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Anisotropic Peeling-Ballooning Mode Scans of JET-like Equilibria

J. Doak[1], M. J. Hole[1], L. Stals[1], Z. Qu[2], M. Fitzgerald[3]
[1] Mathematical Sciences Institute, ANU, [2] Nanyang Technological University, [3] CCFE, Culham Science Centre
e-mail (speaker): joshua.doak@anu.edu.au

The anisotropic fluid codes HELENA+ATF [1] and MISHKA-A [2] have been used to investigate the effects of scaling pressure anisotropy on Edge Localised Modes in tokamak plasma scenarios based on both theoretical H-mode scenarios and JET shots. Isotropic marginal stability studies of JET scenarios do not always correctly predict the marginal stability boundaries of ELMs [3], and high beam power and gas fueling can be associated with the early triggering of ELMs. Neutral beam injection can produce significant anisotropy, which is known to affect the stability of ballooning modes [4], motivating studies on the effects of pressure anisotropy on ELM stability in JET scenarios. Previous studies have investigated how anisotropy affects ballooning mode stability in simple H-mode tokamak scenarios with circular boundaries, showing increases in ballooning mode growth-rates when $p_\perp > p_\parallel$ associated with the destabilising outboard shift in pressure surfaces [5]. More recently we have also investigated how different equilibrium constraint choices can affect the stability results, changing the apparent magnitude of the effect but not the direction.

We have applied these methods for studying anisotropic ballooning stability to a set of JET-like equilibria, based on an ELMing JET shot. We chose the pressure constraint as $p_i = < p^* > = < \frac{p_\parallel + 2p_\perp}{3} >$, and fixed flux averaged density and toroidal current density through an iterative remapping procedure. We constructed a series of anisotropic equilibria with varying $p_\parallel / p_\perp$. When $p_\parallel > p_\perp$ in the first scenario for a peeling-ballooning unstable equilibrium, the largest growth-rate (at n_{tor}≈20) increases, and when $p_\parallel < p_\perp$ the growth-rate decreases. By scanning over the normalized pressure gradient α, we have also seen that the marginally stable α changes similarly with $p_\parallel / p_\perp$. This trend is opposite to the one observed previously in ballooning modes. This work is currently being extended to a parameter scan over edge current and pressure gradient to study how the marginal stability boundary is deformed as pedestal anisotropy is scaled. We are also investigating how different choices of anisotropic pressure p^* constraints may change the observed stability trends.

References

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