(AST 462) Physics of Astrophysics 2: Astrophysical Fluid and Plasma Dynamics

Professor: Eric Blackman, B&L 417A, 5-0537

Texts: A. Choudhuri, Physics of Fluids and Plasmas (Required); F. Shu, Gas Dynamics (Recommended),

Course grading: course will be graded pass-fail

Course work:

The only graded work in this course will be a final exam graded pass with distinction, pass, or fail. This system is a version of the "Cambridge University"model for courses.

1. Study class notes and text
2. Practice problems as needed (not graded)
3. Make a table of contents for the course notes to guide study.
4. Final exam (only graded work) based on class notes

Tentative Physics Topics Outline: (Astrophys. applications will be discussed in context)

Neutral Fluids

Kinetic theory vs. Fluids: the big picture

Boltzmann equation and collisions

Transport Theory

Moment Equations/Basic Fluid Equations

Hydrostatic Equilibrium Limit

Bernoulli's Principle

Vorticity and Circulation

Inviscid vs. Viscous Flows

Sound Waves

Spiral Density Waves

Fluid Instabilities

Shocks

Thermal Instability

Hydrodynamic Turbulence

Mixing Length Theory of Convection

Rotating Fluids

Accretion Disks

Outflows

Magnetohydrodynamics, Plasmas and Related Phenomena

Basic Plasma Physics

Basics of MHD and relation to hydrodynamics

Flux Freezing

Magnetic Breaking

MHD Outflows

Magnetic Dynamos

MHD Turbulence

MHD Stability

Magneto-rotational Instability and Accretion Disks