Ballooning modes for rotating accretion discs including dissipation*

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Abstract

Recently there has been an attempt [A. Kirillov et al., Phys. Rev. Lett. **111**, 061103 (2013)] to investigate the stability of dissipative rotating accretion discs imbued with a magnetic field, with respect to localized modes. As we show, these modes are none other than the familiar ballooning modes. However, some mistakes were made in the Kirillov analysis, which we correct in this work. While in principle, the theory of ballooning modes with shear flow is known, the present configuration presents new directions of investigation. For example, we can give some conditions for stability.

The more technically challenging issue is the choice of the dependent variable to be used. In Ideal MHD stability analysis it is common to use the Lagrangian displacement vector $\boldsymbol{\xi}$, but in dissipative systems this does not appear obvious since it is not possible to solve for most other perturbed profiles in terms of $\boldsymbol{\xi}$. We nevertheless show that the perturbed equations are simplified this way. Moreover, if we are interested in only small diffusivity, an expansion can be worked out and the use of $\boldsymbol{\xi}$ becomes natural and useful for obtaining the deviation of stability from the ideal plasma case

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