Understanding LOC/SOC Phenomenology in Tokamaks

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Phenomenology of Ohmic energy confinement saturation in tokamaks is reviewed. Characteristics of the linear Ohmic confinement (LOC) and saturated Ohmic confinement (SOC) regimes are documented and transformations in all transport channels across the LOC/SOC transition are described, including rotation reversals, "non-local" cut-off and density peaking, in addition to dramatic changes in fluctuation intensity. Unification of results from nearly 20 devices indicates that the LOC/SOC transition occurs at a critical value of the product of the density, edge safety factor and device major radius, and that this product increases with toroidal magnetic field [1]. This is demonstrated in Fig.1.

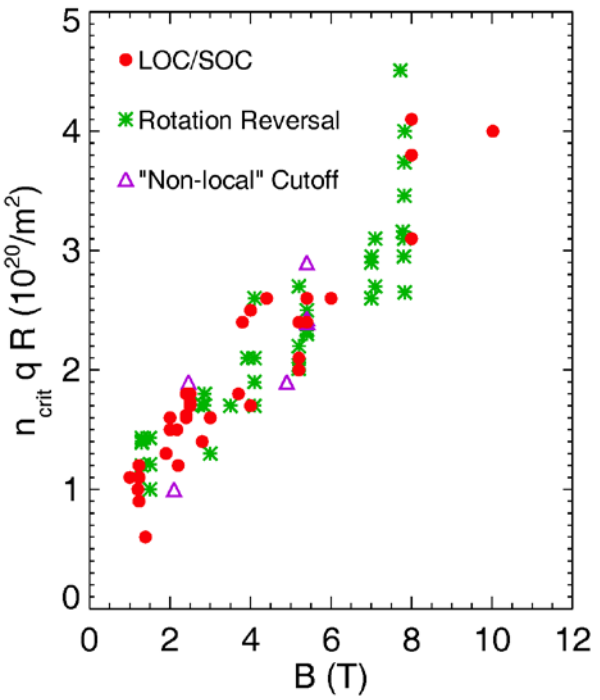

Fig.1 The product of n_{crit}, the edge q value and R as a function of toroidal magnetic field from 18 individual tokamaks. Red dots are from the LOC/SOC transition, green asterisks are from rotation reversals and purple triangles are from the "non-local" cut-off.

Comparison with gyro-kinetic simulations suggests that the effects of sub-dominant TEMs are important in the LOC regime while ITG mode turbulence dominates with SOC [2].

References

[1] J.E.Rice *et al*., 2020 Nucl. Fusion submitted.
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