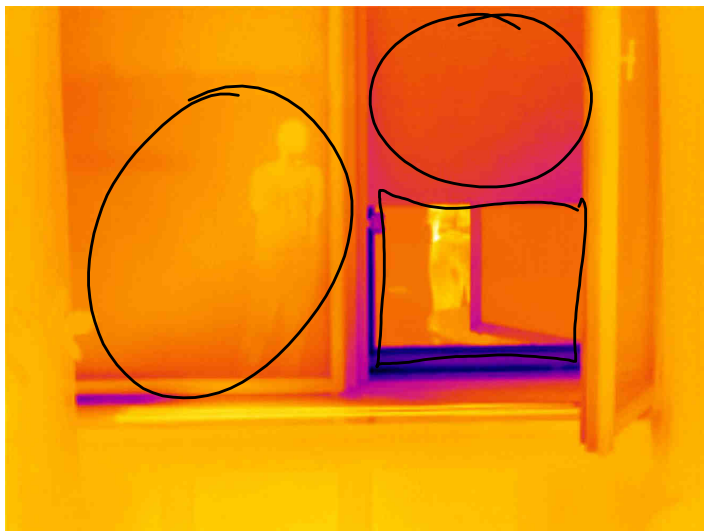
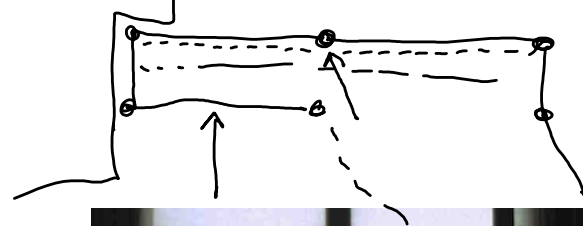
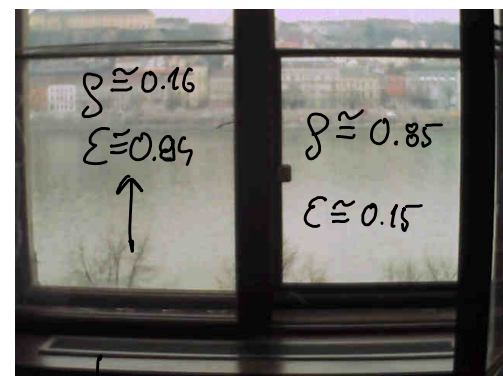
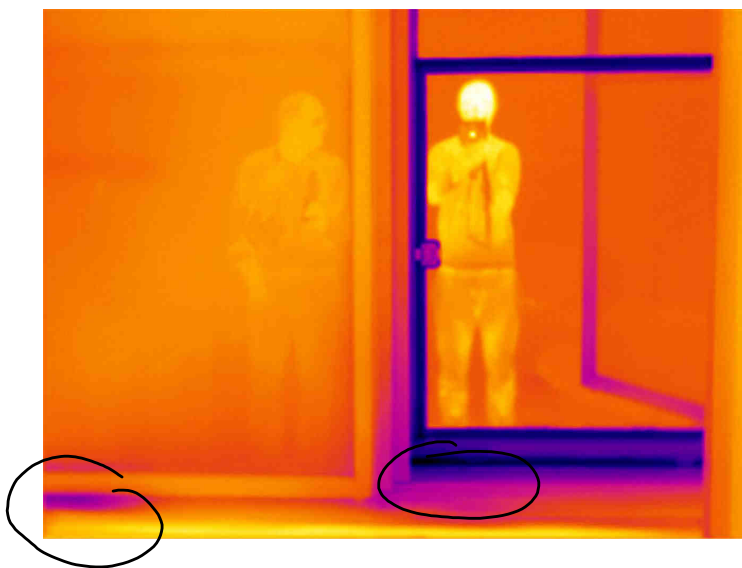
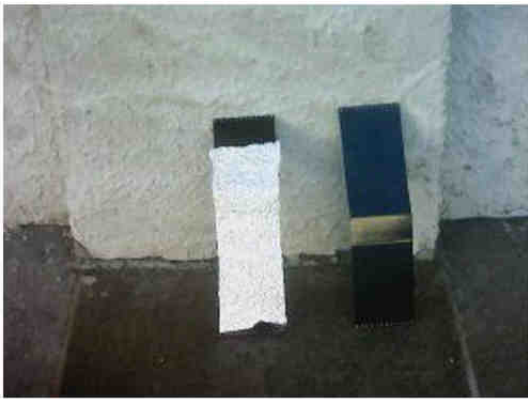


