Alfvén Instability in ITER Baseline Scenario with I_P=15 MA

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Burning plasmas in ITER constitute a challenging new field of physics, which requires, in particular, understanding of fundamental issues associated with the super-Alfvénic energy range of fusion-born alpha-particles and ions used in auxiliary NBI heating. Since the ITER scale plasmas with many modes and small ratio between the fast particle orbit and minor radius, $\rho_\alpha / a \cong 10^{-2}$, goes well beyond the present-day experiments, an extrapolation towards ITER is not straightforward and Alfvén instability remains a significant issue for high-Q operation. Here, we consider linear instability of Alfvén eigenmodes (AEs) in the baseline ITER burning plasma scenario with plasma current of I_P = 15 MA. Local stability estimates are used, with assessment of plasma impurity effects and D:T concentration on the mode stability. It is found that for the flat density and safety factor profiles predicted with the ASTRA transport code, two very different radial regions in the plasma exist at the Q=10 ITER operational point with 15 MA:

1) Core plasma region, $r/a \leq 0.5$, in which the main part of alpha-particle population is confined, $q(r)$ is flattish, and TAE and EAE gaps are scarce. In this region, thermal ion Landau damping absolutely dominates over the sum of alpha-particle and the beam drives;
2) External plasma region, $r/a \geq 0.5$, where alpha-population is not very strong, but TAE-gap density is very high (meaning all TAEs are global). In this region, alpha-drive exceeds the ion Landau damping giving the net drive ~1.5 x 10^{-3}. The beam can further destabilise TAEs in this region.

Taking into account that the beam will be applied on ITER throughout whole discharge, the transport path to the Q=10 point in the region with $T_i \leq 15$ keV could be more unstable to TAE than the Q=10 point itself.

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