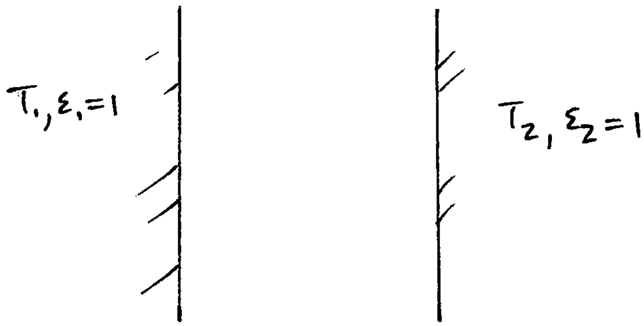
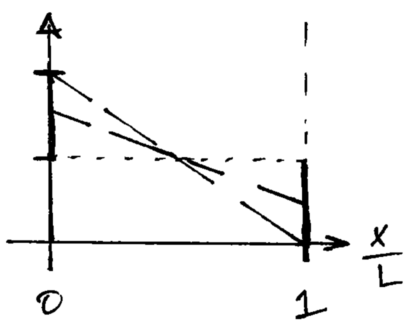
2.58 5/2/06



$$\frac{e_b - e_{b_2}}{e_{b_1} - e_{b_2}} \equiv \phi_b$$



MEANINGS —

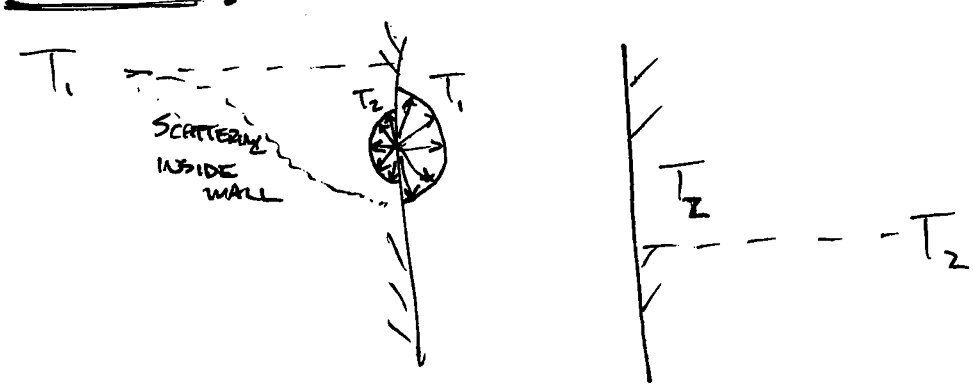
FLAT TEMP:

TWO STREAMS OF NON SCATTERING PHOTONS

LOCAL NRG DENSITY ⟺ TEMP.

BUT NON EQUIL.

TEMP JUMP:



APPROXIMATE SOLN'S :

$\tau_L \ll 1$ — OPTICALLY THIN

$\tau_L = \chi_e \cdot L$

$\tau_L \gg 1$ - OPTICALLY THICK

$$\mu \frac{dI}{d\xi} = -I + I_b$$

$$\xi \equiv \chi_e z$$

1st ORDER,

$$\frac{dI}{d\xi} \longrightarrow \frac{dI_b}{d\xi}$$

1st ORDER DIFFUSION APPROX.

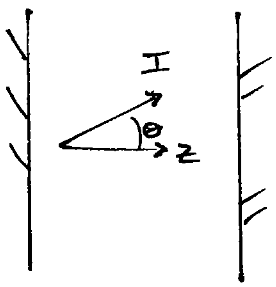
$$\boxed{I = I_b - \mu \frac{dI_b}{d\xi}}$$

FIRST-ORD. APPROX.
SOME BOOKS USE HIGHER ORDERS IN THIS TERM, WHICH IS INCONSISTENT

$$q_z'' = \int_{4\pi} I \cos\theta \, \underbrace{d\Omega}_{\sin\theta \, d\theta \, d\phi}$$

$$= \int_0^{2\pi} d\phi \int_0^{\pi} \cos\theta \Big(\underbrace{I_b}_{\int = 0} - \underbrace{\cos\theta \frac{dI_b}{d\xi}}_{\int \frac{1}{2} \cos^3\theta \Big|_0^{\pi} =} \Big) \sin\theta \, d\theta$$

$$\frac{1}{3} \cos^3\theta \Big|_0^{\pi} \qquad \frac{1}{2} \cos^2\theta \Big|_0^{\pi}$$



"LOOKS" LIKE FOURIER LAW

$$q_z'' = -\frac{4\pi}{3}\frac{dI_b}{d\xi} = -\frac{4}{3}\frac{\pi}{\kappa_e}\frac{dI_b}{dz}$$

DIFFUSE-GRAY APPROX.

$$e_b = \pi I_b$$

$$q_z'' = -\frac{4}{3}\frac{1}{\kappa_e}\frac{de_b}{dz}$$

(ROSSELAND DIFFUSION APPROX.)

$$I_b = \frac{u_b \cdot c}{4\pi}$$

LIGHT SPEED

$$= -\frac{1}{3}\frac{c}{\kappa_e}\frac{du_b}{dz}$$

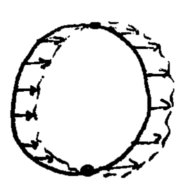
$$\frac{du_b}{dT}\frac{dT}{dz} = C_v \frac{dT}{dz}$$

$$\boxed{q_z'' = -\left(\frac{1}{3} c \cdot \Lambda \cdot C_v\right)\frac{dT}{dz}}$$

HAS FOURIER FORM.