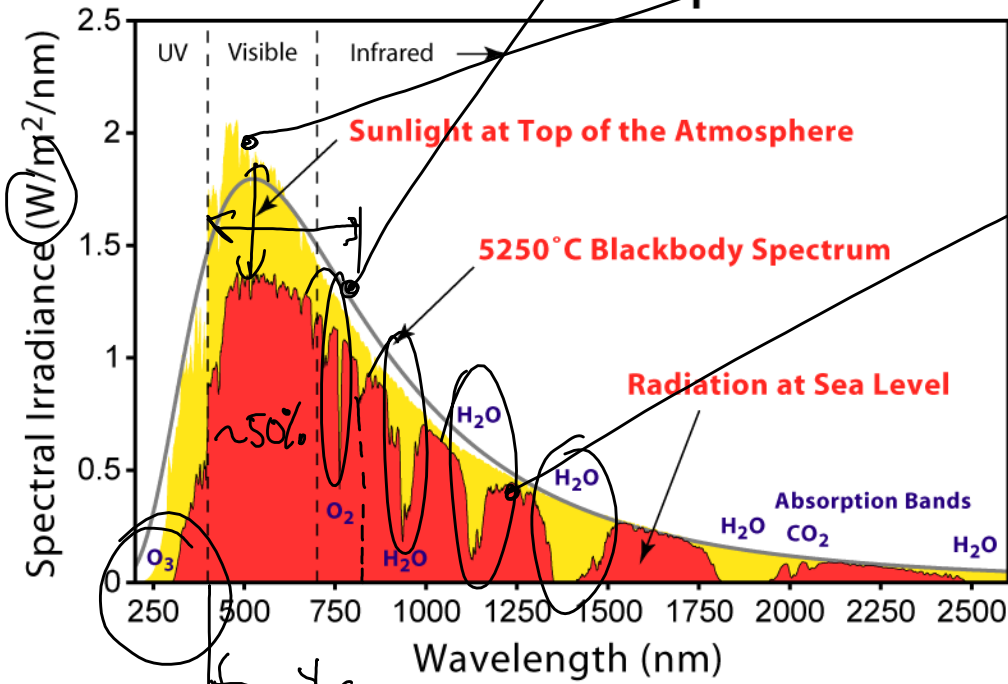
00 - IR példák

2016. október 20.
14:11



$T \approx 6000$ [K] abszolút fekete test
teljesen a látható
terelekre beeső sug.

Solar Radiation Spectrum

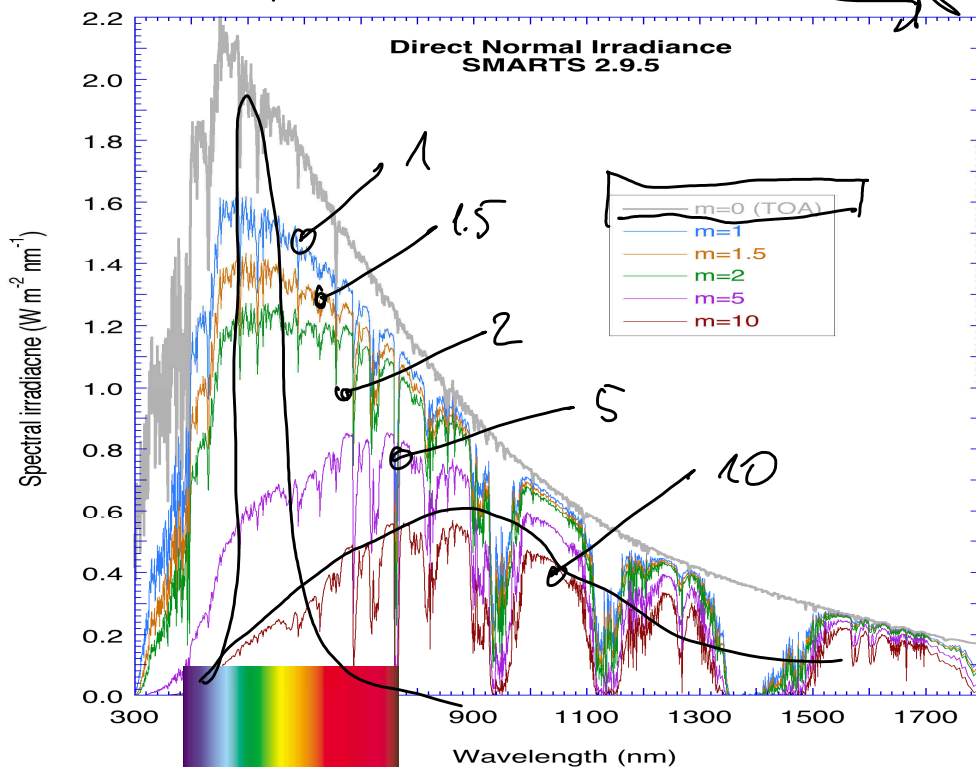


tényleges Föld
felszíni nettó
sug.

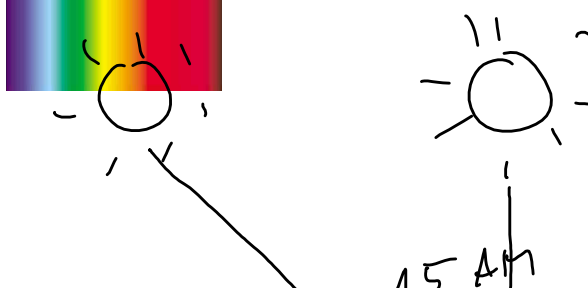
1.5 [AM]

