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Global Magnetorotational Instability with Density Gradients
JESSE PINO, SWADESH MAHAJAN, Institute for Fusion Studies, The University of Texas at Austin — The magnetorotational instability (MRI) is an important mechanism for the transfer of angular momentum in rotating astrophysical systems such as accretion disks and proto-neutron stars (PNS). The standard MRI dispersion relation is drawn from a local analysis, but can be misleading when the radial wavelength is comparable to the equilibrium scale size. We examine global perturbations of a differentially rotating MHD plasma with radial density gradients. If the equilibrium magnetic field is either purely axial or purely toroidal, axisymmetric modes can be found as global radial eigenvalues of an effective potential. A class of unstable 'cavity' modes are found to be localized by the form of the rotation and density profiles, with reduced dependence on boundary conditions. For equilibria in which rotation shear is restricted to a finite area, a well-defined boundary-condition problem is solved and the results are compared with the local theory, and the importance of these MRI modes to core collapse supernova is analyzed. Non-axisymmetric perturbations and helical equilibrium field profiles are investigated, as well as consequences for the nonlinear regime.

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