

Week 1-2: Basic equations of magnetohydrodynamics (MHD): Electrodynamics; Review of hydrodynamics; Incorporation of the Lorentz force for MHD; Reduced forms of the equations; diffusive limit; conductive limit; Dynamics of MHD at low and high  $R_m$

Week 3-4: Kinematics of MHD: Alfvén Theorem; Advection, diffusion of magnetic field; Helicity; Flux expulsion.

Week 5: Magnetohydrostatics: Cylindrically-symmetric flux tubes (axial; azimuthal; force-free); current-free fields; force-free fields

Week 6: Waves: acoustic, shear Alfvén, compressional Alfvén, internal gravity, inertial, magnetoacoustic, acoustic-gravity

Week 7: Instabilities -- Rayleigh-Taylor; Interchange; Pinch; Magnetoconvection; Magnetic buoyancy

Week 8-9: Instabilities -- Dynamo Theory (Small-scale/large-scale dynamos; Cowling's Theorem; kinematic dynamos; mean field electrodynamics; dynamo waves; non-kinematic dynamos; fast dynamos; turbulent dynamos). Magnetorotational Instability (MRI)

Week 10: Special topics: e.g. numerical MHD, MHD turbulence