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EX/10-2: Spatiotemporal Structure of the Turbulence-flow Interaction at the L-H Transition in TJ-II Plasma

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The spatiotemporal behaviour of the interaction between turbulence and flows has been studied close to the L-H transition threshold conditions in the edge region of TJ-II plasmas. The temporal dynamics of the interaction displays an oscillatory behaviour with a characteristic predator-prey relationship. This intermediate oscillatory transient stage has been seen in L-H transition experiments in some other devices. However, in those experiments, as in the Kim & Diamond predator-prey theory model, only the temporal dynamics of the turbulence-flow interaction is studied. In TJ-II, dedicate experiments have been carried out to study the spatial evolution of the turbulence-flow oscillation pattern. Radial outward and inward propagation velocities of the turbulence-flow front are found. As the turbulence-flow front propagates outwards, the turbulence-flow events generate a dual shear layer and thus enhance the formation of the radial electric field well. A possible explanation for the spatiotemporal evolution of the oscillation-pattern could be linked to the radial spreading of the plasma turbulence from the plasma core to the edge barrier. As the turbulence propagates towards the barrier, the associated turbulence driven flow generates the inner shear layer which in turn regulates the turbulence level. The observations could be also figured out in terms of turbulent bursts propagating toward the plasma edge. These turbulent bursts could be generated in the plasma interior due to instabilities linked, for instance, to the magnetic topology. A reversal in the front propagation velocity is observed in some particular cases after a quiet period without oscillations. In those cases the oscillation-pattern arises at the outer shear layer position and propagates towards the plasma interior. The results indicate that the edge shear flow linked to the L-H transition can behave either as a slowing-down, damping mechanism of outward propagating turbulent-flow oscillating structures, or as a source of inward propagating turbulence-flow events. These results show the need of approaching L-H transition studies within a 1-D spatiotemporal framework.

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