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Plasma Structure Change and Intermittent Fluctuation near Magnetic Island X-Point under Detached Plasma Condition in LHD

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Recent study in the Large Helical Device (LHD) indicated that applying resonant magnetic perturbation (RMP) field is able to keep highly-radiating zone near the magnetic island X-point inside the ergodic region and particle flux onto the divertor plate is reduced accompanied by stable plasma detachment [1]. However, it is not clear yet where the particle flux starts to decrease in the RMP assisted plasma detachment experimentally. In addition, recent studies in several magnetic confinement devices implied that intermittent cross-field transport would be enhanced in the detached divertor [2-4].

We have investigated plasma structure change and plasma fluctuation property near helical divertor X-point and on divertor plate by using a fast scanning Langmuir probe and a probe array embedded on a divertor plate in the RMP assisted detached plasmas in LHD. When the RMP induced magnetic island X-point ($n/m = 1/1$) is located near the helical divertor X-point, the reduction of particle flux accompanied by the plasma detachment occurred near the helical divertor X-point ($n/m = 2/10$), which leads to the reduction of the particle flux at the strike point on the divertor plate. We also found that when the divertor plasma turned to be the detached condition, the enhanced plasma fluctuations were confirmed between the helical divertor X-point and ergodic region, which exhibited a dynamic behavior having a large amount of positive-spike components with highly intermittent property.

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- [3] N. Ohno et al., J. Plasma Fusion Res. 80 (2004) 275.
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