Turbulence response in the high Ti discharge of LHD

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High ion temperature was achieved by using an ion heating positive ion based neutral beam injection. Internal transport barrier (ITB) was clearly observed and was associated with impurity hole[1]. The ion thermal conductivity was down to the neoclassical level suggesting the suppression of turbulence driven anomalous transport. Spatial dynamics of micro-turbulence of high Ti discharge was measured by two-dimensional phase contrast imaging (2D PCI) [2]. The 2D-PCI can measure turbulence for $k=0.1-1\ mm^{-1}$, f=5-500kHz. The peak in spatial spectrum of fluctuations was around $k_{perp}\rho_i=0.5$, where k_{perp} is perpendicular wavenumber and ρ_i is ion Larmor radius. This peak is in the unstable region of ion temperature gradient mode [3]. A fluctuation peak at around ITB foot point where normalized position ρ = 0.7, increased when ITB grew. However, fluctuation did not increase inside ITB, where ion transport was improved. This fluctuation is likely to propagate to the ion diamagnetic direction in plasma frame, because plasma ExB rotation inside ITB are in the electron diamagnetic direction with negative neoclassical Er while fluctuations propagated in the ion diamagnetic direction in laboratory frame. With the increase of ion temperature gradient at ITB foot point, turbulence intensity increased. Therefore this is likely the grows of ion temperature gradient mode fluctuations around the foot point of ITB. Inside the ITB where the ion temperature gradient increased as well, fluctuation intensity did not increase. These suggest there are some mechanism to suppress the ion temperature gradient mode inside ITB. Comparison with linear gyro kinetic theory is now underway.

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