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I2.106 Isotope effects on transport and turbulence in LHD

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In LHD, hydrogen and deuterium isotope experiments were extensively carried out from the 2017 experimental campaign. In ECRH plasma, positive isotope effects in global energy confinement time taoE ECH proportional to A^(0.22±0.01) ne bar ^(0.60±0.01) Pabs^(-0.51±0.01) and negative isotope effects in global particle confinement time taoP ECH proportional to A^(-0.33±0.02) ne bar^(0.52±0.02) Pabs^(-0.69±0.02) were found [1]. Figure 1 shows comparison of profiles for almost identical ne bar and Pabs in H and D plasma. As shown in Fig.1 (a), ne profiles are clearly different. In D plasma, ne profile is clearly hollow, while it is flat in H plasma. Since neutral penetration of H and D are almost identical, the difference of ne profile is due to the difference of transport. Te is clearly higher in D plasma at reff/a99<1.0, while ECH power deposition profiles are almost identical. In H plasma, logarithmic gradient (LTe^-1) of Te is constant at reff/a99=0.2~0.9. In D plasma, however, LTe^-1 varies depending upon the location. Stronger stiffness is found in H plasma. Figure 1 (d) shows comparison of ion scale (ki~0.2) turbulence level measured by two-dimensional phase contrast imaging [2]. The edge turbulence levels at reff/a99>0.9 are almost identical both in H and D plasma, while, core turbulence level at reff/a99<0.9 in H plasma is clearly higher than turbulence levels in D plasma. Trapped electron mode (TEM) and ion temperature gradient mode (ITG) are possible candidates for measured turbulence. Both TEM and ITG can be stabilized in the positive density gradient of hollowed profile [3]. Suppressed turbulence level in the positive gradient region qualitatively agrees with gyrokinetic linear prediction.

[1] K. Tanaka et al, submitted to Nucl. Fusion,

[2] K. Tanaka et al, Rev. Sci. Instrum. 79, (2008), 10E702 3,

[3] M. Nakata et al, Plasma Phys. Control. Fusion in press

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