(5.31) $$\frac{dP}{d\tau} = \frac{g}{\kappa_R}$$ $\left[g = -\frac{GM}{r^2} \leftarrow ? \right]$ ← use 5.31 to find $P(\tau)$

(5.33) $$T^4 = \frac{3}{4} T_{eff}^4 \left(\tau + \frac{2}{3}\right)$$ ← use 5.33 to find $T(\tau)$ [T_{eff} comes fr. $L = 4\pi R^2 \sigma_B T_{eff}^4$]

(5.34) $$P = \frac{R_g}{\mu} \rho T$$ ← use 5.34 to find ~~p(τ)~~ $\rho(\tau)$. $T_{eff}^4 = \frac{L}{4\pi r^2 \sigma_B}$

$$\int_{P_1}^{P_2} dP = \int_{\tau_1}^{\tau_2} \frac{g}{\kappa_R} d\tau$$

$$P_2 - P_1 = \frac{g}{\kappa_r} (\tau_2 - \tau_1)$$

but ~~ctr~~ $\tau = \tau(r)$, right?

What is the relation b/w M, r, and τ, here?!

$$\cancel{d\tau = \frac{\kappa_R}{g} dP}$$

$$d\tau = -\frac{\kappa_R r^2}{GM_r} dP$$

once you have a calc. dM_r

$$dM_r = 4\pi r^2 \rho\, dr$$

once you have ρ, calc dr

$$dr = -\frac{d\tau}{\kappa_R \rho}$$

$$dP = \frac{g}{\kappa_R} d\tau$$

$$dP = \frac{-GM_r}{r^2 \kappa_R} d\tau$$

$$\cancel{d\tau = -\kappa_R \rho\, dr}$$

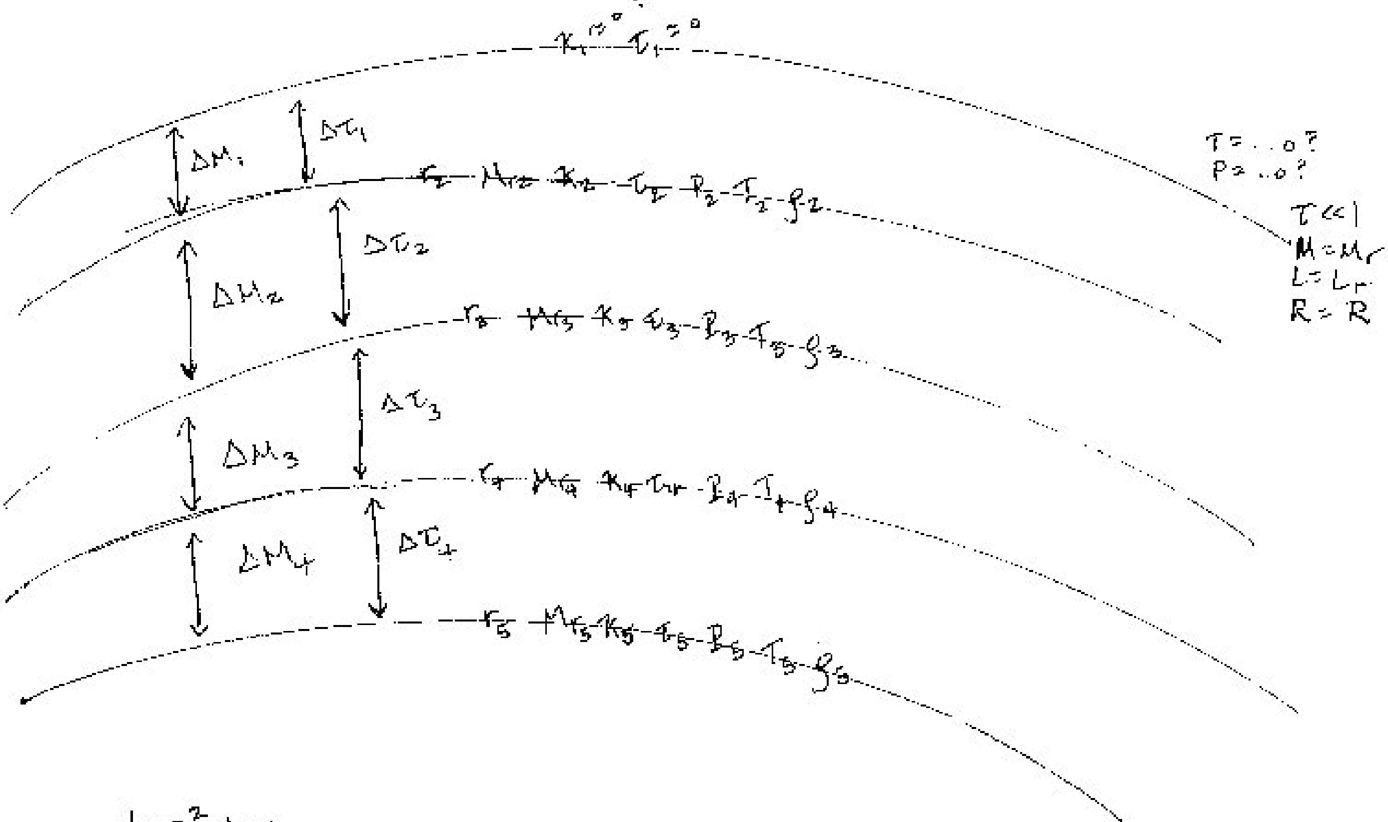
$$-\frac{d\tau}{\kappa_R} = \rho\, dr$$

$$\cancel{dP = \frac{GM_r}{r^2} \rho\, dr}$$

$$dM_r = -\frac{4\pi r^2\, d\tau}{\kappa_R}$$

κ_R = "radiative opacity"

$$d\tau = -\frac{\kappa_R\, dM_r}{4\pi r^2}$$



$$\Delta M_n = -\frac{4\pi r^2 \Delta\tau_n}{\kappa_R}$$

$$P_2 - P_1 = -\frac{GM_r}{r^2\kappa_r}(\tau_2 - \tau_1)$$

$\kappa_{R_2} = \kappa_{R_1}$?
how do we find the initial (outer) value of κ_R?!

if $P_1 = 0$ & $\tau_1 = 10^{-3}$ (say, effectively zero)
then:

$$P_2 = -\frac{GM_{r2}}{r_2^2\kappa_{r2}}(\tau_2 - 0)$$

$$T_2 = \left[\frac{3}{4}T_{eff}^4\left(\tau_2 + \frac{2}{3}\right)\right]^{1/4} = \left[\frac{3}{4}\frac{L}{4\pi r^2\sigma_B}\left(\tau_2 + \frac{3}{2}\right)\right]^{1/4}$$

$$\rho_2 = \frac{P_2\mu}{R_g T_2}, \quad R_2 = R_1 + dr_2 = R_1 - \frac{d\tau}{\kappa_{r2}\rho_2}, \quad M_2 = M_1 + dM = M_1 - \frac{4\pi R_{2(1)}^2\, d\tau}{\kappa_{r2}}$$