P 4: Magnetic Confinement II

Time: Tuesday 11:00–12:00 Location: H5

Invited Talk P 4.1 Tue 11:00 H5

Overview on turbulence in the shear- and scrape-off layer at W7-X — •Andreas Krämer-Flecken[1], Olaf Grulke[2], Xiang Han[1], Carsten Killer[2], Elisee Trier[3], Thomas Windisch[2], and Haoming Xiang[1] — [1]Institut für Energie- und Klimaforschung, Forschungszentrum Jülich, 52425 Jülich — [2]MPI für Plasmaphysik, Teilinstitut Greifswald, 17491 Greifswald — [3]MPI für Plasmaphysik, Teilinstitut Garching, 85748 Garching

The presentation intends to give an overview on mode and turbulence phenomena observed in the plasma edge, island divertor and scrape-off layer (SOL) at the stellarator W7-X. This region is investigated by a suit of probe heads measuring profile properties as well as characterizing turbulence in the SOL and island region. In the shear layer those measurements are continued by poloidal correlation reflectometry. Measurements of quasi coherent modes are reported in the shear layer located in the plasma edge. Furthermore a low frequency mode in plasmas with an edge iota of $\iota = 1$ are observed which show a modulation of the plasma flow as well.

During scans of the edge iota, plasmas with an increased diamagnetic energy due to variations in the positioning of the 5/5 island chain gained large interest. In these plasmas a low frequency modulation of the plasma rotation is observed, interrupted by fast events in the plasma current. Transient high frequency events in the range of $800\ kHz - 1000\ kHz$ precede the observation of spikes in the plasma current signal.

P 4.2 Tue 11:30 H5

Analytical model for collisional impurity transport covering all collisionality regimes — •Daniel Fajardo[1,2], Clemente Angioni[1], Patrick Maget[3], Pierre Manas[3], and the ASDEX Upgrade Team[1] — [1]Max-Plack-Institut für Plasmaphysik, Garching, Germany — [2]Technische Universität München, Munich, Germany — [3]CEA/IRFM, Saint Paul-lez-Durance, France

In tokamak plasmas, collisional transport of impurities can be dominant over turbulent transport, particularly for heavy impurities. A recent analytical model for the Pfirsch-Schlüter (PS) flux, including the self-consistent coupling to the poloidal density distribution [P. Maget et al, Plasma Phys. Control. Fusion 62 (2020) 105001], is extended to cover all collisionality regimes, relaxing the condition of main ions in the deep banana regime. Additionally, a fully analytical model for the Banana-Plateau (BP) flux was developed, completing the neoclassical flux. This new model is compared to the drift-kinetic code NEO and the fluid code NCLASS, showing agreement with NEO on broad scans in collisionality, trapped particle fraction, charge and mass. A change in magnitude and even in sign in the temperature screening effect at the transition between the BP and PS regimes is identified and well reproduced. Radial profiles of transport coefficients are calculated for ASDEX Upgrade experimental profiles and ITER and DEMO predicted profiles, and successfully compared to NEO and NCLASS. This model is suited for fast integrated modelling applications due to its low computational cost.

P 4.3 Tue 11:45 H5

Impurity transport studies on Wendelstein 7-X by Tracer-Encapsulated Solid Pellets (TESPEL) — •René Bussiahn[1], Naoki Tamura[2], Kieran McCarthy[3], and the W7-X team[1] — [1]Max-Planck-Institute for Plasma Physics, Greifswald, Germany — [2]National Institute for Fusion Science(NIFS), Toki, Japan — [3]Centro de Investigaciones Energeticas, Medioambientales y Tecnologicas

During OP1.2b operation phase of the stellarator Wendelstein 7-X, the TESPEL injections have proven successfully as a complementary tool to Laser-Blow-Off (LBO) for impurity transport studies. Contrary to LBO - depositing tracers close to the plasma edge which are subsequently transported and spread out into the plasma, TESPEL can release the embedded impurity tracers instantly after the ablation of the protecting polystyrene shell in the core of the plasma within a well defined spatial region of a few cm^3. The deposited tracers are localized within the plasma from time-of-flight measurements. The temporal dynamics of the shell ablation is well reproduced by neutral gas shielding models. This confirms the applicability of the tracer localisation method. The spectral line emission time-traces of various tracer ion charge states show distinct differences between LBO and TESPEL, especially in their initial phase. Later, the curves are similar and the related impurity decay times are inversely proportional to the heating power. First impurity transport studies by means of the code STRAHL resulted in a good reproduction of the line emission time-traces and confirm the important role of anomalous transport in W7-X, as reported for LBO injections before.