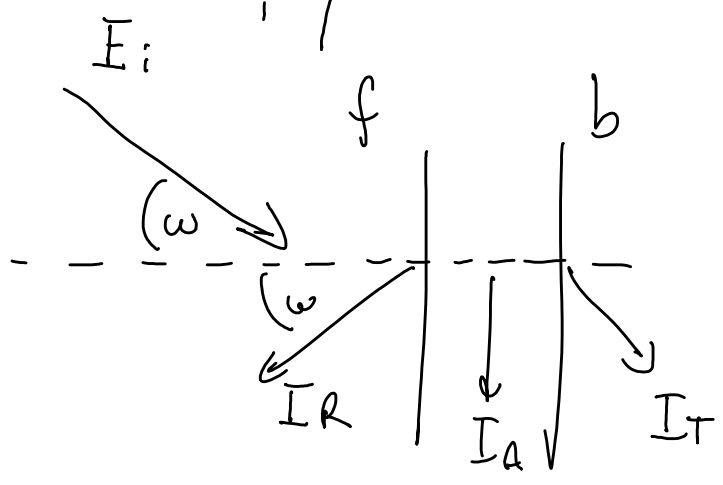
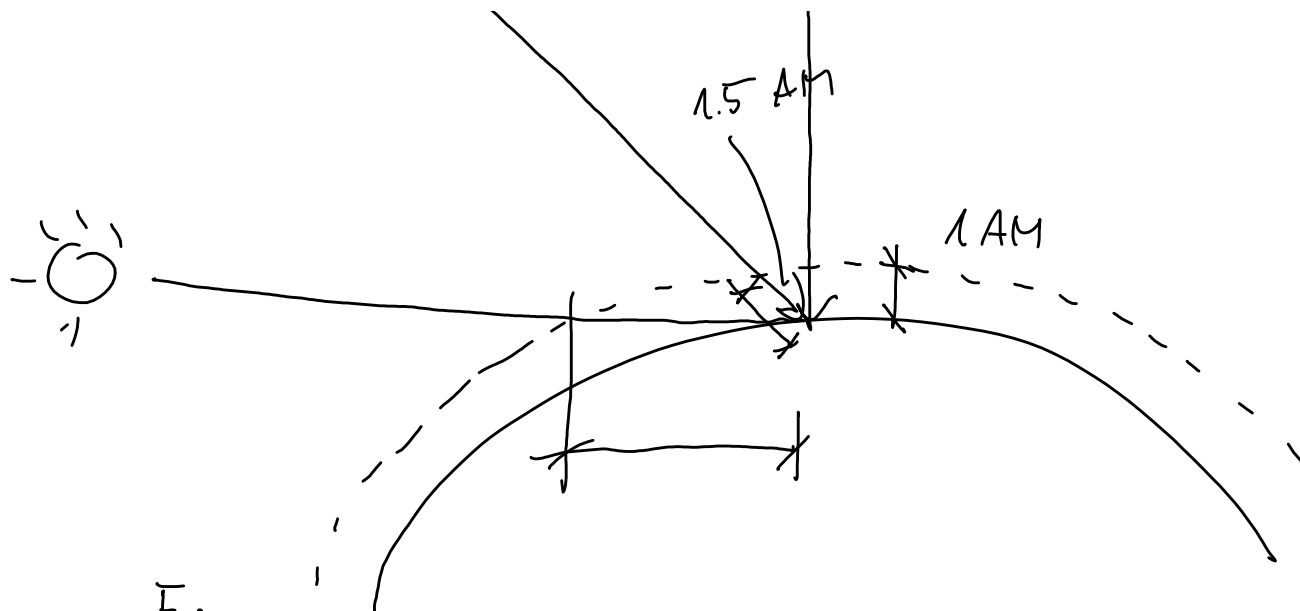
N_2 , H_2O , O_2
 CO_2

IR



ISO 9895-1





$$\bar{I}_i = \bar{I}_R + \bar{I}_A + \bar{I}_T / I_i$$

$$1 = \frac{\bar{I}_R}{\bar{I}_i} + \frac{\bar{I}_A}{\bar{I}_i} + \frac{\bar{I}_T}{\bar{I}_i}$$

