§22. Configuration Effects on Turbulence Transport in LHD

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The characteristics of the particle transport are studied from density modulation experiments in LHD[1]. The roles of fluctuations are investigated from the turbulence measurements by using a two dimensional phase contrast interferometer (2D-PCI) [2,3]. These studies are done under three different magnetic configurations. The experimental values of particle diffusion coefficients (D) and particle convection velocities (V) are compared with neoclassical prediction. The value of D is anomalously large and both in core and edge in whole configuration and core convection velocities were comparable with neoclassical estimation in the present experimental regime. The three kind of fluctuation, whose existing region, propagation direction, peak wave number is different, are observed. Low k (~0.4mm^{-1}) are localized in core (ρ<0.8), and higher k (~0.8mm^{-1}) are localized in edge (ρ>0.8). Edge high k components consist of two components. One is propagating to the electron diamagnetic direction and the other to the ion diamagnetic direction in laboratory frame.

As shown in Fig.1, the fluctuation level of edge ion diamagnetic components increases with D_{edge} in the all configurations, although the edge electron diamagnetic components do not show such a clear dependence on D_{edge}. This strongly suggests edge ion diamagnetic components play role on edge diffusion. Figure 2 (a) (b) shows density and fluctuation profiles. At more outward shifted configuration, where edge diffusion becomes larger, fluctuation amplitude becomes larger under similar averaged density. However, the growth rate does not vary very much, although diffusion and fluctuation changes clearly. Especially, growth rate is not smallest Rax=3.6m, whose fluctuation amplitude and D_{edge} are the smallest. One of the possible interpretation is reduction of growth rate or stabilize due to the Er shearing rate (ω_{Er}). Figure 2 (d) shows γ_{ITG} - ω_{Er}. The Er shearing rate was calculated with Er from GSRAKE code. The value of γ_{ITG} - ω_{Er} becomes smaller at Rax=3.6m suggesting stronger ω_{Er} help to reduce fluctuation. However, more detail systematic study is required to conclude the identification of the edge ion diamagnetic components and the mechanism of reduced fluctuation at Rax=3.6m.

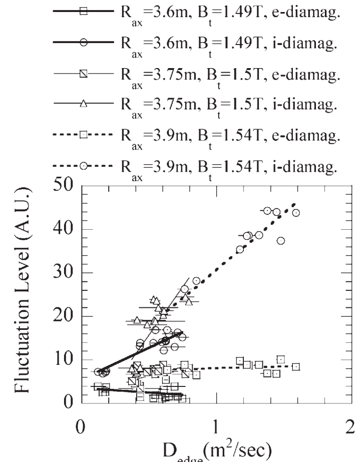

Fig.1 Relation of D_{edge} and edge fluctuation level for three different configurations

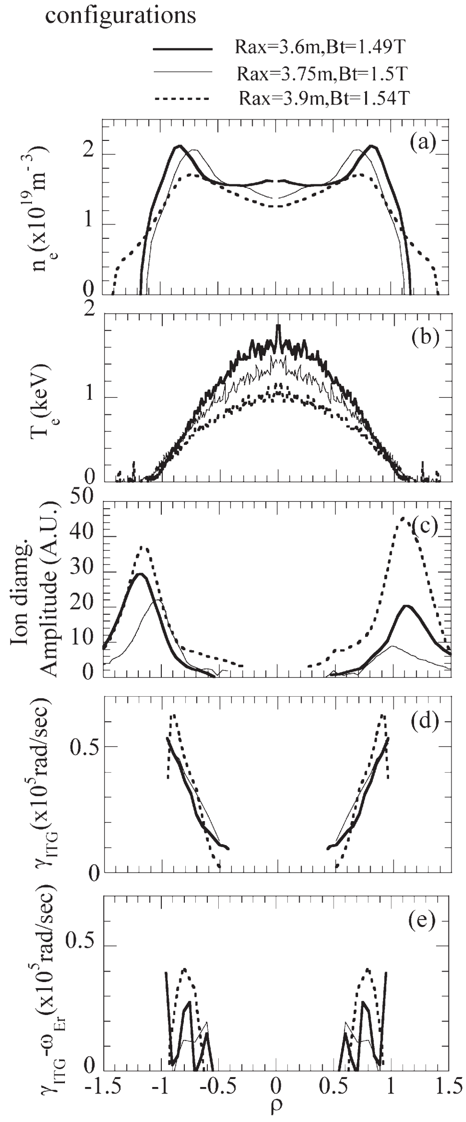

Fig.2 (a) n_e, (b)T_e profile, (c) Fluctuation amplitude profile (d) ITG growth rate and (e) ITG growth rate subtracted Er shearing rate. D_{edge}=0.18, 0.42, 0.57m^2/sec at Rax = 3.6, 3.75, 3.9 m respectively.

Reference

1) Tanaka, K., et al., to be published Fusion Science and Technology
2) Sanin, A.L., et al.., Rev. Sci. Instrum. 75, (2004) 3439
3) Michael, C.A., to be published Rev. Sci, Instrum.