[구SE-19] Nonlinear evolution of Alfven waves via mode conversion

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It is well known that the FLRs are excited by compressional waves via mode conversion, but there has been no apparent criterion on the maximum amplitude in the regime of linear approximations. Such limited range of amplitude should be understood by including nonlinear saturation of FLRs, which has not been examined until now. In this study, using a three-dimensional magnetohydrodynamic (MHD) simulation code, we examine the evolution of nonlinear field line resonances (FLRs) in the cold plasmas. The MHD code used in this study allows a full nonlinear description and enables us to study the maximum amplitude of FLRs. When the disturbance is sufficiently small, it is shown that linear properties of MHD wave coupling are well reproduced. In order to examine a nonlinear excitation of FLRs, it is shown how these FLRs become saturated as the initial magnitude of disturbances is assumed to increase. Our results suggest that the maximum amplitude of FLRs become saturated at the level of the same order of dB/B as in observations roughly satisfies the order of ~0.01. In addition, we extended this study for the plasma sheet boundary layer (PSBL) region. We can discuss the maximum disturbances of the Alfven via mode conversion becomes differently saturated through each region.

[구SE-20] Simulation study on the nonlinear evolution of EMIC instability

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Charged particle energization is an outstanding problem in space physics. This paper investigates the nonlinear dynamics of Alfve´n-cyclotron waves accompanying particle heating processes and the drift Alfv´en-cyclotron (or EMIC) instability associated with a current disruption event on 29 January 2008 observed with THEMIS satellite by means of a particle-in-cell simulation. The simulation shows that the drift Alfv´en-cyclotron instabilities are excited in two regimes, a relatively low frequency mode propagating in a quasi-perpendicular direction while the second high-frequency branch propagating in a predominantly parallel propagation direction, which is consistent with observation as well as earlier theories. It is shown that parametric decay processes lead to an inverse cascade of Alfv´en-cyclotron waves and the generation of ion-acoustic waves by decay instability. It is also shown that the nonlinear decay processes are accompanied by small perpendicular heating and parallel cooling of the protons, and a pronounced parallel heating of the electrons.