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On the non-stiffness of edge transport in L-modes[1]

OLIVIER SAUTER, CRPP-EPFL, Lausanne, Switzerland

Transport analyses using first principle turbulence codes with $1^1/_2$-D transport codes often study transport properties in a region between the plasma axis and a normalized radius around 0.8. Here, heat transport shows significant stiffness properties with R/L_{Te} values relatively independent of the auxiliary input power. We present experimental studies, in the TCV tokamak, of the transport properties in the edge region, close to the last closed flux surface, namely between $\rho_V = 0.8$ and 1 ($\rho_\psi \geq 0.9$), where ρ_V relates to the square root of the normalized volume inside the flux surface. We show that electron transport is not stiff in this region and extremely high R/L_{Te} values can be attained even with L-mode confinement. This result brings a new perspective to several "accepted" understandings. In particular, a specific study related to the Ip scaling of ohmic and ECH L-mode discharges shows that the strong Ip scaling is, in reality, strongly related with this non-stiff edge region. The Te scale length is shown to be proportional to Ip in the edge region and constant (independent of Ip) in the core. The relation with L-H transition and the I-modes will also be discussed, as the edge gradient can now be continuously increased, by increasing the input power, even during the L-mode phase. It is proposed that the pedestal width is related to the width over which the transport is non-stiff, and that this can already be studied, in detail, in L-mode. This study explains the large increase in confinement obtained with negative triangularity and a new model is proposed, including non-stiff edge local transport, which recovers the experimental observations.

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