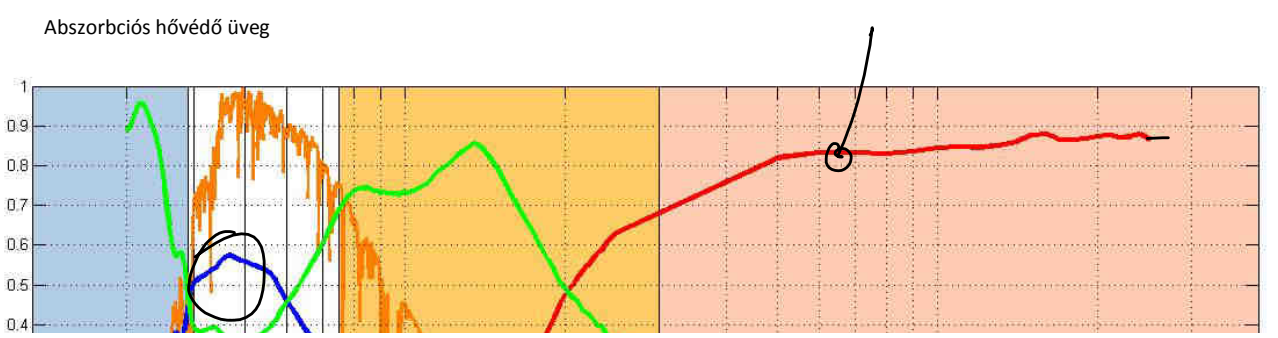
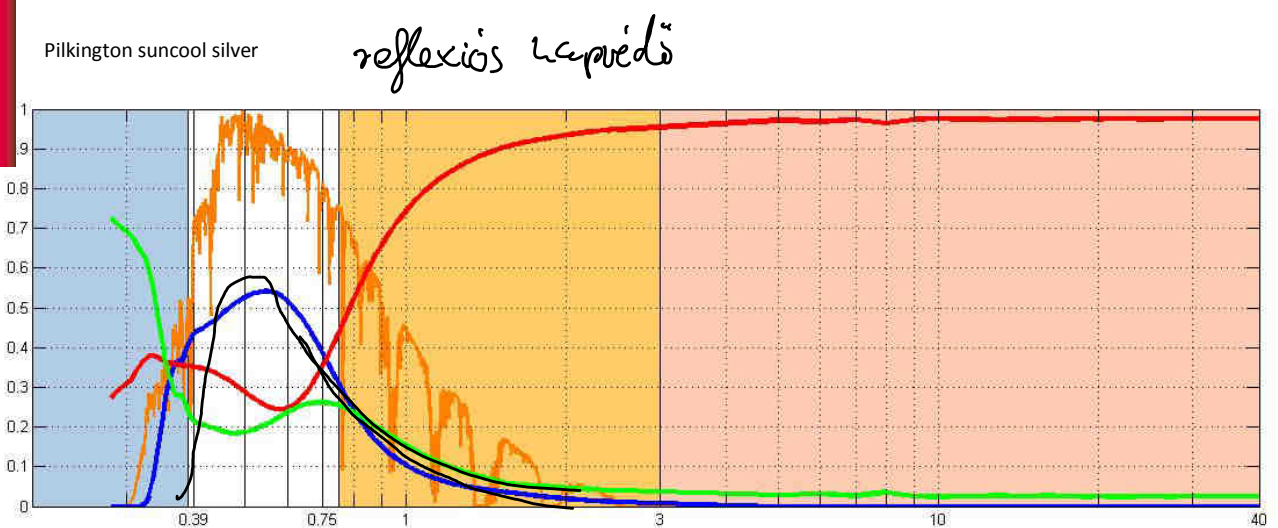
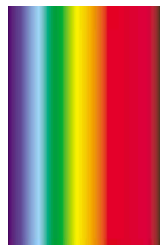
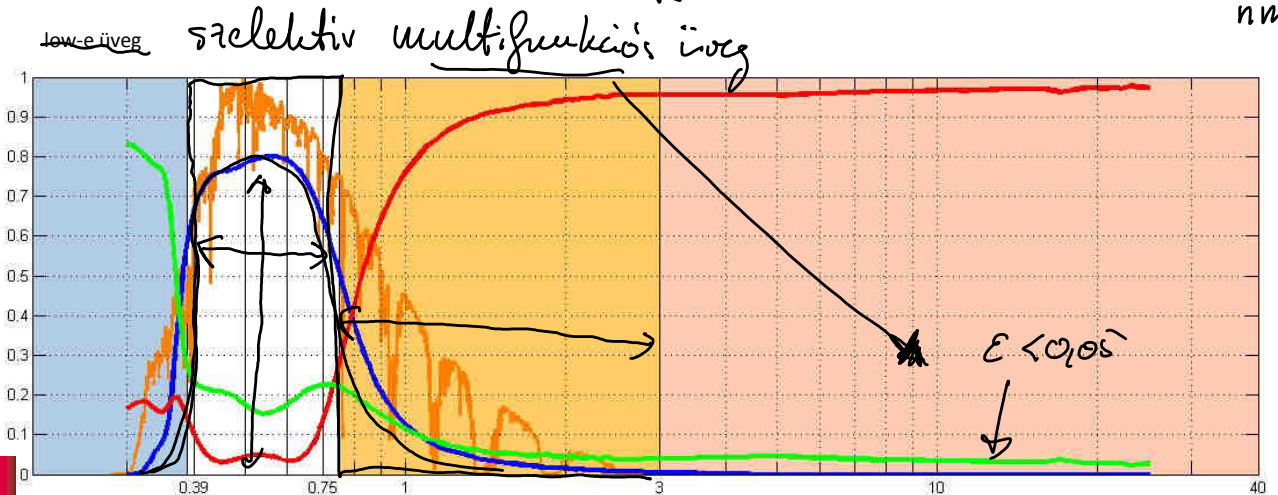
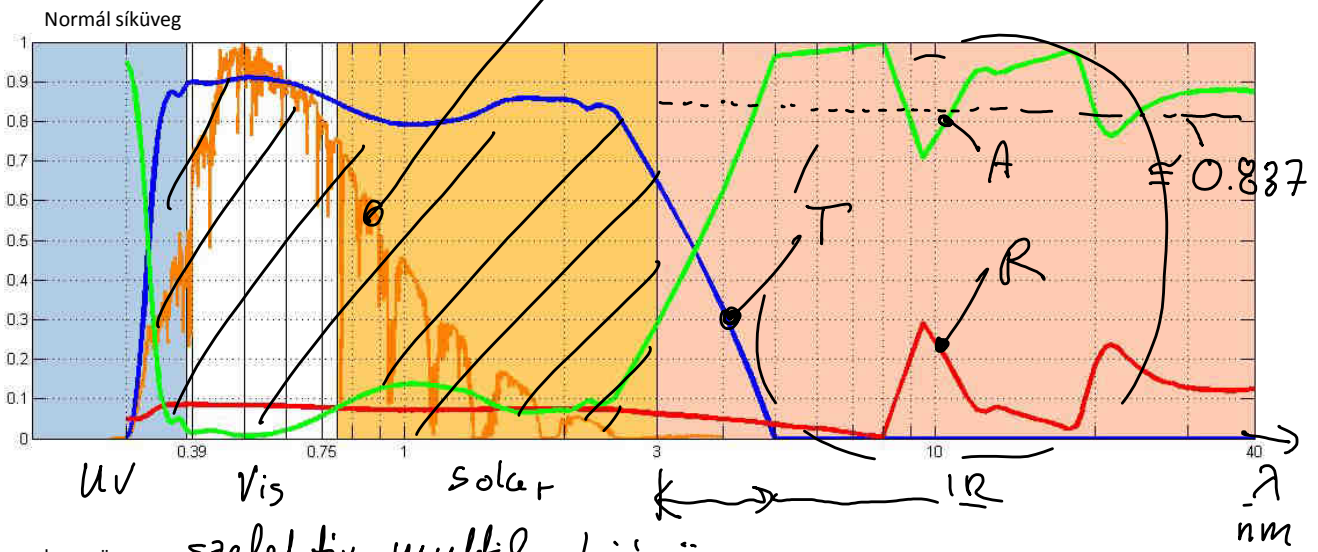
$$1 = R + A + T$$

