P 20: Invited talks V

Time: Friday 11:00–12:30 Location: P-H11

Invited Talk P 20.1 Fri 11:00 P-H11

On the hunt for a reactor-relevant scenario for W7-X — •Golo Fuchert for the W7-X team-Collaboration — Max-Planck-Institut für Plasmaphysik, Greifswald, Germany

The optimized stellarator Wendelstein 7-X (W7-X) aims to demonstrate a steady-state reactor-relevant scenario. Already the first divertor experiments at W7-X gave initial insights in how such a scenario could potentially look like, which key questions need to be answered in order to improve the performance of W7-X, and if the scenarios that will be developed can also teach us something about a potential reactor. A starting point of scenario development is the understanding of operational limits. Obviously it has to be physically possible to run a particular scenario. Here, mainly limitations arising from the ECR heating physics and the power balance (radiative density limit) have been identified in the first experimental campaigns of W7-X and essentially follow theoretical expectations. Furthermore, a reactor-relevant scenario should combine good energy confinement, steady-state conditions and divertor detachment. All three criteria have been achieved individually. Good confinement seems to depend on reduced turbulent transport in plasmas with steep density gradients. Steady-state plasmas have been achieved at moderate densities and heating powers. And detachment was demonstrated at high densities. But combining all three into an integrated scenario is a challenge that will guide the experimental exploration of W7-X for the foreseeable future. On this path, the flexibility of the magnetic configuration offers unique opportunities, but increases the complexity of the task at hand.

Invited Talk P 20.2 Fri 11:30 P-H11

Plasma für die Gaskonversion: Power-to-X — •Andreas Schulz, Katharina Wiegers, Matthias Walker und Günter Tovar — Universität Stuttgart, IGVP, Pfaffenwaldring 31, 70569 Stuttgart, Germany

Im Koalitionsvertrag 2021 - 2025 zwischen der Sozialdemokratischen Partei Deutschlands (SPD), BÜNDNIS 90 / DIE GRÜNEN und den Freien Demokraten (FDP) „Mehr Fortschritt wagen“ steht als eines der großen Ziele, die Klimaneutralität spätestens 2045 zu erreichen. Das Umweltbundesamt beziffert den deutschen Primärenergiebedarf für 2018 auf 3.942.341 TJ (1,1 EWh); davon liegt alleine der Anteil für die chemische Industrie bei rund 42 %. Für das Erreichen der angestrebten Klimaneutralität müssen Technologien erforscht werden, die Energie aus erneuerbaren Ressourcen für die chemische Industrie nutzbar machen. Eine Möglichkeit ist, elektrische Energie über Plasmaverfahren in die chemische Synthese zu integrieren. Dabei muss sich das Plasma gegenüber etablierten und sehr gut erforschten Verfahren, wie die Elektrolyse oder elektrische Widerstandserwärmung (Power-to-Heat), behaupten. Grundsätzlich wird ein Plasma dazu genutzt, um ein energetisch tief liegendes Molekül durch Energiezufuhr in einen aktivierten Zustand überzuführen. Aktuell sind am IGVP die Moleküle CO_2, N_2, und H_2O im Fokus der Forschung. CO_2 wird durch Dissoziation in CO und O· zerlegt, N_2 mit O_2 zu NO reagiert und aus H_2O wird für die Radikalchemie die beiden Radikale ·OH und H· erzeugt.

Invited Talk P 20.3 Fri 12:00 P-H11

Combined Phase Contrast Imaging and Small-Angle X-Ray Scattering Diagnostic of Relativistic Plasmas at the High Energy Density Instrument at European XFEL — •Alejandro Laso Garcia[1], Toma Toncian[1], Hauke Hoeppner[1], Alexander Pelka[1], Carsten Baehtz[1], Erik Brambrink[2], Jan-Patrick Schwinkendorf[2], Motoaki Nakatsutsumi[2], Johannes Hagemann[3], and Thomas Preston[2] — [1]Helmholtz-Zentrum Dresden - Rossendorf, Dresden, Germany — [2]European XFEL GmbH, Schenefeld, Germany — [3]Deutsches Elektronen-Synchrotron DESY, Hamburg, Germany

The bright ultra-short X-ray pulses of the EuXFEL provide an invaluable tool to spatially and temporally investigate the laser-plasma interactions at solid density. At the HED instrument, the high-power laser ReLaX currently delivers pulses of 3 J of energy with 25 fs duration on target, reaching intensities up to 10^{20} W/cm^2.

In April and May 2021, Small Angle X-Ray Scattering and Phase Contrast Imaging were simultaneously demonstrated in pump-probe experiments at HED in a community experiment involving 15 institutions from all over the world. In this talk we will present the preliminary results of this community experiment probing ultrafast phenomena in a wide array of target configurations: hole boring in wires, shockwave generation in CH blocks, buried heating of a wire inside a CH medium, foam ionization and collective effects in heated foils.