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Effects of Heat and Particle Sources Perturbations on L-H-L Transitions Based on Bifurcation Concept

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This work aims to investigate the effects of perturbations of heat and particle sources on the formations of edge transport barrier (ETB) and on the hysteresis properties at the L-H-L transitions in the framework of bifurcation concept. The formation of transport barriers is studied via the combination of thermal and particle transport equations, which also includes neoclassical and anomalous effects. The suppression mechanism based on flow shear stabilization is assumed to affect only on the anomalous channel, where the flow shear is estimated from the force balance equation and couples both transport equations. The main thermal and particle sources are localized near plasma center and edge, respectively. Experimental evidences and theoretical understanding reveal that the formation of an ETB, leading to an L-H transition, is related to the critical heating threshold. Analytical study reveals that the fluxes versus gradients space exhibits bifurcation behaviour with s-curve soft bifurcation type. Evidently, the backward H-L transition occurs at lower values than that of the forward transition, illustrating hysteresis behavior. This work investigates perturbations effects of thermal and particle sources on the formations of both ETB and hysteresis properties. The focus is on the possibility of L-H transition triggering by the fluctuations in heating at marginal point and by pellet injection. It was shown that H-mode can be triggered and maintained so the central plasma pressure can be increased.

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