Nonlinear MHD effects on the Alfvén eigenmode evolution

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For the Alfvén eigenmode (AE) instabilities, the particle trapping is the dominant saturation mechanism. On the other hand, the nonlinear effects of the MHD fluid might play an important role for large fluctuation amplitude, for example, $\delta B / B \sim 10^{-2}$ at the peak location of the AE spatial profile. Two types of simulations are carried out to investigate the MHD nonlinear effects. The first type is the hybrid simulation of the MHD fluid and the energetic particles. This simulation contains fully nonlinear effects of both the MHD fluid and the energetic particles, using the MEGA code [1]. The second type of the simulation is carried out with the partially linear MEGA code where the MHD equations are linearized. Thus, we can clarify the MHD nonlinear effects comparing the results of the two types of simulations. We will investigate the generation of both the fluctuations of short wave length and the flows and magnetic fields with the poloidal and toroidal mode numbers m/n=0/0. The dependence on the fluctuation amplitude and the strength of dissipations (viscosity and resistivity) will be discussed.

References

[1] Y. Todo *et al*., Phys. Plasmas **12**, 012503-1-7 (2005).