P 15: Magnetic Confinement V & Helmholtz Graduate School V

Time: Thursday 16:30–18:15 Location: H5

Invited Talk P 15.1 Thu 16:30 H5

Physics studies with high-power electron cyclotron heating (ECRH) on ASDEX Upgrade — •Jörg Stober and ASDEX Upgrade Team — MPI für Plasmaphysik, Garching, Germany

The ECRH system of ASDEX Upgrade has been upgraded over the last 15 years from a 2 MW, 2 s, 140 GHz system to an 8 MW, 10 s, dual frequency system (105/140 GHz). The power roughly equals the installed ion cyclotron resonance (ICRF) power. The power of both wave heating systems together ($>$ 10 MW in the plasma) is about half of the available power from the neutral beam heating (NBI), allowing significant variations of torque input, of the shape of the electron and ion heating profiles even at high heating power.

This system allows addressing important issues fundamental to a fusion reactor: H-mode operation with dominant electron heating, accessing low collisionalities in full metal devices, novel scenarios without edge eruptions (ELMs), influence of Te/Ti and rotational shear on transport, dependence of impurity accumulation on heating profiles. Experiments on these subjects will be presented here. The adjustable localized current drive capability of ECRH allows dedicated variations of the shape of the q-profile and studying their influence on non-inductive Tokamak operation. The ultimate goal of these experiments is to use the experimental findings to refine theoretical models such that they allow a reliable design of operational schemes for reactor size devices. In this respect, recent studies comparing gyrofluid (TGLF) and gyrokinetic (GENE) modelling of non-inductive high beta plasmas will be reported.

P 15.2 Thu 17:00 H5

Investigation of increased core ion temperatures in high-beta advanced scenarios in ASDEX Upgrade — •Maximilian Reisner[1], Jörg Stober[1], Alessandro Di Siena[2], Rainer Fischer[1], Andreas Burckhart[1], Alexander Bock[1], Emiliano Fable[1], Rachael McDermott[1], Alejandro Bañon Navarro[1], and the ASDEX Upgrade Team[3] — [1]Max-Planck-Institut für Plasmaphysik, 85748 Garching bei München, Germany — [2]UT Austin, 201 E 24th St, Austin, Texas, USA — [3]See the author list of H. Meyer et al, Nucl. Fusion 59, 112014 (2019)

Non-inductive advanced scenarios are a possible way for future nuclear fusion power plants based on the tokamak design to run in non-pulsed operation. In these scenarios, the ohmic current is replaced by externally driven currents and the intrinsic bootstrap-current. Since the bootstrap-current is produced in the presence of pressure gradients, internal transport barriers or regions of reduced turbulent transport are favourable to such scenarios. Such local reductions in transport have been observed in non-inductive ASDEX Upgrade discharges. There are several parameters that are thought to be connected to local reductions of transport in the plasma core, such as the ExB-shear, the magnetic shear and the fast ion pressure. In this contribution, results of experiments conducted in the Tokamak ASDEX Upgrade will be presented, which aim to study the individual contributions of these parameters to the observed reductions in transport. These experimental findings are backed up by simulations using the quasilinear transport model TGLF and the gyrokinetic code GENE.

P 15.3 Thu 17:25 H5

Localization of magnetic reconnection during sawtooth crash in ASDEX Upgrade — •Oleg Samoylov, Valentine Igochine, Andreas Stegmeir, Hartmut Zohm, and The ASDEX Upgrade Team — Max Planck Institute for Plasma Physics, Boltzmannstr. 2, 85748 Garching, Germany

The work discusses the toroidal localization of magnetic reconnection during sawtooth crashes. Numerical analysis with realistic heat diffusion coefficients shows that heat distributes itself helically along the torus faster than the temporal resolution of any existing ECE diagnostics. It makes local and global (helically axisymmetric) magnetic reconnection indistinguishable for an observer, while a local crash in which the heat stays confined within a finite helical region could be distinguished. Statistical analysis of sawtooth crashes with the ECEI diagnostic is conducted in ASDEX Upgrade. Our data reveals no evidence of a local sawtooth crash and supports the numerical results.

P 15.4 Thu 17:50 H5

Plasma electron acceleration up to 100 keV in the TJ-K stellarator — •Alf Köhn-Seemann[1], Gregor Birkenmeier[2,3], Eberhard Holzhauer[1], Mirko Ramisch[1], Gabriel Sichardt[1], and Ulrich Stroth[2,3] — [1]IGVP, University of Stuttgart — [2]Max Planck Institute for Plasma Physics, Garching — [3]Physics Department E28, TUM, Garching

In conventional microwave heating scenarios, the injected microwaves' frequency must be equal to or higher than the electron cyclotron frequency (ECF) to transfer their energy to the plasma. Here, we describe in contrast an operational regime at the stellarator TJ-K where the heating occurs well below the ECF, but still above the lower-hybrid frequency: energy is deposited at the so-called O-resonance. A population of high-energy electrons observed in the scenario is attributed to strong wave electric fields at this resonance. Simple physics considerations estimating the energy gain during a half-cycle of the wave electric field have been used to describe this acceleration scheme for plasma electrons. The model has been successfully compared with measurements using a pulse-height analyzer allowing to determine the fast electrons' energy.