Mechanisms for Control of ITBs in Fusion Self-Heated Plasmas

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Simple dynamical models have been able to capture a remarkable amount of the dynamics of the transport barriers found in many devices, including the often disconnected nature of the electron thermal transport channel sometimes observed in the presence of a standard (``ion channel'') barrier. By including in this rich though simple dynamic transport model an evolution equation for electron fluctuations we have previously investigated the interaction between the formation of the standard ion channel barrier and the somewhat less common electron channel barrier. The electron channel formation and evolution is even more sensitive to the alignment of the various gradients making up the sheared radial electric field then the ion barrier is. Because of this sensitivity and coupling of the barrier dynamics, the dynamic evolution of the fusion self-heating profile can have a significant impact on the barrier location and dynamics. To investigate this, self-heating has been added this model and the impact of the self-heating on the formation and controllability of the various barriers is explored. It has been found that the evolution of the heating profiles can suppress or collapse the electron channel barrier. Opening and closing the electron channel can be used to control both the profiles and potentially the ash accumulation. Using RF and NBI modification, schemes will be investigated for profile/barrier control.