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Comparison of turbulent transport regulated by shear layers on conventional and spherical tokamaks

Recent flux-driven gyrokinetic computational modeling and theory suggested the existence of an E×B staircase in the plasma core consisting of a series of m/n=0/0 E×B shear layers formed at different plasma minor radii. These layers then act as semi-permeable transport barriers and thus regulate the background gradients. Experimental work in TORE-SUPRA shows that the turbulent radial correlation length exhibits a number of marked reductions across the minor radius.
In order to find more direct indications of the presence of E×B staircase, a series of experiments have been conducted on HL-2A tokamak and several solid evidences have been found. The results of turbulence analysis show several reductions of the radial correlation length and multiple shear layers of the poloidal velocity across the minor radius. The direction of poloidal velocity even reverses at different minor radii. There are also some corrugations in the ∇T_e and ∇n_e profiles at the positions of the shear layers. In this experiment, multiple plasma behaviors were studied together to give a thorough view of the E×B staircase for the first time.
However, there is rare result on spherical tokamaks about turbulent transport regulated by shear layers, especially in core plasma. Therefore, a comparison between conventional and spherical tokamak is helpful to understand the effect of poloidal asymmetry and aspect ratio on turbulent transport.
SUNIST spherical tokamak is available for turbulence research in both boundary and core plasma. The ultrafast reciprocating probe, which is used for measuring the floating potential, electron temperature, density and so on, has achieved the diagnostics in core region with slight damage on probe and weak disturbance on plasma. The density information is also obtained from the FMCW reflectometer and interferometer. The DBS reflectometer gives the poloidal velocity, which is of great importance for the research on flow shear. Additionally, the biasing electrode is used for artificially changing the flow shear.
In this work, the behaviors of turbulence transport are investigated on HL-2A conventional tokamak and SUNIST spherical tokamak and a comparison of the results is shown.

Primary authors: Mr LIU, Wenbin (Tsinghua University); Prof. TYNAN, George (University of California, San Diego); Prof. TAN, Yi (Tsinghua University); Prof. GAO, Zhe (Tsinghua University)

Presenter: Mr LIU, Wenbin (Tsinghua University)

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