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ECRH and ECCD Experiments at the Wendelstein7-X Stellarator HEINRICH LAQUA, HARALD BRAUNE, MATTHIAS HIRSCH, UDO HOEFEL, STEFAN MARSEN, DMITRY MOSEEV, TORSTEN STANGE, ROBERT WOLF, Max-Planck-Institute for Plasma Physics, Greifswald, Germany, TOM WAUTERS, Laboratory for Plasma Physics, LPP-ERM/KMS, Brussels, Belgium, TEC Partner, W7-X TEAM — Plasmas in the first operation phase OP1.1 of W7-X were exclusively heated by ECRH. 6 gyrotrons with up to 4.3 MW power at 140 GHz and a quasi-optical transmission line generated plasma start-up, heating and wall conditioning with a very high reliability. The central ECRH power deposition enabled highly peaked electron temperature (Te) profiles with a peak Te above 8 keV, n_e of $4 \bullet 10^{19} m^{-3}$ and flat ion temperatures profiles reaching 2 keV. By off-axis ECRH, the absence of core Te profile resilience in W7-X was demonstrated. With ECRH-power modulation heat waves for transport analysis have been generated on a regular basis. First ECCD experiments demonstrated a strong sensitivity of the confinement with sawtooth-like crashes of the central Te profile when central ECCD was applied. The high Te enabled successful demonstration of ECRH in O2-mode only. This scenario is foreseen for high-density operation above the X2-mode cut-off density in the next operation phase. The density control could be recovered by ECRH discharges in helium, which substituted glow discharge when the supra-conducting field coils were charged. The efficiency of ECRH absorption was monitored by diagnostics that measured the unabsorbed part of the ECRH. These also served as plasma interlock, preventing damages by unabsorbed ECRH power.

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