The Role of Zonal Flow Predator-Prey Oscillations in Triggering the Transition to H-Mode Confinement

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Abstract

Direct evidence of Zonal Flow (ZF) predator-prey oscillations and the synergistic roles of ZF- and equilibrium $\boldsymbol{E} \times \boldsymbol{B}$ flow shear in triggering the low- to high confinement (L- to H-mode) transition in the DIII-D tokamak is presented. Periodic turbulence suppression is first observed in a narrow layer at/inside the separatrix when the shearing rate transiently exceeds the turbulence decorrelation rate. The final transition to H-mode with sustained turbulence/transport reduction is controlled by equilibrium $\boldsymbol{E} \times \boldsymbol{B}$ shear due to the increasing ion pressure gradient.