BALLOONING MODE STABILITY FOR SELF-CONSISTENT PRESSURE AND CURRENT PROFILES AT THE H–MODE EDGE*

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Stability to ballooning modes at the edge of H–mode plasmas has long been a candidate for explaining ELM behavior. The sensitivity of "stiff" transport models to the magnitude of the edge pressure pedestal has increased the interest in the maximum sustainable pressure gradient near the plasma boundary. Ballooning stability can be quite sensitive to local variations in the pressure gradient and current density which can make comparison with experiment difficult. This work focuses on evaluating the ballooning mode stability of equilibria constructed with self-consistent profiles near the edge of the plasma. In particular the bootstrap current contribution consistent with edge pressure gradients is included in the equilibrium calculations. We include the effects of adding a large pressure gradient localized near the edge of the plasma consistent with the experimentally measured DIII–D profiles. In DIII–D, pedestal pressure is well represented by a hyperbolic tangent and we use that profile parameterization in this study. We consider ranges of pedestal heights and widths, and radial locations of the transition region producing the pedestal. The magnitude of the bootstrap current is also varied. The bootstrap current is found generally to raise the stability limit for the pressure gradient by reducing the local shear. Three distinct situations can occur from including the self-consistent bootstrap current: 1) the first stable limit is raised but the plasma remains in the first stable regime, 2) access to second stability can occur on some flux surfaces near the maximum pressure gradient, but nearby flux surfaces remain in the first stable regime and limit stability, 3) access to the second stable regime is achieved over the width of the enhanced pressure gradient region and the ballooning mode provides no limit for the pressure gradient. Full results from the parameter scans will be presented and implications for interpretation of DIII–D data will be discussed.

Session Topic: ELM Physics and Theory

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