Contribution ID: **601** Type: **Poster**

Characteristics of turbulent transport in flux-driven toroidal plasmas

Wednesday, 19 October 2016 08:30 (4 hours)

Profile stiffness and intermittent bursts are the basis in understanding L-mode plasmas. However, why and how these different processes coexist and regulate the transport have not been fully clarified. Here, we presented an overall picture of flux-driven ITG turbulent transport which reveals profile stiffness with self-similarity and SOC type intermittent bursts simultaneously using a flux-driven gyrokinetic code by incorporating with statistical analyses.

We found that the transport is regulated by four non-diffusive processes, (1) radially localized fast time scale avalanches, (2) radially extended global bursts, (3) slow time scale avalanches with stair-case, (4) transport with long range time correlation. Among them, the process (2) is the key, which results from the instantaneous formation of radially extended ballooning-type structure with long radial correlation length from meso- to macro-scale. Such structures are disintegrated and damped by self-generated zonal flows while the repetitive occurrence of such structure provides a strong constraint on the profile causing stiffness.

Zonal flows produced by such global modes becomes the origin of the shear layer of radial electric field and associated pressure corrugation, referred to as ExB staircase. Since they are excited near both edges of global mode, the interspace is determined approximately by the size of the global mode. The staircase is found to evolve dynamically coupled with successive excitation of global mode. This process causes a long time scale breathing in transport and plays a role in sweeping out corrugations appeared on the self-organized stiff profile.

To obtain a unified view of transport, we study the spatio-temporal characteristics statistically. Quasi-steady baseline of transport is due to eddies from micro- to meso-scale, which follow a power law scaling, while the busty part to global eddies which release large amount of free energy as a non-power law tail component. The spatio-temporal linkage of such different non-diffusive processes leads to a new turbulent state dominated by long range correlation in time and space.

Finally, we found that the magnetic shear is a key parameter, so that the profile stiffness with specific function form and intermittency have revealed in moderate magnetic shear plasmas while weaken in those with weak and reversed magnetic shear.

Paper Number

TH/P3-2

Country or International Organization

Japan

Primary author: Prof. KISHIMOTO, Yasuaki (Kyouto University)

Co-authors: Mr LIU, Hairui (Kyoto University); Dr LI, Jiquan (Kyoto University); Mr OBREJAN, Kevin (Kyoto University); Mr WANG, Wei (Kyoto University); Dr IMADERA, kenji (Kyoto University)

Presenter: Prof. KISHIMOTO, Yasuaki (Kyouto University)

Session Classification: Poster 3

Track Classification: THC - Magnetic Confinement Theory and Modelling: Confinement