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## 3D Plasma Response to Resonant External Magnetic Perturbation and its Impact on Fast Ion Confinement in JT-60SA Plasmas

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The reduction of the heat load on divertors caused by Edge Localized Modes (ELMs) is a key issue in the ITER. Large energy flux of Type-I ELMs is expected to cause melting of the tungsten divertors in ITER. One of the methods to control ELMs is an application of Resonant Magnetic Perturbation (RMP) fields; in fact, mitigation or suppression of ELMs by RMPs are observed in many tokamak experiments. However, those results are not verified in the steady state operation. Therefore, to extrapolate those results to the ITER, RMPs experiments in the JT-60SA tokamak are critical and urgent issues. In the JT-60SA experiments, Error Field Correction Coils (EFCCs) will be utilized as RMP coils. For this reason, we have qualitatively and quantitatively studied the magnetic field topology with superposed RMPs by EFCCs to develop scenarios of RMPs experiment in the JT-60SA. In the operational aspects, how much the EFCC current to stochastize the magnetic field structure is necessary since EFCCs must be used for the error field correction and the capacity of EFCC power supplies is limited.

We have modeled RMPs of  $n=3$  and found that the current of EFCCs ( $I_{EFCC}$ ) higher than 10kA can stochastize the magnetic field in the edge region under the vacuum approximation without including plasma responses. To evaluate an effect of plasma responses, the 3D MHD equilibrium is calculated by the HINT2 code resulting in significant changes of the magnetic topology. Namely, magnetic islands in the plasma core evolve but the stochasticity of magnetic field lines in the edge region decreases. To recover the same stochasticity in the vacuum approximation with  $I_{EFCC}$  of 10kA, current higher than 30kA is necessary for the 3D plasma responses. Thus, the 3D plasma response can shield RMPs. Moreover, fast ion losses directly depend on the magnetic topology. 3D Monte Carlo simulations are performed with RMPs and the loss behavior is significantly changed by the 3D plasma response.

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