On the saturation of the magnetorotational intability near threshold

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Abstract:

We explore by means of a weakly nonlinear analysis near threshold of the magnetorotational instability for two-dimensional disturbances. We find that amplitude of saturation of the unstable mode goes as the square root of the magnetic Prandtl number (Pm) in the small Pm limit. We further demonstrate that in the small Pm limit, the shearwise transport of momentum scales as the 1/R where R is the hydrodynamic Reynolds number. We discuss the implications of these results for astrophysical accretion disc systems, numerical simulations and earth-bound laboratory experiments.