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TH/P4-24: Effects of Collisionality on the Nonlinear Characteristics of Boundary Turbulence and Blob/hole Transport in Tokamak Plasmas

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Blob/hole dynamics near tokamak separatrix is of striking importance in determining the boundary transport. Based on simulations using an extended 2-region (edge/SOL) fluid model, we found that blob/hole dynamics are sensitively influenced by the plasma collisionality, i.e., ion-electron and ion-neutral collisions. Namely, the holes are enhanced in highly collisional edge whereas the blobs are weakened at the SOL, causing larger particle convection. These blob/hole dynamics are closely correlated with potential dipoles. The trends are experimentally evidenced on the HL-2A tokamak. Moreover, as the neutral-ion collision increases, the blobs at the SOL tend to develop into streamers propagating outwards with reduced amplitude while the holes inwards are suppressed, showing a key role in nonlinear structure regulation and resultant transport suppression. Results suggest that adjusting the plasma collisionality by fueling, e.g., gas puffing, could serve as a method to nonlinearly select turbulent structures, i.e., blobs, holes or streamers, to access the control of boundary transport.

Country or International Organization of Primary Author

Japan

Collaboration (if applicable, e.g., International Tokamak Physics Activities)

China

Primary author: Mr JIQUAN, Li (Japan)

Co-authors: Prof. JIAQI, Dong (Southwestern Institute of Physics); Dr CHENG, Jun (Southwestern Institute of Physics); Prof. YASUAKI, Kishimoto (Kyoto University); Dr LONGWEN, Yan (Southwestern Institute of Physics)

Presenter: Mr JIQUAN, Li (Japan)

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