Analysis of Low frequency Alfven Eigenmodes in Toroidal Plasmas Using Drift-Kinetic Dielectric Tensor

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Recently a number of low-frequency global eigenmodes have been observed in toroidal plasmas. Some of them are identified as Alfvén eigenmodes, such as TAE, EAE and RSAE. Lower frequency modes are regarded as Alfvén waves coupled with drift waves and/or acoustic waves, such as geodesic acoustic mode (GAM). These modes can be excited by energetic ions and have deteriorating effects on plasma performance and wall heat load due to fast ion loss. On the other hand, they are expected to become a potential diagnostics scheme, the so-called MHD spectroscopy, to evaluate plasma parameters, e.g. density and safety factor profiles.

In order to analyze the low-frequency eigenmodes in tokamak plasmas, the full wave code TASK/WM has been extended to use the drift-kinetic dielectric tensor. In the previous version of TASK/WM, the response of bulk plasma is described by a kinetic dielectric tensor in uniform plasma, and that of energetic ions by a simple drift-kinetic dielectric tensor in which the effect of diamagnetic motion is included, but that of magnetic drift motion is not. In order to describe the effect of magnetic drift, the integration in momentum space is carried out numerically to obtain the drift kinetic dielectric tensor.

With this new version of the TASK/WM code, various Alfvén eigenmodes and those coupled with the acoustic modes; e.g., the beta-induced Alfven Eigenmode (BAE) and the beta-induced Alfven-acoustic Eigenmodes (BAAE), are calculated, and the results are compared with those of theoretical predictions and the previous version of the TASK/WM codes. Low frequency eigenmodes in helical system plasmas will be also studied.