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L to H Mode Transition: Parametric Dependencies of the Temperature Threshold

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On a global scale, the L to H mode transition happens above a critical power threshold. On a local scale, a critical temperature threshold (T_th) is often reported to characterize the transition. The parametric dependencies of this local criterion are easier to be compared to theoretical approaches based on local mechanisms. Such a comparison is presented here.
The L to H mode transition is modelled by a ratio of two times, one characterizing the turbulence and one characterizing the mean radial electric field shear (ExB shear). The assumption made is that the transition in H mode occurs when the shorter of the two times is the one characterizing the ExB shear. The ExB shear is estimated by a value at the LCFS depending on the temperature gradient and a more inner value where the poloidal velocity is given by the neoclassical theory. The background turbulence results from a competition between Ion Temperature Gradient and Trapped Electron Modes at low collisionality and Resistive Ballooning Modes at higher collisionality which is modelled analytically thanks to fluid limit formulations. The ratio of the analytically derived growth rate and ExB shearing rate is a function of the temperature as well as other factors. By changing a parameter (B, density, etc.) a critical value of this ratio is reached for a different temperature.
The resulting T_th dependences are coherent with the dependences of the power threshold with respect to B; it explains the existence of a minimum in density and its shift towards larger value in case of lower Z_eff as observed in JET-ILW.

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