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外部RMPに対する交換型不安定性の応答の運転条件依存性

Dependence of Interchange Instability Response to External RMP on Discharge Conditions

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For the development of economical nuclear fusion reactors with magnetically confined torus plasmas, we should achieve to confine stably high beta plasmas. However, there are some obstacles to achieve it, and MHD instabilities are one of them. In tokamak and helical plasmas, which are typical torus plasmas, different types of MHD instabilities are observed due to the different method to generate the magnetic bottles. In helical systems including Large Helical Device (LHD), control of pressure driven MHD instabilities, such as resistive interchange instability which can degrade confinement performance, is important. We experimentally investigate on a method to suppress resistive interchange instability by applying external RMP in the LHD.

Our previous experimental study shows that the static m/n=1/1 external RMP can suppress the m/n=1/1 resistive interchange instability without the RMP penetration to the resonant surface, as shown in the range painted blue in FIG.1. The stabilization due to the external RMP is observed under various operational conditions. Moreover, it is also found that a little improvement of the achieved beta value as well as the beta gradient at the resonant surface is observed, depending on the experiment condition.

On the other hand, it is found that the threshold of the external RMP amplitude expected to completely suppress the instability without the RMP penetration changes depending on the discharge conditions. Here, the threshold is estimated from the extrapolated value of the dependence of the magnetic field fluctuation amplitude on the external RMP amplitude indicated by a red dashed line in FIG1. We investigate how the threshold changes depending on the discharge conditions. As a result, the threshold has a high correlation with the volume averaged beta value, as shown in FIG.2. Here, the blue symbols in FIG.2 indicate data in an operational magnetic field strength case, 1.375T, and the black squares correspond to the other operational magnetic field strength. FIG.2 suggests a possibility that the threshold is different depending on the operational magnetic field strength even in the same operational beta. So, we are going to show a dependence of the threshold on the operational magnetic field strength and/or collisionarity under the same volume averaged beta value.

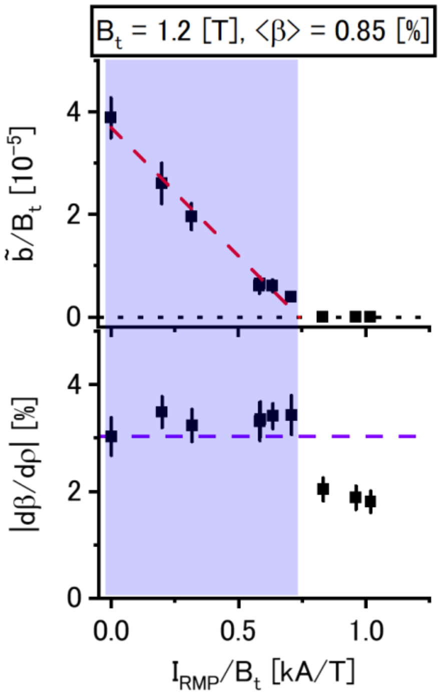

FIG.1

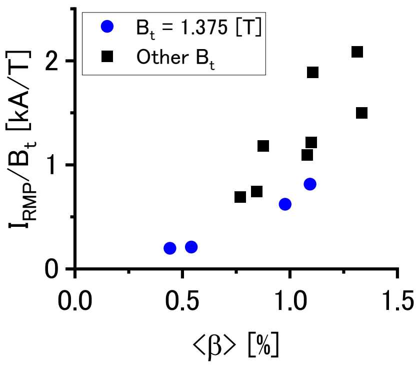

FIG.2