Radial transport of poloidal momentum in ASDEX Upgrade in L-mode and H-mode

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Turbulent transport and related parameters were investigated in the SOL of ASDEX Upgrade (AUG) in L-mode and H-mode discharges. The probe head [1] carries six probe pins of 1 mm diameter and 2 mm length. One pin is radially protruding by 3 mm. With this array the poloidal and radial electric field components $E_{\theta,r}$, respectively, and the ion density $n$ could be determined simultaneously. From these data in particular the radial flux of poloidal momentum, $M_r = n v_r v_{\theta,0} = n E_{\theta} E_r / B_\phi^2$, was derived ($B_\phi$ is the toroidal magnetic field). The density $n$ and the radial and poloidal velocity components, $v_{r,0}$, respectively, are defined as $X = X_0 + X_\text{fl}$ (i.e. the stationary and the fluctuating components). Thereby the momentum flux splits into various contributions [2,3] of which three are of interest to us: (i) Reynolds stress $\mathcal{R}_e = n_0 v_{r,0} v_{\theta,0}$, (ii) convective momentum flux term $v_{\theta,0} \Gamma = v_{\theta,0} n_0 v_{r,0}$ and (iii) triple fluctuating term $n v_{r,0} v_{\theta,0}$. Here we discuss the probability density functions (PDF) of these quantities, normalized to their standard deviations, for L-mode shot #23157 during its diverted phase and H-mode shot #23163. In case of H-mode discharges, $M_r$ is calculated separately for ELM-intervals and inter-ELM intervals, i.e., in between type-I ELMs. Whereas in H-mode due to neutral beam injection (NBI) there is an external source for toroidal angular momentum, in the L-mode discharge there is only intrinsic rotation. In both cases we see radial flux of poloidal momentum but with opposite signs. The interpretation of these findings will be discussed in the 4-page contribution.

References