

Exercises for Space Plasma Physics:

V. MHD

1. Remember the main steps we needed to derive the MHD-equations from a statistic particle model.
2. Under which conditions is the MHD-model valid?
3. Explain the different terms in the MHD-equations qualitatively.
4. Explain ideal and resistive MHD.
5. Are space plasmas typically ideal or resistive plasmas?
6. How can Ohm's law as used in MHD be derived from a two-fluid model?
7. In MHD one often compares different energy forms like the magnetic pressure $p_B = \frac{B^2}{2\mu_0}$ and the kinematic energy density $E_{\text{kin}} = \rho \frac{v^2}{2}$ with the plasma pressure p . How do p_B and E_{kin} evolve in time? Hint: derive the corresponding evolutionary equations from the MHD momentum-transport equation.