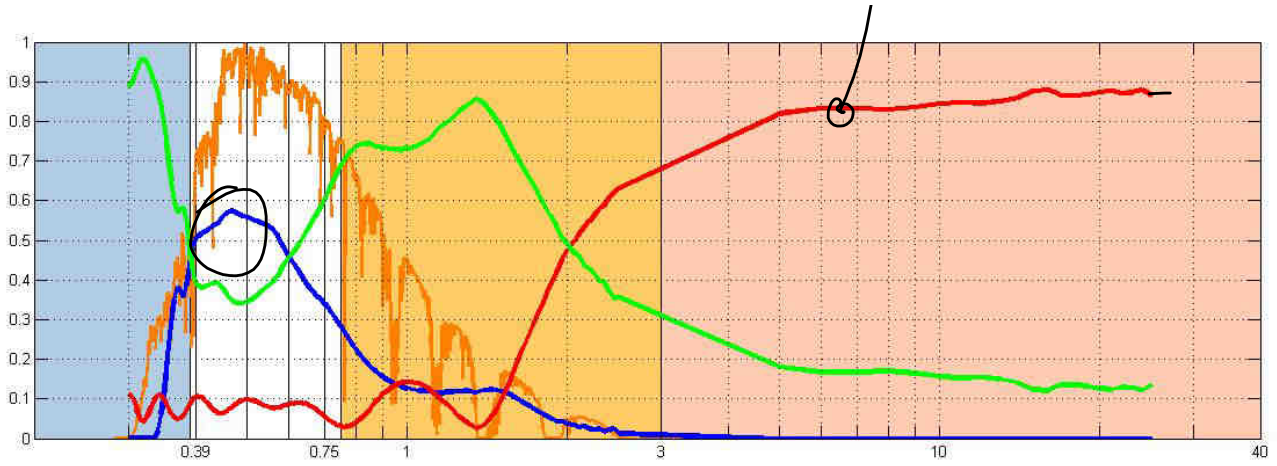
$$1 = \tau_f(\omega, \lambda) + \rho_f(\omega, \lambda) + \alpha_f(\omega, \lambda)$$

$$1 = \tau_b(\omega, \lambda) + \rho_b(\omega, \lambda) + \alpha_b(\omega, \lambda)$$

03 - Építési üvegek spektrális tulajdonságai

2016. október 13.
17:30





Antg. üveg stáruéletás

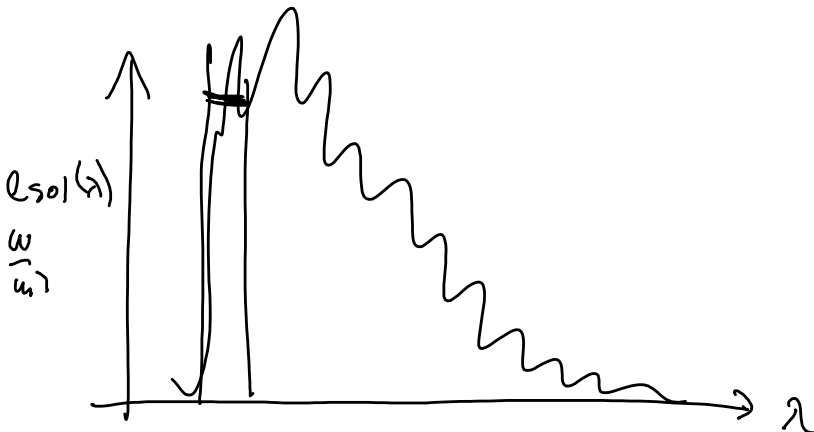
$W = 0$
1.5 AW

+ hemiszférikus

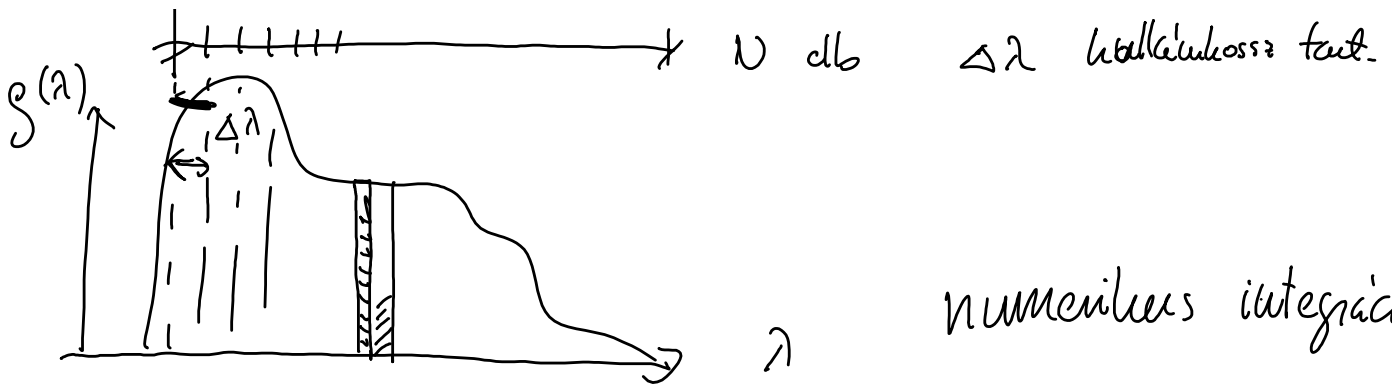
IGDB

- LBNL Optics
- LBNL Window
- (LBNL Therm)

$$\frac{W}{m^2} = \int_{\lambda} \left[\frac{W}{m^3} e_{sol}(\lambda) \right] d\lambda$$



