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TH/6-2: Role of External Torque and Toroidal Momentum Transport in the Dynamics of Heat Transport in Internal Transport Barriers

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We study the coupling of intrinsic rotation and toroidal momentum transport to the dynamics of internal transport barriers (ITB). In particular, we (1) elucidate the role of external torque in ITB formation and ion temperature de-stiffening, (2) analyze the interplay between intrinsic rotation and ITB dynamics, and (3) characterize the heat transport in steady state ITB plasmas. First, we find an external torque can either facilitate or hamper bifurcation in heat flux driven plasmas depending on its sign relative to the direction of intrinsic torque. The ratio between the radially integrated momentum density to power input is shown to be a key control parameter governing the characteristics of bifurcation. Second, we find that intrinsic rotation is closely coupled to ITB dynamics via dynamic change of Reynolds stress. In particular, we show that the excitation of parallel shear flow instability causes a Reynolds stress change and drives a momentum redistribution, which significantly influences ITB dynamics. Finally, we show that highly non-diffusive transport processes prevail in ITB plasmas (depending on the degree of turbulence suppression) from a statistical analysis of heat transport in steady state ITBs obtained from a long time flux-driven gyrofluid simulations.

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