1st Asia-Pacific Conference on Plasma Physics, 18-23, 09.2017, Chengdu, China

Plasma Physics Intrinsic rotation reversal, non-local transport, and turbulence transition in KSTAR L-mode plasmas

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Experiments of electron cyclotron resonance heating (ECH) power scan in KSTAR tokamak clearly demonstrate that both the cutoff density for non-local heat transport (NLT) and the threshold density for intrinsic rotation reversal can be determined by the collisionality (as shown in fig.1). We demonstrate that NLT can be affected by ECH, and the intrinsic rotation direction follows the changes of NLT. The cutoff density of NLT and threshold density for rotation reversal can be significantly increased by ECH. The poloidal flow of turbulence in core plasma is in the electron direction in ECH plasmas. The auto-power spectra of density fluctuation are almost the same in the outer region for both ECH and OH plasmas. On the other hand, the divergence in density fluctuation spectra at high frequency range between OH and ECH plasma is clearly observed in core region. The features of linear confinement and saturated confinement are also appeared in ECH plasma (as shown in fig.2), which is similar to the linear ohmic confinement (LOC) mode and saturate ohmic confinement (SOC) mode. All these observations in macroscopic parameters and micro fluctuations suggest a possible link between the macro phenomena and the structural changes in turbulence mode.

Acknowledgement

This research is supported by the Brain Korea 21 Plus Project (No. 21A20130012821).

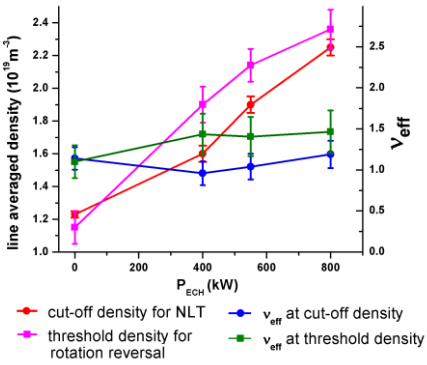

Figure1 The cut-off density for NLT and threshold density for rotation reversal in ECH power scan shots. The normalized effective collisionality at ρ~0.5 at cut-off density and threshold density is also plotted in this figure.

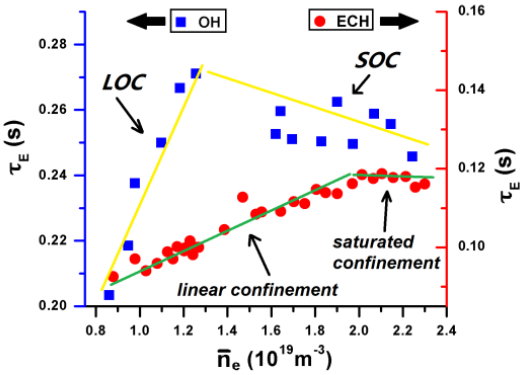

Figure 2 Energy confinement time v.s. line average density for OH and ECH plasmas.