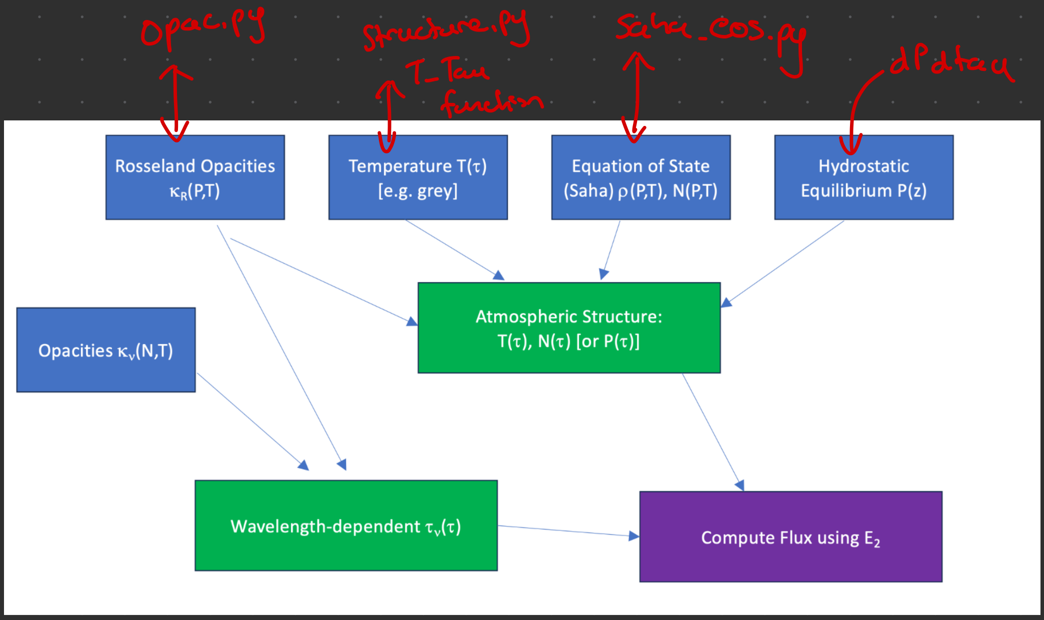

opac.py
structure.py
T_Tau function
saha_eos.py
dPdtau
Rosseland Opacities $\kappa_R(P,T)$
Temperature $T(\tau)$ [e.g. grey]
Equation of State (Saha) $\rho(P,T)$, $N(P,T)$
Hydrostatic Equilibrium $P(z)$
Opacities $\kappa_\nu(N,T)$
Atmospheric Structure: $T(\tau)$, $N(\tau)$ [or $P(\tau)$]
Wavelength-dependent $\tau_\nu(\tau)$
Compute Flux using E_2

T_Tau function

$$T^4 = \frac{3}{4} T_{eff}^4 \left(\tau + \boxed{q(\tau)} \right)$$

Exact solution

With external irradiation:

$$T^4(\tau_H) = \frac{\kappa_J}{\kappa_B} \left[\frac{3}{4} T_{eff}^4 \left(\frac{1}{3f} \tau_H + \frac{1}{3g} \right) + W T_{irr}^4 \right]$$

