Stability boundaries for fast particle driven TAE in stellarators

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With the improvement of the stellarator concept, the fast particle influence on MHD fluctuations in stellarators becomes more and more important [1,2].
Recently, there have been experimental efforts to explore the parameter space (β_{fast}/β, v_{fast}/v_A) for fast particle driven modes in stellarators [2].
To tackle this problem also theoretically, a kinetic MHD model [3] will be used. Starting with MHD eigenfunctions from the three-dimensional MHD stability code CAS3D[4], a growth or damping rate is calculated numerically from the particle-wave energy transfer. The respective code CAS3D-K treats all species drift-kinetically. The particle orbits are approximated to follow the field lines and to undergo averaged drifts within the flux surface [3,5,6]. Both, passing and reflected particles are considered.
The perturbative calculation of bulk plasma damping rates in a hybrid model has been put into question in the past [7]. However, a successful benchmark against a gyrokinetic eigenvalue code [8] in a 2D situation will be presented.
It is shown that qualitatively similar stability boundaries can be obtained for a TAE mode in W7-AS. To shed light on geometrical effects, comparison is made between different stellarator configurations.
Finally, an extension of the kinetic MHD model towards kinetic Alfvén waves will be discussed.

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