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P2.1094 Coexistence of magnetic island chains and resistive ballooning mode turbulence

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Control of turbulent particle and heat transport is an important issue for magnetically confined fusion plasmas such as tokamaks and helical devices. Repetitive transport bursts due to the magnetohydrodynamic turbulence in the pedestal region, called the edge localized modes (ELMs), will be serious problems for future devices. Resonant magnetic perturbations (RMPs) by external current coils are used to generate magnetic island chains and mitigate or eliminate the ELMs[1]. It is not fully understood what kind of physical mechsnism exists in the background where RMPs affect ELMs. Similarly, it is not clear how plasma turbulence influences the formation of magnetic islands due to RMPs.
The goal of the present study is to self-consistently simulate the interaction between the resistive ballooning mode turbulence with magnetic island chains due to RMPs. We have been developing a simulation code, which solves a set of reduced two-fluid equations for threedimensional and multi-helicity perturbations in tokamaks with circular poloidal cross sections. In our previous work, repetitive and intermittent transport bursts driven by the resistive ballooning mode turbulence with external heating are simulated, and an effect of a RMP on turbulent heat transport is examined[2]. The transport bursts are found to be replaced by more moderate and continuous transport when the penetration of the RMP occurs. The change in the transport pattern is found to be associated with the effect of the RMP on nonlinear coupling of fluctuations. In the previous work, the effect of the ballooning mode turbulence on the stability of magnetic island chains is not examined. However, the stability of magnetic islands and the state of turbulence should be discussed simultaneously. We are planning to revisit this problem by recosidering values of transport coefficients and by sophisticating the flow model.

References

[1] T. E. Evans et al., Nucl. Fusion 48, 024002 (2008).
[2] S. Nishimura and M. Yagi, Plasma Fus. Res. 6, 2403119 (2011).

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