DIFFUSIVE LIMIT, $\frac{L}{\Lambda} \gg 1$, FOR PHOTONS MEANS OPTICALLY THICK

$I \longrightarrow$

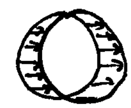


DIFFERENCE GIVES HEAT FLOW

$\varepsilon_1 = 1$

T_1

$$q''_w = \int_0^{2\pi} d\phi \int_0^{\pi/2} I_w \cos\theta \sin\theta \, d\theta + \underbrace{\int_0^{2\pi} d\phi \int_{\pi/2}^{\pi} I \cos\theta \sin\theta \, d\theta}_{q''/2}$$



NOTE! B.C's @ WALL ARE NOT THE SAME

AS... WHAT.

see pp5

NEED TO MAKE APPROXIMATIONS FOR BCs

$$I_w = \varepsilon I_b + (1-\varepsilon) I^-$$

$$\int_0^{\pi/2} \left(\varepsilon I_b + (1-\varepsilon) I^- \right) \sin\theta \cos\theta \, d\theta$$

$$\varepsilon I_b \left(-\frac{1}{2} \cos^2\theta \right)_0^{\pi/2} = \frac{1}{2} \varepsilon I_{bw}$$

★★ I_b IS I IN MEDIUM

I_{bw} IS I FROM THE (TW) WALL

$$(1-\varepsilon) \int_0^{\pi/2} \left[I_b(0) + \cos\theta \frac{dI_b}{d\xi} \right] \sin\theta \cos\theta \, d\theta = \cancel{\tfrac{1}{2}(1-\varepsilon) I_b(0) +}$$

$$= \ldots$$

$$= \frac{1}{2}(1-\varepsilon) I_b(0) + (1-\varepsilon)\left(-\frac{1}{3}\cos^3\theta\right)_0^{\pi/2} \frac{dI_b}{d\xi} = \ldots$$

$$= \frac{1}{2}(1-\varepsilon) I_b(0) + (1-\varepsilon)\frac{1}{3}\frac{dI_b}{d\xi}$$

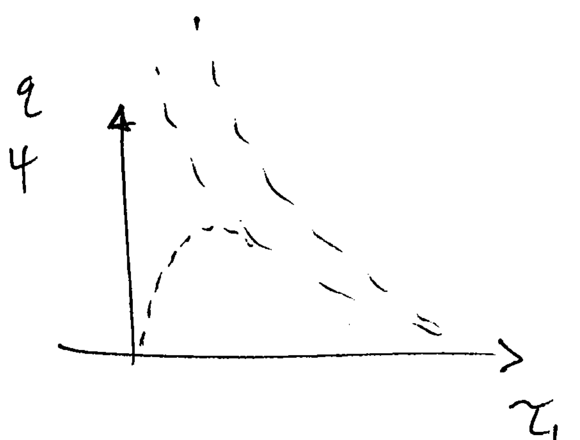
$$\Longrightarrow \boxed{q'' = q''_w = \frac{e_{bw} - e_b(0)}{\frac{1}{\varepsilon_1} - \frac{1}{2}}}$$

"Deissler Temp. Jump" B.C.

$$\bar{\nabla}\cdot\bar{q}'' = 0 = \nabla^2 T$$

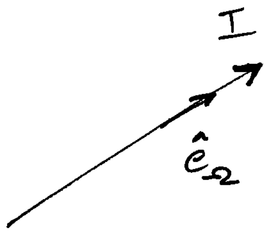
$$\frac{d^2 e_b}{dz^2} = 0 \longrightarrow e_b = az + b$$

$$\Longrightarrow q'' = \frac{e_{bw1} - e_{bw2}}{1 + \frac{4}{3}\tau_L}$$ SPH

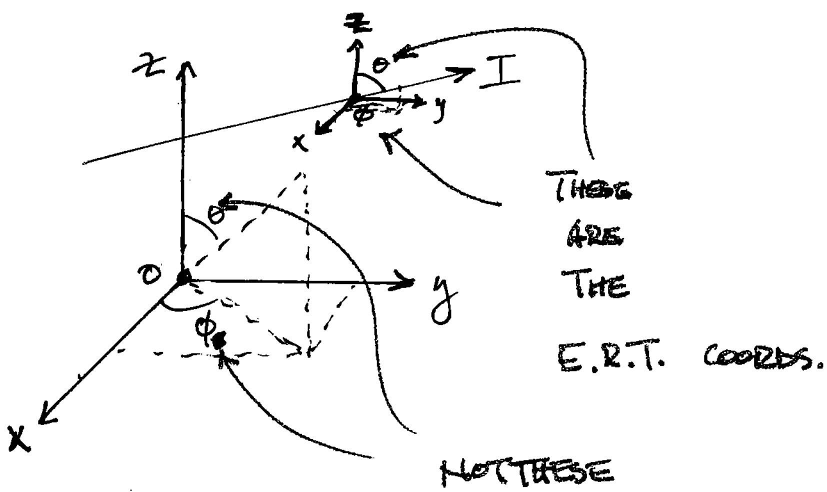


BOOKS ARE WRONG HERE

SPHERICAL & CYL. COORDS



$$\frac{1}{k_e}\,\hat{e}_\Omega \cdot \underbrace{\overline{\nabla}_F I}_{\text{ANALOGOUS TO } \frac{dI}{ds}} = -I_\eta + \overset{\text{SOURCE TERM}}{S_\eta}$$



$$\underbrace{\mu}_{\cos\theta}\frac{\partial I}{\partial \tau} + \frac{1-\mu^2}{\tau}\frac{\partial I}{\partial \mu} = S_\eta - I_\eta$$