetic field. The other one only occurs in a plasma with minor ions at oblique propagation and is caused by the coupling between the R-mode and L-mode creating a point of maximum phase velocity as described in earlier papers. The parameter dependence of both type of oscillitons has been analyzed and will be presented.