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P2.1092 Temperature ratio dependence on turbulence-driven impurity transport in Wendelstein 7-X

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This contribution reports on the impurity confinement in Wendelstein 7-X which was studied with dedicated impurity injection by means of laser blow-off. Basically, the understanding of impurity transport is a demanding task for stellarators with the aim of steady state operation. Especially, the accumulation of impurities in confined plasmas can cause an early pulse termination due to a radiative collapse. Hence, the investigation of transport properties is inevitable and was done for different operation scenarios in the last operation phase of Wendelstein 7-X (W7X) to develop favorable operating scenarios that avoid these accumulations. From the analysis of the temporal evolution of the emission from several ionization stages of the injected impurity, it turns out, that for relevant plasma scenarios no impurity accumulation were found and the impurity transport time is mainly in the order of 100 ms. Additionally, the impurity transport tends to be turbulence-driven. These results are supported by core turbulence measurements and calculation from 1D transport code STRAHL involving the drift kinetic equation solver (DKES) for the neoclassical expectations. These calculations in sum enable for instance the comparison of the neoclassical and anomalous diffusion coefficient. As a result, the anomalous diffusion coefficient is two orders of magnitude larger compared to neoclassical expectation and supports the experimental finding of turbulence-driven impurity transport. Additionally, there are experimental indications for a temperature ratio dependent impurity confinement. The anomalous diffusion coefficient decreases meanwhile the impurity transport time increases with the temperature ratio T_i / T_e. This temperature ratio is the threshold for the ion-temperature gradient instabilities which seems to be the major turbulence mechanism in W7-X so far.

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