Fast-Ion Transport in the ASDEX-Upgrade and DIII-D Tokamaks*

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Unprecedented measurements of the fast-ion transport caused by a broad range of fluctuations have 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 made possible 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 have advanced our understanding of the wave-particle interaction responsible for the fast-ion transport induced by Alfven Eigenmodes (AEs), Sawtooth 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. Multiple FILD and FIDA systems in both devices are currently being used to investigate the impact of externally applied 3D fields (such as those used for ELM control) on the fast-ion distribution function. A survey of the most relevant experimental and modelling results obtained through this collaboration will be presented.

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