

Problem set 3, due in on Monday March 16.

Derivation of MRI.

I have posted Anders Johansen's talk on my webpage, up to page 19. You should read and understand the derivations of all the basic equations up to page 19. Then you are well-equipped to solve the following problem:

a. Derive the dispersion relation for the vertically-propagating wave in which the fluid displacement is purely horizontal. Plot ω^2 as a function of $k_z c_A / \Omega$, where c_A is the Alfvén speed.

b. Find k_z and the growth rate for the fastest-growing mode.

c. Show that MRI is quenched in thin discs for sufficiently large vertical magnetic fields, and estimate the value of this critical field. Show that for this value of B , the Alfvén speed is of the same order of magnitude as the sound speed.

d. Repeat calculation in "a.", but include terms due to magnetic diffusivity. Find the value of the diffusivity for which MRI is suppressed.