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Numerical simulation of the interaction between the Double Tearing Mode and the ITG turbulence (II)

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Reversed shear configuration represents an effective way to achieve a better confinement of the plasma inside tokamaks via the formation of Internal Transport Barriers (ITB), and especially via the restriction of small scale turbulence such as the Ion Temperature Gradient (ITG) mode. However, this configuration is unstable to large scale instabilities such as the Double Tearing Mode (DTM). On the other hand, interactions between different scale instabilities are thought to give essential clues to understand complex dynamics of the plasma. Here, we look at the interplay between ITG and DTM via numerical simulations.

DTM has been previously investigated by solving the two-field reduced MHD equations (flux and flow functions) in slab geometry. Here, we give new highlights on the understanding of the trigger process of the fast growth that is found between the strongly coupled (1/3-regime) and the weakly coupled DTM (3/5-regime) [1]. More precisely, we propose to stress the importance of the structure as a trigger for a new instability to arise. For that, we take the two-dimensional deformed structure at different times as a new equilibrium from which reset perturbations can evolve linearly. We find that during the fast growth, the deformation of the structure is such that new instabilities are linearly unstable.

We also propose to discuss the criteria through which DTM and ITG can interplay with each other, such as the high mode numbers that are important for the DTM in the construction of the magnetic structure (and therefore its deformation), and that are made unstable via ITG.

[1] Y. Ishii, M. Azumi, Y.Kishimoto, Phys. Rev. Letts.89, 20(2002)