λ_{mfp} = mean free path $\sim \frac{1}{N_{cm}/Vol} \cdot \frac{1}{\sigma}$

cross section (Thompson, absorption, bremsstrahlung)

$\frac{N_{atoms}}{Vol} = \frac{\rho(r)}{mass_{atom}}$

$N_\gamma(out) = N_\gamma(in) \cdot e^{-\tau}$

τ = optical depth

$\bar{\kappa} \cdot \rho \cdot dr = \tau$

κ ↑ opacity

Build a model star

chemical composition, T surface, $P_{surf} \simeq 0$

Total mass → $\bar{\rho}$

$\rho(r) = \rho_H(r) + \rho_{He}(r) + \rho_{metal}(r)$

$T(r)$ $P(r)$

1) Equation of state
2) Hydrostatic Equilibrium
3) radiation transport

+ Light pressure

$P_{light} = \frac{1}{3} E/Vol$

$E_\gamma = pc$

(massless objects)

Volume $= 4\pi r^2 \Delta r$

Mass $= 4\pi r^2 \Delta r \cdot \rho(r)$

$P(r) \cdot 4\pi r^2 = F_{grav}(m>r)$

$4\pi r^2 P(r+\Delta r) = F_{grav}(m>r+\Delta r) =$

$F_{grav}(m>r) - G\frac{4\pi r^2 \Delta r \rho(r) \cdot M(r)}{r^2}$

$4\pi r^2 P(r)$

$\Rightarrow P(r+\Delta r) - P(r) = -G\frac{\rho(r) M(r)}{r^2}\Delta r$

$M(r) = 4\pi \int_0^r r'^2 \rho(r') dr'$

$P(r) = \sum_{species} \frac{\rho^{(r)}}{A} \cdot RT(r)$

$PV = NRT$

N = # of moles

$\frac{N}{V} \cdot A$ ↳ molar mass

IDEAL GAS

$E = \frac{3}{2}NRT$

$E = \frac{3}{2}P \cdot V$

$P = \frac{2}{3} E/Vol$ *

$E_{kin\ gas} = \frac{1}{2}mv^2 = \frac{p^2}{2m}$