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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, \( M_r = n v_r v_{\theta} \), was derived (\( B_{\phi} \) is the toroidal magnetic field). The density \( n \) and the radial and poloidal velocity components, \( v_r, v_{\theta} \), respectively, are defined as \( X = X_0 + X_f \) (i.e. the stationary and the fluctuating components). Thereby the radial flux of poloidal momentum splits into various contributions [2,3] of which three are of interest to us: (i) Reynolds stress \( \mathcal{R}_E = n_0 v_r v_{\theta} \), (ii) convective momentum flux term \( v_{0,0} \Gamma = v_{0,0} n v_r v_{\theta} \), and (iii) triple fluctuating term \( n_0 v_r v_{\theta} \). 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.

References