$e(\lambda)$ $\Delta \lambda$ $W \text{ dB}$ $\Delta \lambda$ $W \text{ dB}$ $\Delta \lambda$ $W \text{ dB}$

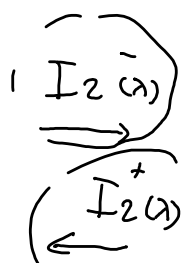
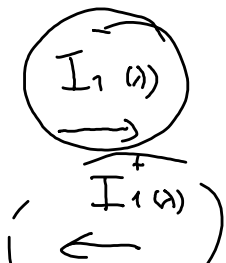
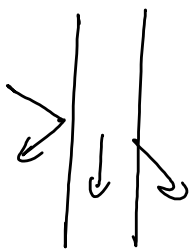


$$T = \frac{\int_{\lambda} e_{sol}(\lambda) \tau(\lambda) d\lambda}{\int_{\lambda} e_{sol}(\lambda) d\lambda}$$

$$\frac{\sum_{i=1}^{N-1} e_{sol}(\lambda_i, \lambda_{i+1}) \tau(\lambda_i, \lambda_{i+1}) \Delta\lambda}{\sum_{i=1}^{N-1} e_{sol}(\lambda_i, \lambda_{i+1}) \Delta\lambda}$$

$$A = \frac{\int_{\lambda} e_{sol}(\lambda) \alpha(\lambda) d\lambda}{\int_{\lambda} e_{sol}(\lambda) d\lambda} \quad \equiv \quad \dots$$

$$R = \frac{\int_{\lambda} e_{sol}(\lambda) \rho(\lambda) d\lambda}{\int_{\lambda} e_{sol}(\lambda) d\lambda} \quad \equiv \quad \dots$$





- 1) $I_1^-(\lambda) = e_{sol}(\lambda) \leftarrow \text{konstantes}$
 - 2) $I_2^-(\lambda) = r_1(\lambda) I_1^-(\lambda) + \rho_{b1}(\lambda) I_2^+(\lambda)$
 - 3) $I_3^-(\lambda) = r_2(\lambda) I_2^-(\lambda) + \rho_{b2}(\lambda) I_3^+(\lambda)$
 - 4) $I_1^+(\lambda) = r_1(\lambda) I_2^+(\lambda) + \rho_{f11}(\lambda) I_1^-(\lambda)$
 - 5) $I_2^+(\lambda) = r_2(\lambda) I_3^+(\lambda) + \rho_{f12}(\lambda) I_2^-(\lambda)$
 - 6) $I_3^+(\lambda) = \phi \leftarrow \text{konstantes}$
- 1

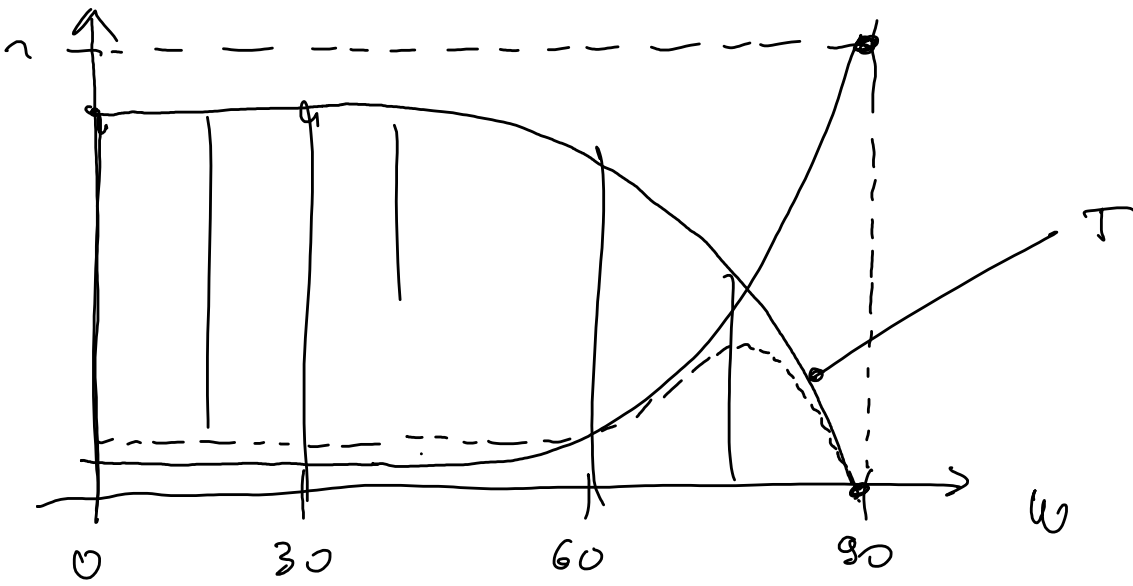
$$T = \frac{\int_{\lambda} I_3^-(\lambda) d\lambda}{\int_{\lambda} I_1^-(\lambda) d\lambda} \approx \frac{\sum_{i=1}^{N-1} I_3^-(\lambda_i, \lambda_{i+1}) \Delta\lambda_i}{\sum_{i=1}^{N-1} I_1^-(\lambda_i, \lambda_{i+1}) \Delta\lambda_i}$$

$$A_1 = \frac{\int_{\lambda} (I_1^-(\lambda) + I_2^+(\lambda) - I_1^+(\lambda) - I_2^-(\lambda)) d\lambda}{\int_{\lambda} I_1^-(\lambda) d\lambda}$$

