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Fast-ion transport and NBI current drive in ASDEX Upgrade
BENEDIKT GEIGER, MARKUS WEILAND, ALEXANDER MLYNEK, MIKE DUNNE, RALPH DUX, RAINER FISCHER, JOERG HOBIRK, CHRISTIAN HOPF, MATTHIAS REICH, DAVID RITTICH, FRANCOIS RYTER, PHILIP SCHNEIDER, GIOVANNI TARDINI, Max-Planck Institute for Plasmaphysics, MANUEL GARCIA-MUNOZ, University of Sevilla, ASDEX UPGRADE TEAM —
Good confinement of fast ions is essential in fusion devices because these suprathermal particles are responsible for plasma heating, current drive and can, if poorly confined, damage surrounding walls. The degradation of the fast-ion confinement caused by large and small scale instabilities must consequently be investigated. In the ASDEX Upgrade tokamak, fast ions are generated by neutral beam injection (NBI) and their slowing down distribution can be studied using FIDA spectroscopy, neutral particle analyzers and neutron detectors. Neo-classical fast-ion transport is observed by these measurements in MHD-quiescent discharges with relatively weak heating power (less than 5 MW). The presence of sawtooth instabilities, in contrast, yields a strong internal fast-ion redistribution that can be modelled very well when assuming full reconnection of the helical magnetic field. The fast-ion current drive efficiency has been studied in discharges with up to 10 MW of heating power in which on-axis and off-axis NBI were exchanged. The radial shape of the fast-ion population, generated by the different NBIs, changes as predicted and a corresponding modification of the current profile is measured.

Benedikt Geiger
Max-Planck Institute for Plasmaphysics

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