$$\sigma T^4 = \frac{1}{4} \left(1 - \alpha(T)\right) L_{\otimes}$$

Full sphere

$$I(\;)$$

$$\sigma T_{eq}^4 = \sigma T_{int}^4 + \boxed{(1 - A_B) F^{inc}}$$

H $\rightarrow$ eddington Flux

$+I(0)$

Temp of planet

$P =$ pressure

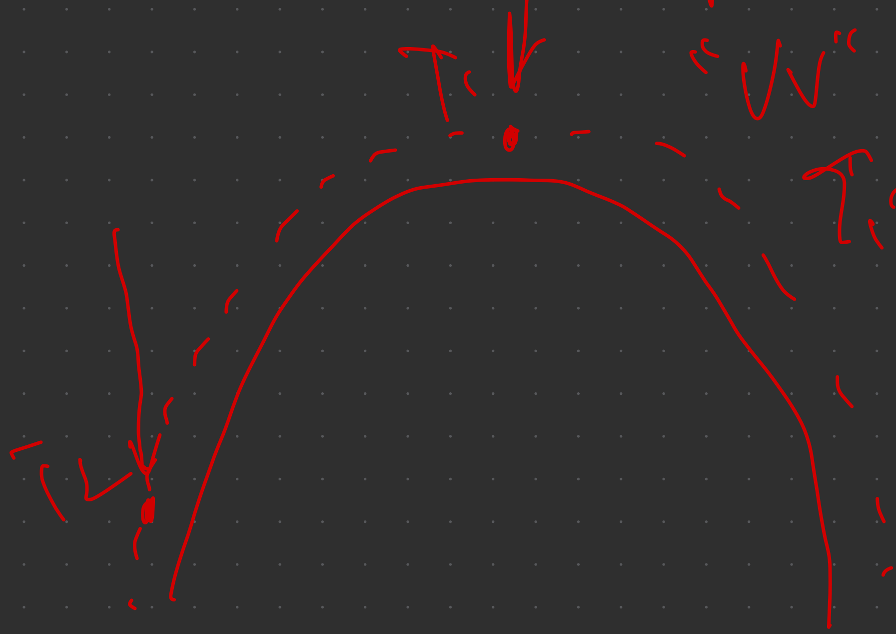
$\rho =$ density

$\rightarrow$ interna

Albedo

Temp for sun $\rightarrow$ F

OTF



if just optically thin "UV" then $T_1 \approx T_2$

$$\kappa_J = \frac{\int_0^\infty \kappa_\nu J_\nu \, d\nu}{J}$$

mean Intensity

↳ heating from absorption

$$\kappa_B = \frac{\int_0^\infty \kappa_\nu B_\nu \, d\nu}{B}$$

Planck

↳ local planet temp

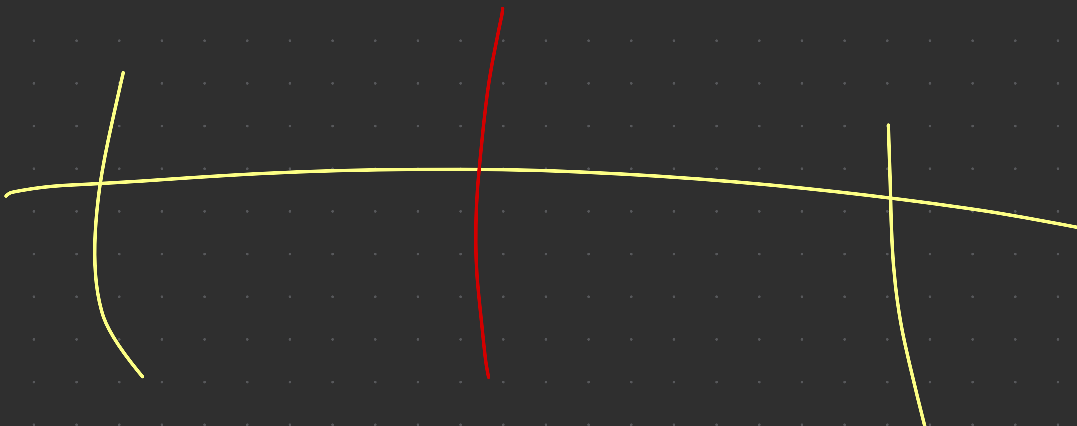
$$\boxed{T} = \boxed{\frac{\kappa_J}{\boxed{\kappa_B}}}$$

Based on each other

↳ Compute $\boxed{\kappa_J(\tau), \kappa_B(\tau)}$ on the (P, T) profile

Things to implement

- [ ] → line opacities ?
- [ ] → EOS for molecules
- [ ] →



graphs

Kinda - Grey atmosphere

some help from Grif

w/ wrong EOS.

Vernica

Kinda - Grey atmosphere

using Vernica code

w/ correct EOS.

fix opacities?

Grif

using Vernica code

non Grey atmosphere

nathan

Looking at how UV and IR effects the

spectrum by

changing k_j and k_B

H He Ne C N

	He	H_2	Ne	CH_4	A	NH_2
%	97.2	2.3	0.39	0.063	0.042	0.0029

×2

×4 H H

$H_2 \to 2H$

$He \to 1He$

$Ne \to Ne$

$CH_4 \to 1C + 4H$

$NH_3 \to 1N + 3H$

$Ar \to 1Ar$?

⇒ num of atoms

$\frac{0.063 \times 4}{H \text{ atom}}$ as many compared to C ? etc...

$$\boxed{H = 2 \times 2.3 + 0.063 \times 4 + 2 \times 0.0029}$$

He = He %

C = 0.6

N = 0.0029

$$\tau = \underbrace{N}_{\text{column density}} \underbrace{\sigma}_{\text{crossection}}$$

$$H = \frac{k_B T}{\mu}$$

$$z = -H \ln \frac{\rho}{\rho_0}$$

Constants

de broglie constant:
For quantum wavelength
Calculation

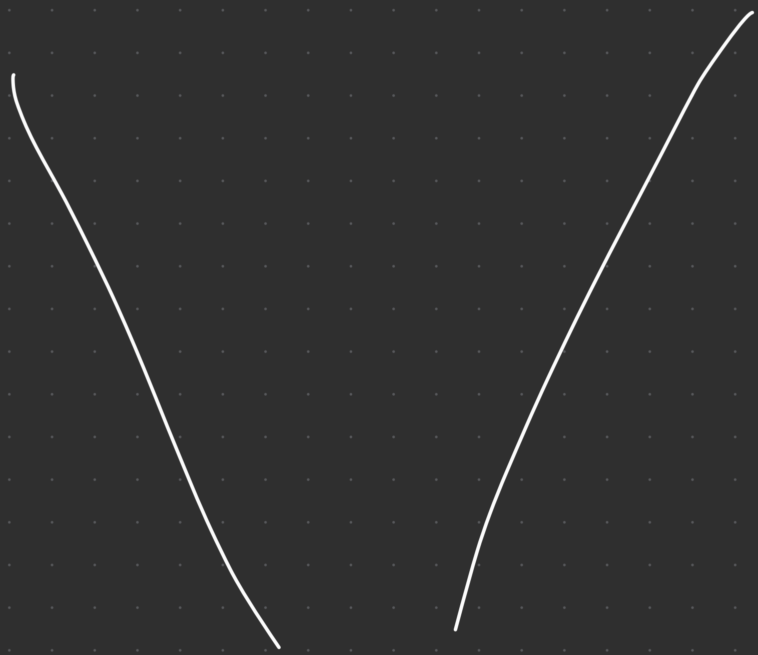
eV_Boltzman_constant: Energy - temp conversion

deybe_constant: For plasma screening effects

delchi_const: Ionization potential corrections

Composition:

$H \rightleftharpoons H_2$



Equation
of state

Equilibrium solve uses:

↓

ns_from_rho_T (to get Saha solution)

↓

converts Saha n

$\rightarrow \log P$

via $P = n k_B T$

↓

Initial guess

↓

Deplete atoms to account for molecules

↓

solve