Poster

Turbulence Invasion from the Scrape-off-Layer as the Mechanism for H→L transition and Power Hysteresis

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We propose a reduced model of the global state bifurcation of a magnetically confined plasma system, i.e., from high(H) confinement mode to low(L) confinement mode. The essence is the consistent treatment of the couplings of edge layer and scrape-off-layer(SOL), i.e., the SOL turbulence is driven by the heat flux from the edge and in turn the edge transport is enhanced due to turbulence spreading from the SOL. For heating power below a critical threshold, the edge shear layer will fail to keep the SOL turbulence out, so that SOL turbulence invades, erodes the edge pressure profile, and induces H→L transition. This process can occur even if local excitation of edge turbulence is strongly suppressed. The model leads to a understanding of the origin of power hysteresis, as due to the difference in power for local suppression(L→H transition) and SOL turbulence invasion(H→L transition). A testable prediction for the critical heat flux(corresponding to the heating power) of H→L transition is derived. The model also illuminates the aspects of core-boundary couplings.

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