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EX/P7-23: Far-reaching Impact of Intermittent Transport across the Scrape-off Layer: Latest Results from ASDEX Upgrade

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Latest research of intermittent transport in the scrape-off layer (SOL) of the ASDEX Upgrade tokamak is presented. Near the separatrix the fluctuations of the plasma and the floating potentials, measured by various Langmuir probes (LPs), are found to be anti-correlated due to fluctuations of the electron temperature. This indicates that, in contrast to a widely used experimental practice, a free exchange of both potentials is unjustified and can lead to significant error. Measurements of ion energies in turbulent L-mode and ELM filaments were carried out using a retarding field analyzer. In L-mode plasma, the filament ion temperature measured at 2 cm outside the separatrix is 80-110 eV, i.e. 3-4 times the background ion temperature. Turbulent filaments also convect plasma to the wall with larger density than the background plasma density. Qualitatively similar observations were obtained during inter-ELM periods. Such enhanced particle and energy fluxes can potentially raise the erosion of the first wall in ITER. The ion temperature averaged over an ELM measured 35-60 mm outside the separatrix is in the range of 20-200 eV (5-50% of the pedestal top ion temperature). This demonstrates that ELM filaments carry hot ions over large radial distances in the SOL, which, in turn, can lead to enhanced sputtering from the first wall in future tokamaks. Lowest ion energies are observed during ELMs mitigated by in-vessel magnetic perturbations (MPs). The ELM ion temperature in the far SOL is found to increase with the ELM energy, indicating that on average the filaments in large ELMs propagate faster radially. The filamentary structure of the ion current density measured by LPs at the outboard mid-plane during mitigated ELMs is qualitatively similar to that observed during type I ELMs. The amplitude of the ion current density decreases only slightly when ELMs are mitigated, but, in contrast to type I ELMs, bursts of the ion current are observed throughout the ELM cycle including inter-ELM periods. This shows again that ELM mitigation replaces type I ELMs by more continuous transport events. In H-mode, MPs modify the SOL transport (intermittency decreases, time-averaged ion current rises) even if the plasma density is below the empirical ELM mitigation threshold. In the low density L-mode, MPs are associated with the decrease of the fluctuation level in the SOL.

Country or International Organization of Primary Author

Germany

Primary author: Mr KOCAN, Martin (Germany)

Co-authors: Dr NOLD, Bernhard (Institut für Plasmaforschung, Universität Stuttgart, 70569 Stuttgart, Germany); Dr SCOTT, Bruce (Max-Planck-Institut für Plasmaphysik, EURATOM Association, 85748 Garching, Germany); Dr MASZL, Christian (Institute for Ion Physics and Applied Physics, Association Euratom-ÖAW, Austria); Dr FUCHS, Christoph (Max-Planck-Institut für Plasmaphysik, EURATOM Association, 85748 Garching, Germany); Dr IONITA, Codrina (Institute for Ion Physics and Applied Physics, Association Euratom-ÖAW, Austria); Dr WOLFRUM, Elisabeth (Max-Planck-Institut für Plasmaphysik, EURATOM Association, 85748 Garching,

Germany); Dr GENNRICH, Felix (Institute for Ion Physics and Applied Physics, Association Euratom-ÖAW, Austria); Dr MEHLMANN, Franz (Institute for Ion Physics and Applied Physics, Association Euratom-ÖAW, Austria); Dr CONWAY, Garrard (Max-Planck-Institut für Plasmaphysik, EURATOM Association, 85748 Garching, Germany); Dr HORACEK, Jan (Association EURATOM-IPP.CR, Za Slovankou 3, 18200 Prague 8, Czech Republic); Dr ADÁMEK, Jiri (Association EURATOM-IPP.CR, Za Slovankou 3, 18200 Prague 8, Czech Republic); Dr MARASCHEK, Marc (Max-Planck-Institut für Plasmaphysik, EURATOM Association, 85748 Garching, Germany); Dr KOMM, Michael (Association EURATOM-IPP.CR, Za Slovankou 3, 18200 Prague 8, Czech Republic); Dr DE MARNÉ, Pascal (Max-Planck-Institut für Plasmaphysik, EURATOM Association, 85748 Garching, Germany); Dr FISCHER, Rainer (Max-Planck-Institut für Plasmaphysik, EURATOM Association, 85748 Garching, Germany); Prof. SCHRITTWIESER, Roman (Institute for Ion Physics and Applied Physics, Association Euratom-ÖAW, Austria); Dr MÜLLER, Stefan (Max-Planck-Institut für Plasmaphysik, EURATOM Association, 85748 Garching, Germany); Dr EICH, Thomas (Max-Planck-Institut für Plasmaphysik, EURATOM Association, 85748 Garching, Germany); Dr RIBEIRO, Tiago (Max-Planck-Institut für Plasmaphysik, EURATOM Association, 85748 Garching, Germany); Dr LUNT, Tilmann (Max-Planck-Institut für Plasmaphysik, EURATOM Association, 85748 Garching, Germany); Prof. STROTH, Ulrich (Max-Planck-Institut für Plasmaphysik, EURATOM Association, 85748 Garching, Germany); Dr ROHDE, Volker (Max-Planck-Institut für Plasmaphysik, EURATOM Association, 85748 Garching, Germany); Dr MÜLLER, Werner (Max-Planck-Institut für Plasmaphysik, EURATOM Association, 85748 Garching, Germany); Dr SUTTROP, Wolfgang (Max-Planck-Institut für Plasmaphysik, EURATOM Association, 85748 Garching, Germany); Mr HUANG, Zhouji (Institut für Plasmaforschung, Universität Stuttgart, 70569 Stuttgart, Germany); Dr HERRMANN, albrecht (Max-Planck-Institut für Plasmaphysik, EURATOM Association, 85748 Garching, Germany); Prof. KALLENBACH, arne (Max-Planck-Institut für Plasmaphysik, EURATOM Association, 85748 Garching, Germany)

Presenter: Mr KOCAN, Martin (Germany)

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