Contribution ID: **735** Type: **Poster**

EX/4-4: Control of 3D Edge Radiation Structure with Resonant Magnetic Perturbation Fields Applied to Stochastic Layer and Stabilization of Radiative Divertor Plasma in LHD

Thursday, 11 October 2012 08:30 (4 hours)

It is found that resonant magnetic perturbation (RMP) fields has stabilizing effect on radiating edge plasma, realizing stable sustainment of radiative divertor (RD) operation in the Large Helical Device (LHD). Without RMP, otherwise, thermal instability leads to radiative collapse. Divertor power load is reduced by a factor of 3˜10 during the RMP assisted RD phase. RMP has m/n=1/1 mode, which has resonance layer in the edge stochastic region, and creates remnant island. 3D edge transport simulation result, which is consistent with the radiation profile measurement, show radiation condensation around X-point of the island, where the code predicts n_e > 10ˆ20 mˆ-3 and T_e ˜ a few eV. The well structured edge radiation with RMP such as the selective cooling around X-point is considered to provide stabilization effect by holding the intense radiation there and thus avoids it penetrating inward. It has also been demonstrated that RMP fields itself can onset transition to RD operation by increasing perturbation strength while density and input power are kept constant. The results show a possibility of new control knob for divertor power load in 3D magnetic field configuration. Operation range of RMP assisted RD is identified in terms of RMP strength and radial location of resonance layer of RMP.

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Session Classification: Poster: P5