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流れをもつ平衡のMHDモデル間比較
Comparison between equilibria with flow in MHD models

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Equilibria with flow in MHD models were constructed from extended MHD equations which include two-fluid (TF) and ion finite Larmor radius (FLR) effects [1,2]. The four models, MHD, MHD with TF and FLR effects (TF+FLR), MHD with FLR effects (FLR), and MHD with TF effects (TF) are compared with each other. The reduced MHD equations for high-beta toroidal equilibrium with flow are derived with asymptotic expansions with respect to the inverse aspect ratio of a torus. Two cases of flow are considered: toloidal and poloidal flows are comparable with the poloidal Alfvén velocity and the poloidal sound velocity.

In the case of flow comparable with the poloidal Alfvén velocity indicates the large modification of the Shafranov shift of the magnetic axis due to the poloidal flow [3]. We examine the TF and FLR effects on the Shafranov shift in the presence of flow. Figure 1 shows the dependence of the Shafranov shift on the poloidal Alfvén Mach number of the $E\times B$ flow for the four models. For MHD, the shift is enhanced by the sub-Alfvénic flow and becomes negative against the geometric axis for the super-Alfvénic flow. The singularity occurs when the poloidal Alfvén Mach number is unity. By including the TF effect, the ion diamagnetic flow is induced and the net flow velocity is the sum of the $E\times B$ and diamagnetic flows. The shift depends on the sign of the $E\times B$ flow to the diamagnetic flow. The solid lines shows that the $E\times B$ and diamagnetic flows are the same sign and the dotted lines shows opposite. By adding the FLR effect to the TF effect, the modification from MHD becomes smaller due to the gyroviscous cancellation.

The case of flow comparable with the poloidal sound velocity is also investigated. Details will be shown in the presentation.

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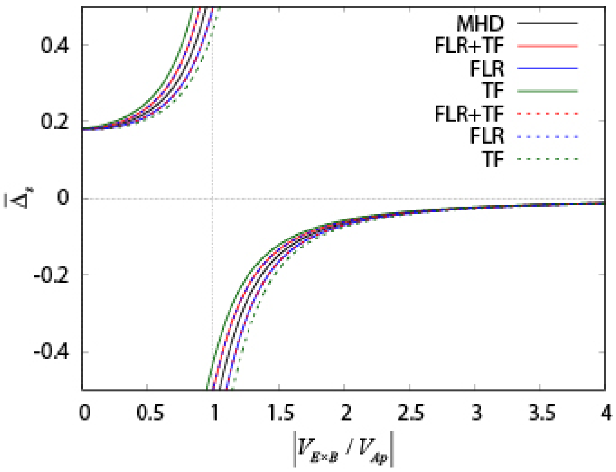

Fig. 1