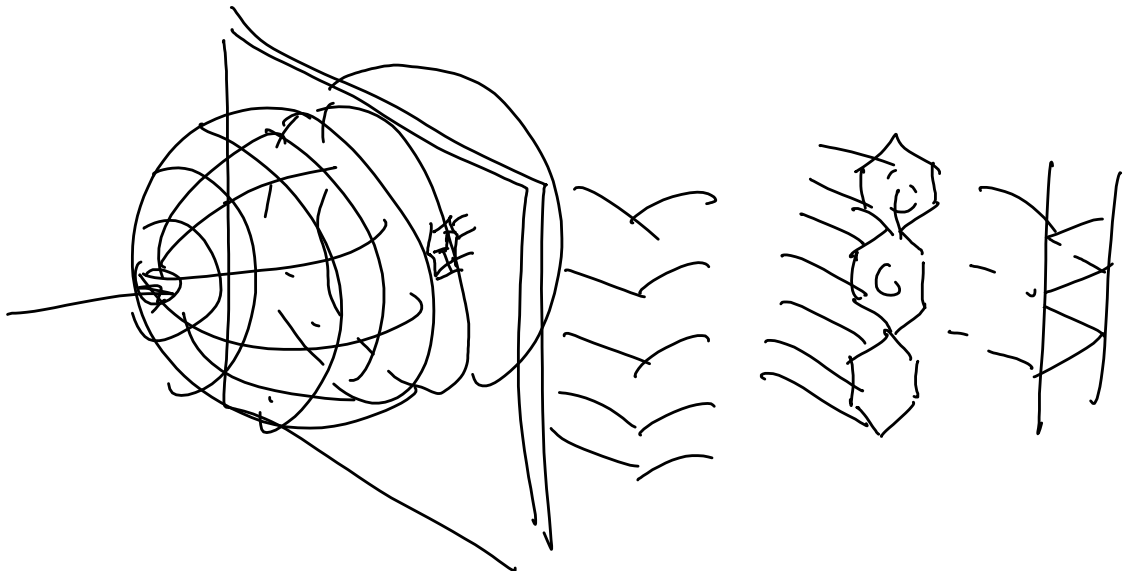
⋮

A_2

$$R_{ref} = \frac{\int_{\lambda} I_1^+(\lambda) d\lambda}{\int_{\lambda} I_1^-(\lambda) d\lambda} \approx \dots$$



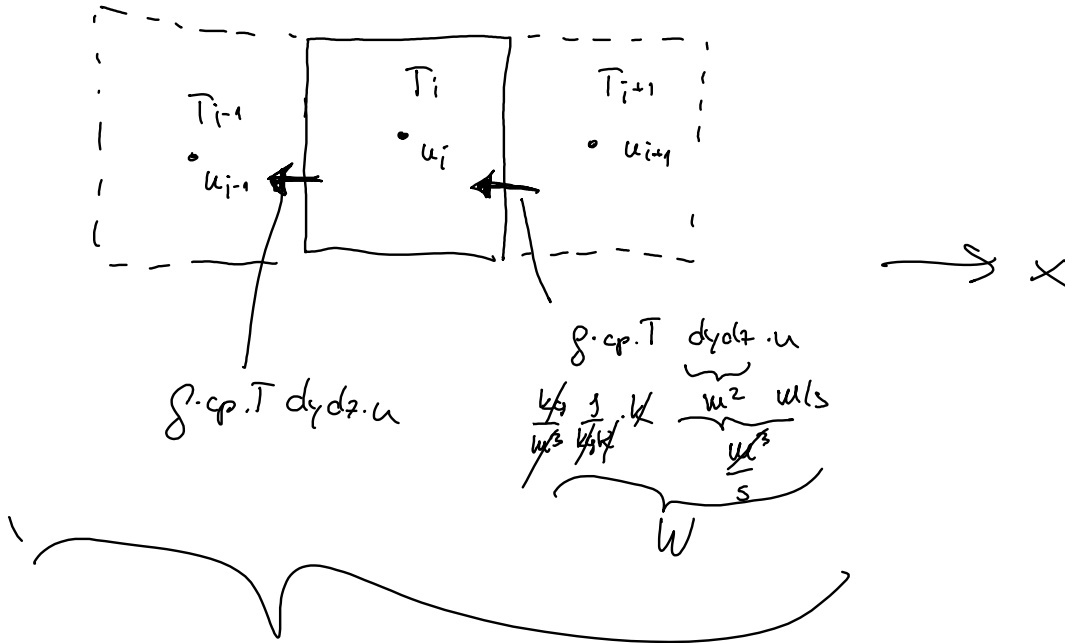
Fresnel



04 - konvektív hőtranszport

2018. november 8.
10:45

| | | | | | | |
|---|---|---|---|---|---|---|
| extenzív mennyiség időbeli megváltozása egy elemi térfogatban | = | extenzív mennyiség vezetékes ki- és beáramlásának előjeles összege az elemi térfogatban | + | extenzív mennyiség forrása az elemi térfogatban | + | extenzív mennyiség konvektív ki- és beáramlásának előjeles összege az elemi térfogatban |
|---|---|---|---|---|---|---|

