ASTR 621: Planetary Science

1. Jean's Mass Equation
$$M_J \left(\frac{kT}{Gm\mu}\right)^{3/2} \frac{1}{sqrt(\rho)} \tag{1}$$
2. Observational Characteristics across a wide wavelength (UV to IR) range
3. Free fall time
   - something
4. Toomre Stability Critera/Parameter
5. Viscous processes
   - ν = kinematic viscosity
   - viscous couple
   - viscosity transports angular momentum outward
   - time scale for viscous mixing much larger than that of star formation
6. Scale Height equation
$$\rho(z) = \rho(z=0)e^{(-z^2/H_z^2)} \tag{2}$$
   for an isothermal disk (constant temperature).
   How do observations of disks around stars in our galaxy support this derived scale geight inference, and what do these observations indicate about the disk's mass relative to the central protostar's mass?
7. Discuss the importance of Dust grains within the nebula's
   - structure (radially and vertical 'z' direction)
   - viscosity (mixing), both radially and in the 'z' direction
     Dust grains are the most probable source of opacity within cold regions of the nebula. Nebula loses thermal energy in the z direction.
   - 'z' direction temperature (disk plane temperature vs 'surface' temperature
   - mass structures
8. The minimum mass solar nebula
   - small enough mass so that its gravitational effect ¡¡ central core's (justified by observed 'bowtie' disk).
   - Must account for all of the non-solar mass in the solar system (assuming formation process was 100% efficient in retaining the available rock (0.5%) and ice (1%).
     Maybe magnetic field responsible for 'missing' angular momentum?

9. Gravitational instabilities
10. Physical/environmental conditions involved in grain formation
    - Dust in the nebula
11. grain size-dependent motions within the nebular disk
12. planetesimal and protoplanet growth in the disk
13. Physical characteristics that characterize 'core accretion' vs. 'gas instability' growth of Jovian-type planets
14. core accretion
15. Exoplanet detection
    - transit - change in light curve
    - radial velocity - stellar reflex motion
    - direct imaging - want planet close to star
    - microlensing - opportunistic, confirm other ways
    - astrometry - variation of star's position
    - timing - first planet found this way!
    - radio emission - (proposed)
    - aliens
16. planet 'types'
17. Energetic processes envolved with planet growth via material accretion