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PD/P8-18: Study on TAE-Induced Fast-Ion Loss Process in LHD

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Characteristics of fast-ion losses induced by toroidal- lfvén eigenmode (TAE) have been investigated over wide parameter ranges of the Large Helical Device (LHD) plasmas to reveal the fast-ion loss process. To study fast-ion losses, a scintillator-based lost-fast ion probe (SLIP) is used, and an increment of fast-ion loss flux due to the TAEs from the neoclassical orbit loss level ($\Delta\Gamma(\text{fast ion})$) is measured. It is newly found that the dependence of fast-ion loss flux on TAE magnetic fluctuation amplitudes changes at a certain fluctuation level. Experimental results show that in the low TAE magnetic fluctuation amplitude (b_{θ} TAE) regime, $\Delta\Gamma(\text{fast ion})$ is proportional to b_{θ} TAE whereas $\Delta\Gamma(\text{fast ion})$ increases with the square of b_{θ} TAE in the higher b_{θ} TAE regime. Simulation by orbit following codes that incorporates magnetic fluctuations with frequency chirping down due to TAEs suggests the change of the fast-ion loss process from a convective ($\Delta\Gamma(\text{fast ion})$ proportional to b_{θ} TAE) to a diffusive ($\Delta\Gamma(\text{fast ion})$ proportional to b_{θ}^2 TAE) character as b_{θ} TAE increases.

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