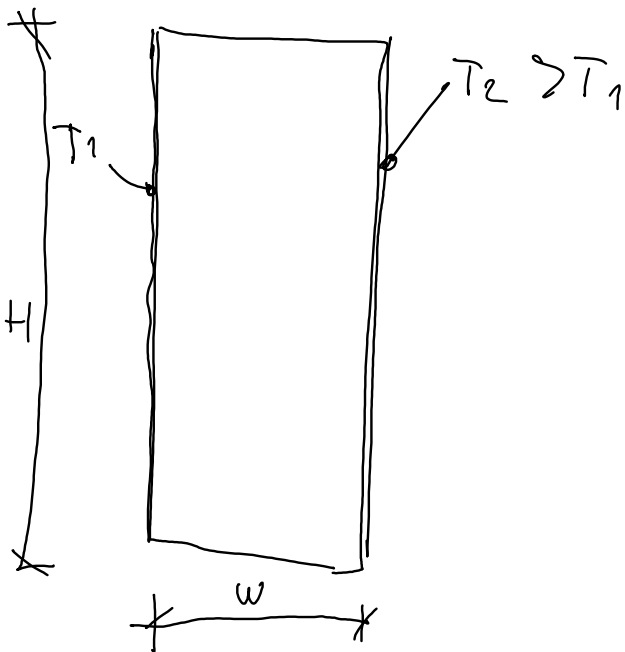
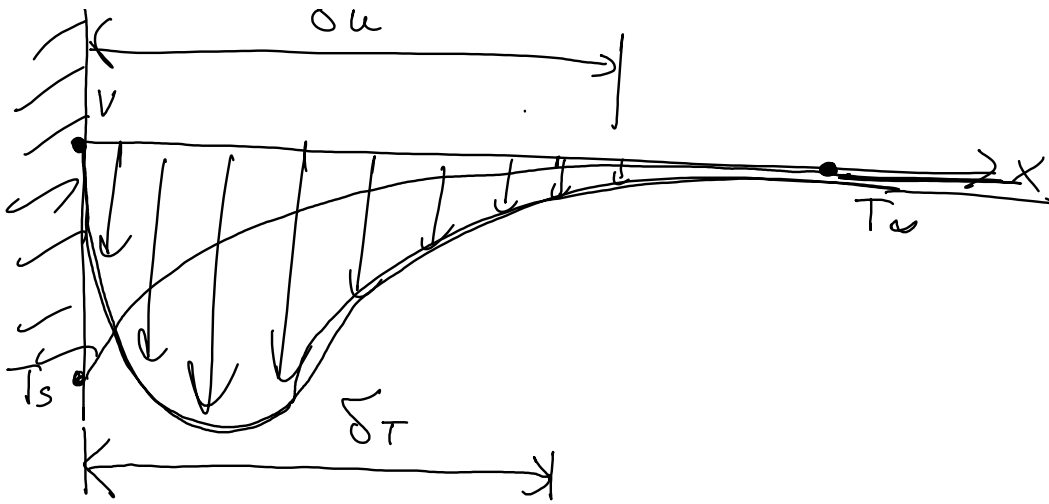


advection

$$\cancel{\frac{\partial}{\partial t} (g_{cp} T)} + \frac{\partial}{\partial x} (g_{cp} T \cdot u) = \frac{\partial}{\partial x} (\lambda \frac{\partial T}{\partial x}) + \cancel{\dots}$$

$\frac{1}{m^3} \cdot \frac{kg}{m^3} \cdot \frac{J}{kg \cdot K} \cdot K \cdot \frac{m}{s} = \frac{J}{m^2 \cdot s}$
 $\left[\frac{W}{m^3} \right]$





| | |
|------------|--|
| $h = ?$ | $Q \cdot t^{-1} \cdot L^{-2} \cdot T^{-1}$ |
| w | L |
| H | L |
| ρ | $M \cdot L^{-3}$ |
| λ | $Q \cdot t^{-1} \cdot L^{-1} \cdot T^{-1}$ |
| c_p | $Q \cdot M^{-1} \cdot T^{-1}$ |
| μ | $M \cdot L^{-1} \cdot t^{-1}$ |
| ΔT | T |
| β | T^{-1} |

(g)

alap dimenziók:

| | |
|-------|-----|
| hossz | L |
| idő | t |
| hőm. | T |
| tömeg | M |
| hő | Q |

vannak változó
 n független dimenzió
 $\rightarrow k - n$ független
dimenziótlan isopot

$$\rightarrow h = f(w, H, \rho, \lambda, c_p, \mu, \Delta T, \beta)$$

$$\pi_1 = f(\pi_1, \pi_2, \pi_3)$$

\uparrow
 fiksio värt 3 funktionaalne rääbtozi

Nusselt arv

$$Nu = \frac{\text{konvektiv k\ddot{a}itad\ddot{a}s}}{\text{konduktiv k\ddot{a}itad\ddot{a}s}} = \frac{h_{conv}}{h_{cond}} = \frac{h_{conv}}{\frac{\lambda}{w}} \left(\frac{h_{conv} \cdot w}{\lambda} \right) [-]$$

$$Nu \begin{cases} \rightarrow \approx 1 \\ \rightarrow > 1 & \text{h\ddot{o}ves + konvektio} \\ \rightarrow \gg 1 & \text{konvektio domineerib} \end{cases}$$

$$\rightarrow h_{conv} = \frac{Nu \cdot \lambda}{w} \quad [W/m^2K]$$