

Plasma Physics
PHYS 6330

Spring 2016
Professor Robert Schunk

MWF 1:30-2:20
SER 122

- 1) Single particle
 - a) cyclotron motion
 - b) $\mathbf{E} \times \mathbf{B}$ drift
 - c) \mathbf{G} drift
 - d) nonuniform \mathbf{B}
 - e) μ magnetic moment

- 2) Boltzmann Equation
 - a) derivation of f equation
 - b) continuity
 - c) momentum
 - d) energy (homework)
 - e) closed set of fluid equations
 - f) fluid drifts $\perp \mathbf{B}$ for collisionless plasma
 - g) fluid drifts $\parallel \mathbf{B}$ for collisionless plasma (Boltzmann relation)

- 3) Waves in Plasma
 - a) electron plasma oscillations
 - b) electron plasma waves ($T_e \neq 0$)
 - c) sound waves in neutral gas
 - d) ion-acoustic waves
 - e) validity of plasma approximation
 - f) upper hybrid oscillations
 - g) lower hybrid oscillations
 - h) ion cyclotron waves
 - i) E&M waves in a vacuum
 - j) E&M waves (light waves) in a plasma
 - k) ordinary wave
 - l) extraordinary wave
 - m) L&R waves
 - n) Alfvén wave
 - o) magnetosonic wave

- 4) Diffusion
 - a) collision terms for momentum equation
 - b) diffusion in weakly-ionized gas
 - c) diffusion in partially-ionized plasma (ambipolar diffusion)
 - d) Ohm's law
 - e) supersonic flow
 - f) time-dependent self-similar expansion
 - g) shock waves
 - h) diffusion in a slab
 - i) diffusion with production source
 - j) diffusion in F-region ionosphere
 - k) diffusion \perp \mathbf{B} with collision terms

- 5) Magnetohydrodynamic Theory (MHD)
 - a) Ideal MHD equations
 - b) Diffusion in a fully-ionized plasma
 - c) hydromagnetic equilibrium
 - d) concept of β
 - e) diffusion of \mathbf{B} into a plasma
 - f) magnetic Reynolds Number
 - g) MHD flow in crossed \mathbf{E} and \mathbf{B} fields

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