Response of Electron-scale Turbulence and Thermal Transport to Continuous ExB Shear Ramping-up in an NSTX L-mode Plasma

EX-C

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Abstract

Microturbulence is considered to be a major candidate in driving anomalous transport in fusion plasmas, and the equilibrium ExB shear generated by externally driven flow can be a powerful tool to control microturbulence in future fusion devices such as FNSF and ITER. Here we present the first observation of the change in electron-scale turbulence wavenumber spectrum (measured by a high-k scattering system) and thermal transport responding to continuous ExB shear ramping-up in an NSTX NBI-heated L-mode plasma. It is found that while linear stability analysis shows that the maximum ETG mode linear growth rate far exceeds the observed ExB shearing rate in the measurement region of the high-k scattering system, the unstable ITG modes are susceptible to ExB shear stabilization. We observed that as the ExB shearing rate is continuously ramped up in the high-k measurement region, the ratio between the ExB shearing rate and the maximum ITG mode growth rate continuously increases (from about 0.2 to 0.7) and the maximum power of the measured electron-scale turbulence wavenumber spectra decreases. Meanwhile, both the electron and ion thermal transports are also reduced as long as MHD activities are not important. These observations are found to be consistent with ExB shear stabilization of the ion-scale turbulence.