Stellar
Midterm 2 Review Topics

Equations to memorize

$$P = K\rho^{\gamma}\,, \tag{1}$$

with $\gamma = 1 + 1/n$ and different values of K for different equations of state.

Lane-Emden is below, but I expect you to know

$$\rho = \rho_c \theta^n \tag{2}$$

$$\xi = r/\alpha\,. \tag{3}$$

Equations I would give you

$$\frac{1}{\xi^2}\frac{d}{d\xi}\left(\xi^2 \frac{d\theta}{d\xi}\right) = -\theta^n\,. \tag{4}$$

$$\left|\frac{dT}{dr}\right|_* < \left(\frac{\gamma_a - 1}{\gamma_a}\right)\frac{T}{P}\left|\frac{dP}{dr}\right|_* \tag{5}$$

$$M_{\rm Ch} = \frac{M_3\sqrt{1.5}}{4\pi}\left(\frac{hc}{Gm_H^{4/3}}\right)^{3/2}\mu_e^{-2} = 5.83\mu_e^{-2}\,M_\odot \tag{6}$$

$$L < \frac{4\pi c G M}{\kappa} \tag{7}$$

$$M_J = \left(\frac{5kT}{G\mu}\right)^{3/2}\left(\frac{3}{4\pi\rho}\right)^{1/2} \tag{8}$$

$$R_J = \sqrt{\frac{15kT}{4\pi G\mu\rho}}\,. \tag{9}$$

Topics

Stellar Models

Polytropic models with values for γ and n
Meaning of γ
Lane-Emden relation
Chandrasekhar mass
Eddington luminosity

Stellar Stability

Dynamical Equilibrium
Thermal Equilibrium
When do we have instabilities?
Convection and when it dominates over radiation

The Sun

Basic properties including properties and effects of the magnetic field

Stellar Evolution

Star Formation process
Jeans radius and mass from hydrostatic equilibrium and Virial
Bonner-Ebert spheres
Hayashi tracks
The initial mass function
Main sequence evolution
The log T-logρ plane
Post-main sequence evolution for > 8 and $< 8\, M_{\odot}$ stars including elements produced and tracks on H-R diagram