Towards the explanation of the LOC–SOC transition phenomenology via ASTRA–TGLF modeling on ASDEX–Upgrade L–mode plasmas

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Ohmic L–mode plasmas obtained in ASDEX–Upgrade are analyzed from the point of view of profile behavior and global confinement. The so–called linear to saturated Ohmic confinement transition (LOC–>SOC) is observed with clear dependence on the plasma density and on the plasma current. Consequent changes in density peaking and intrinsic rotation profiles are also observed [1, 2].

Employing the ASTRA 1.5D transport code [3, 4], complemented with the TGLF model for turbulence–drive transport [5], an exhaustive explanation of the several observations connected with the LOC-SOC transition behavior of profiles and their confinement is given. Combining information from simulated profiles and turbulence spectra in the core region, as main plasma parameters are changed (density, current), the picture of how the plasma evolve from LOC to SOC regimes emerges in self–consistent fashion. The modeling is able to correctly and simultaneously predict electron and ion temperature and density. On the other hand, the behavior of intrinsic rotation is still not fully explained in this framework, although some hints are given on what the mechanism could be.

The work also puts in evidence both the role of edge and core confinement in determining the typically observed energy confinement time vs plasma density curves, whereas the core behavior is analyzed in details from the point of view of turbulence–driven transport. Infact, it is noted already that neoclassical transport is too low to be a player in the LOC–SOC behavior.

References