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Landau-Spitzer Award: Fast-Ion Transport in the ASDEX Upgrade and DIII-D Tokamaks[1]

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Unprecedented insight into the fast-ion transport caused by a broad range of fluctuations has been made possible in the ASDEX Upgrade (AUG) and DIII-D tokamaks thanks to a new set of fast-ion diagnostics developed in the framework of a transatlantic collaboration. The temporal evolution of the fast-ion radial profile with velocity-space resolution has been measured in the AUG tokamak with the implementation of the Fast-Ion D-Alpha (FIDA) technique and associated analysis tools developed originally by the DIII-D group. Time resolved phase-space measurements of fast-ion losses made in DIII-D with a scintillator-based Fast-Ion Loss Detector (FILD) developed at AUG have revealed crucial details of the fast-ion dynamics in the presence of a broad range of MHD perturbations. The joint application of these techniques to AUG and DIII-D plasmas has advanced our understanding of the wave-particle interaction responsible for the fast-ion transport induced by Alfven Eigenmodes (AEs), Sawteeth and Edge Localized Modes (ELMs). Accurate measurements of the fast-ion radial profile have demonstrated the weak or negligible effect that microturbulence has on fast-ion transport. Additionally, multiple FILD and FIDA systems in both devices show a significant increase in EP loss due to externally applied 3D fields (such as those used for ELM control). A survey of the most relevant experimental and modelling results obtained through this collaboration will be presented. This work was carried out together with B. Geiger (IPP-Garching), W.W. Heidbrink (UC-Irvine), D. C. Pace, M. A. Van Zeeland (General Atomics) and the ASDEX Upgrade and DIII-D Teams.

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