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Publication date:
2012

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Citation (APA):

Schrittwieser, R., Mehlmann, F., Naulin, V., Juul Rasmussen, J., Müller, H. W., Ionita, C., Nielsen, A. H., Vianello, N., & Rohde, V. (2012). *Radial transport of poloidal momentum in ASDEX Upgrade in L-mode and H-mode*. Abstract from Workshop on Electric Fields, Turbulence and Self Organization in Magnetized Plasmas (EFTSOMP 2012), Stockholm, Sweden.

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

R. Schrittwieser¹, F. Mehlmann¹, V. Naulin², J.J. Rasmussen², H.W. Müller³,
C. Ionita¹, A.H. Nielsen², N. Vianello⁴, V. Rohde³, ASDEX Upgrade Team³

¹*Inst. Ion Phys. & Appl. Physics, EURATOM-ÖAW Association, University Innsbruck, Austria*

²*Association EURATOM – DTU, Technical University of Denmark, Department of Physics,
DTU Risø Campus, Roskilde, Denmark*

³*Max-Planck-Institute for Plasma Physics, EURATOM Association, Garching, Germany*

⁴*Consorzio RFX, Associazione Euratom-ENEA sulla Fusione, Padova, Italy*

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, $M_r = n v_r v_\theta = n E_\theta E_r / B_\phi^2$, was derived (B_ϕ is the toroidal magnetic field). The density n and the radial and poloidal velocity components, $v_{r,\theta}$, respectively, are defined as $X = X_0 + X_{fl}$ (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 $\mathcal{R}e = n_0 v_{r,fl} v_{\theta,fl}$, (ii) convective momentum flux term $v_{\theta,0} \Gamma = v_{\theta,0} n_{fl} v_{r,fl}$ and (iii) triple fluctuating term $n_{fl} v_{r,fl} v_{\theta,fl}$. 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

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