

Course Topics

- 1) **Overview of Disks; Accretion, Galactic Structure**
- 2) **Keplerian Disks and Accretion: Basics**
 - i) Structure, equilibrium profiles
 - ii) Angular momentum transport, alpha viscosity concept and prescription
 - iii) Mechanism: Axisymmetric Interchange (Rayleigh), Two Particles (Lynden–Bell and Pringle) and the end state
 - iv) Convection: axisymmetric, non-axisymmetric
- 3) **Magnetic Fields and Accretion**
 - i) Essentials of MHD
 - ii) MRI (magneto-rotational instability), MRI—Lynden–Bell connection, mixing length estimates of alpha
 - iii) Disk Dynamos — An Introduction
 - iv) Fate of the field? — Parker Instability and Disk Coronae
 - v) Accretion in collisionless disks (AGNs)
- 4) **Protoplanetary Disks**
 - i) MRI for cooler, weakly ionized disks (effects: resistivity, ambipolar diffusion ...)
 - ii) Convection revisited — non-axisymmetric modes
 - iii) Introduction to planet formation in Disks
 - iv) Disk–Planet Interaction
- 5) **Self-Gravitating Disks and Galactic Dynamics I**
 - i) OV, stellar dynamics, Vlasov–Poisson System, Jeans Equations
 - ii) Stellar Orbits
 - iii) Basic ideas, Jeans and Toomre criteria — fluid and Vlasov
 - iv) BGK Solutions — stationary states
 - v) Violent Relaxation (Lyndell–Bell)
 - vi) Collisionless Jeans instability, Landau Damping

6) Self-Gravitating Disks and Galactic Dynamics II

- i) Energy Principle for self-gravitating matter
- ii) Spiral Waves
- iii) Spiral Wave Amplification: Wave Kinetics for Spirals
- iv) Galactic Magnetic Fields

7) Revisiting Angular Momentum Transport