3rd Asia-Pacific Conference on Plasma Physics, 4-8,11.2019, Hefei, China

Simulations Of Internal Kink(m=1) Modes in a two fluid regime

J.Mendonca[1], D,Chandra[1],A.Sen[1],A.Thyagaraja[2]

[1] Institute for Plasma Research, Homi Bhabha National Institute, Bhat, Gandhinagar-382428,

[2]Astrophysics Group, Bristol University, Bristol, BS8 1TL, UK

e-mail (speaker): jervis.mendonca@ipr.res.in

We have carried out numerical studies on the internal kink (m=1,n=1) mode using the CUTIE[1][2] code and thus extended our previous Visco-Resistive RMHD studies[3] into the two fluid regime. We have observed that two fluid effects are influential in the dynamics of the mode in the following manner. We find in the linear regime that effects of flow on the characteristics of the mode change in the two fluid regime and we have earlier noticed a similar behaviour in the case of (2,1) tearing modes[4]. The presence of an intrinsic poloidal flow present in a two fluid system due to diamagnetic effects is a cause for this behaviour. In particular, the symmetry in the growth rate and frequency curves, as a function of flow, is broken.

An imposed poloidal flow can increase the growth rate of the mode, if it cancels the intrinsic poloidal flow, thus destabilising the mode.The cases with an imposed poloidal and helical flow are also different from the single fluid regime. We have also extended these studies to the nonlinear regime, and obtain a richer picture than that of the corresponding RMHD cases. In particular we notice that poloidal flow can destabilise the (1,1) mode nonlinearly as well. Our results in the two fluid regime extend and complement our single fluid results, and are of significance for tokamaks.

References:

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