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10.47 Reflectometry diagnostics at Wendelstein 7-X: Systems overview and initial results

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Wendelstein 7-X (W7X) is equipped with multiple reflectometry systems which are dedicated to measure localized density fluctuations. Two monostatic Doppler reflectometry (DR) systems (V/W-band) with fixed tilt angles allow to infer the radial electric field E_r in the range $r/a > 0.7$ which extends also into the SOL region where strong modifications of the magnetic topology for the different configurations of W7-X appear. A poloidal correlation reflectometry (PCR) system (K/Ka-band) utilizing five antennae allows to characterize the spatio-temporal behaviour of density fluctuations from which E_r can also be deduced. At low-density operation the PCR measurement range extends to $r/a \sim 0.3$ such that transitions from the ion root in the plasma edge to the electron root in the plasma core can be observed in low collisionality plasmas. To overcome the limitation of a fixed tilt angle DR measurement diminishing the accessible fluctuation wavenumbers a phased array DR system (W-band) is operated that allows to steer the microwave beam. With a second, bistatic DR system at a different toroidal angle the zonal character of the fluctuations can be investigated. This paper gives an overview of the individual systems and summarizes key results from the first W7-X island divertor campaign.

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