Kinetic Damping of Toroidal Alfvén Eigenmode Revisited*

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The problem of kinetic damping of Toroidal Alfvén Eigenmode is revisited. This is motivated in part by recent experimental test of damping models for TAE in JET where the "radiative damping" was found to be negligible and the calculated damping (mainly the electron collisional damping) is much smaller than the measured value[1]. On the other hand, numerical results of the global gyrokinetic code PENN indicated that mode conversion can occur near the center of plasma which resulted in damping rates comparable to the JET measurement[2]. In order to resolve this discrepancy, we re-consider this problem by using a simpler model including the key MHD physics of TAE and the kinetic Alfvén waves with an electron damping model included to weakly damp the kinetic Alfvén excitations so that the mode couping appears as a damping . For a cylindrical model, we show analytically and numerically that there is no mode coupling (or mode conversion) between the global MHD modes and the kinetic Alfvén waves when suitable boundary conditions at the edge are chosen to prevent kinetic Alfvén wave generation there. We extended the numerical model to a simplified toroidal problem and no resolvable mode conversion to kinetic Alfvén waves has been found for a range of q profiles, in contrast to the finding in Ref. [2]. On the other hand we have identified absorption processes due to the Alfvén continuum that should be relevant to the damping mechanisms that are relevant to the JET experiments which have normally not been taken into account in many numerical codes. Details of numerical results for experimental parameters and profiles will be presented.

References

[1] D. Testa, G.Y. Fu, A. Jaun et al., Nucl. Fusion 43, 479 (2003).

[2] A. Jaun, A. Fasoli, and W.W. Heidbrink, Physics of Plasmas, 5, 2952(1998)

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