Wendelstein 7-X
Operation campaigns OP 2.4 & OP 2.5

Task Force III: Physics Integration and Exploration

MAX-PLANCK-INSTITUT FÜR PLASMAPHYSIK

Main objective	Deliverable
Exploit heat and particle transport and stability mechanisms	▪ Quantitative assessment of neoclassical and anomalous heat and particle (main species and impurities) transport channels ▪ Experimental validation of core modeling predictions - instabilities and transport (magnetic geometry, profile gradients, collisionality, pellet dynamics, etc.) ▪ Characterization of turbulent transport and drifts across the LCFS and throughout the SOL, and comparison to modeling ▪ Investigation of instabilities driven or modified by fast ions
Stability of high-beta regimes	▪ Soft/hard beta limits in W7-X beyond Mercier stability ▪ Mapping the operational window of electromagnetic activity (KBM, MTM, Alfvénic, Interchange) up to $\langle\beta\rangle$ = 2.5% (2.5T) and 4% (1.7T) ▪ Exploration of configurations with reduced MHD stability and characterization of MHD-like events previously observed at $\langle\beta\rangle$ > 1.5% (2.5T) and > 1% (1.7T)
Paths towards a next-generation machine	▪ Steady-state scenarios that integrate high core performance (T_i > 2.5 keV) with divertor detachment (f_{rad} > 80%) and stationary impurity content for t > 10s by turbulence optimization (ITG reduction and finite anomalous particle flux), and exploration of detuned scenarios ▪ Assessment of the influence of pressure profile shaping on achievable beta ▪ Exploration of exotic magnetic configurations (e.g. rational iota, internal islands, optimized and degraded) ▪ Investigation of H-mode access in W7-X and its impact on confinement