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Controlled turbulence excitation in LHD plasma edge region

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Turbulence physics is a universal physics research in the nature, especially in plasma physics, where the high degree of freedom allows for a wide variety of physical pictures to appear. In order to understand plasma turbulence physics, it is important to verify the theoretical models assumed by theories and simulations experimentally. In the past, most of the turbulence physics research have been limited to the observation of spontaneously generated turbulence. Some of them show the phenomenon of spreading and transmission in LHD [1].

In this study, we succeeded in generating turbulence actively. As shown in Fig. 1, we attempted to excite turbulence by increasing the local temperature gradient using ECH focused on the edge of the LHD plasma, and to measure the propagation of turbulence into the stochastic layer. When the ECH focus is set to r/a=0.8, the electron temperature gradually increases, and an enhancement of the temperature gradient is obtained as shown in Fig. 2. Millimeter-wave scattering diagnostics with high spatio-temporal resolution [2,3] were used to confirm the success of the experiment, and the radial propagation of the generated turbulence was also observed.

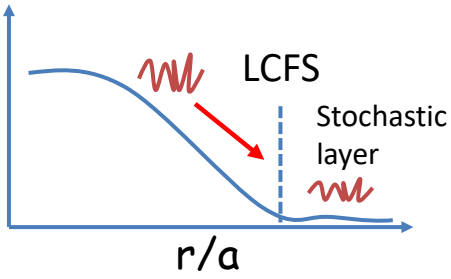

Figure 1. Conceptual diagram of turbulence propagation to the peripheral region.

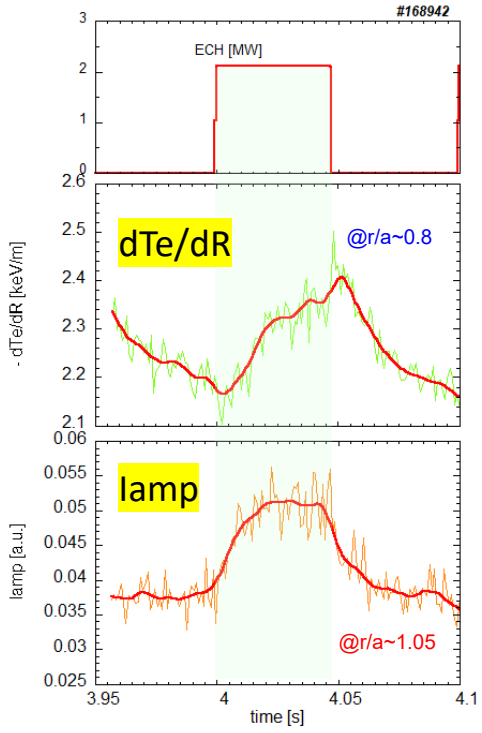

Figure 2. Temporal behaviour of ECH input power, electron temperature gradient at the focus point of ECH, and the turbulence intensity at the stochastic layer.

References

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