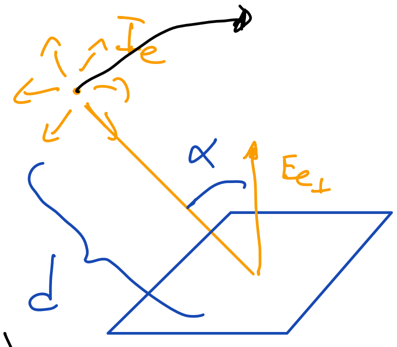
A1 Loi de Bouguer :



$$E_{e_\perp} = \frac{I_e \cdot \cos(\alpha)}{d^2} = \frac{I_{e\perp}}{d^2}$$

$\uparrow$ $\alpha = 0$ (perpendiculaire)

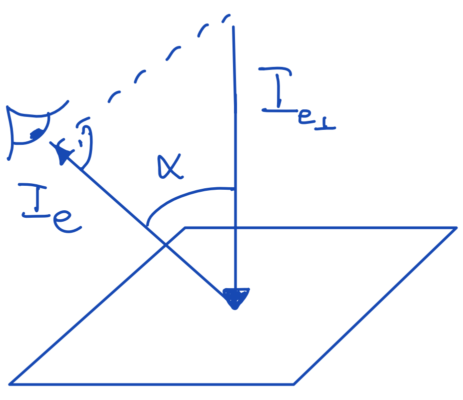
$$\Leftrightarrow I_{e_\perp} = E_{e_\perp} \cdot d^2 = \text{constant}$$

A2

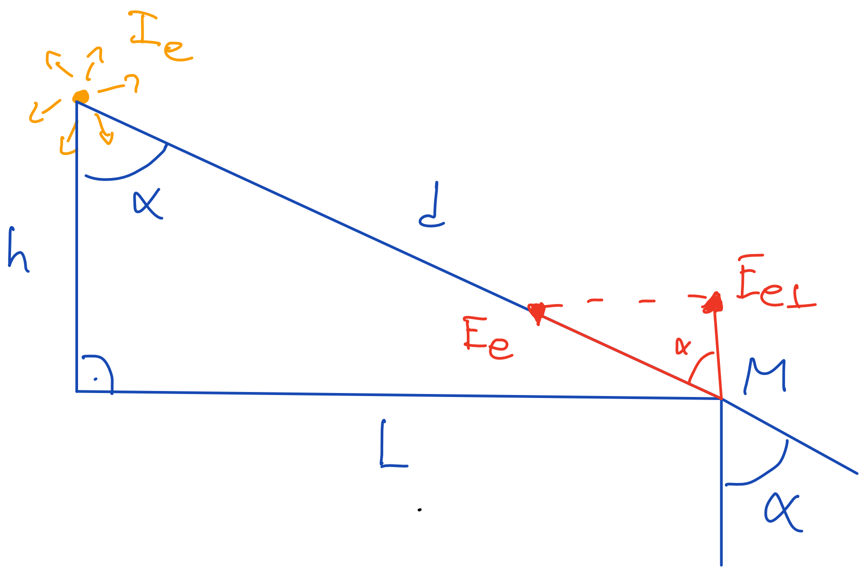
surface lambertienne $\hat{=}$ parfaitement diffusante

↳ satisfait modèle Beer-Lambert :

$$I_e = I_{e_\perp} \cdot \cos(\alpha)$$



B1



$\boxed{\text{I}}$ Trigonométrie:

$$d = \frac{h}{\cos(\alpha)} \qquad \alpha = \arctan\left(\frac{L}{h}\right) = 54.9^\circ$$

$$\Leftrightarrow d = 3{,}48\,m$$

$$E_e = \frac{E_{e\perp}}{\cos(\alpha)}$$

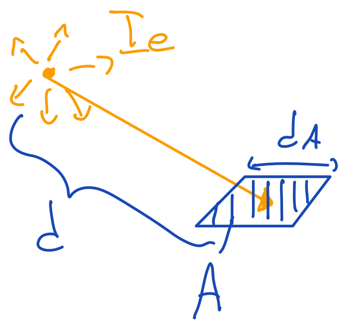
$$I_e = E_e \cdot d^2$$

$\boxed{\text{II}}$ Loi de Bouguer:

$$E_{e\perp} = \frac{I_e \cdot \cos(\alpha)}{d^2} = 103\ W/m^2$$

éclairement énergétique

$\boxed{\text{III}}$ Comme $d \gg d_A \Rightarrow$ éclairement uniforme



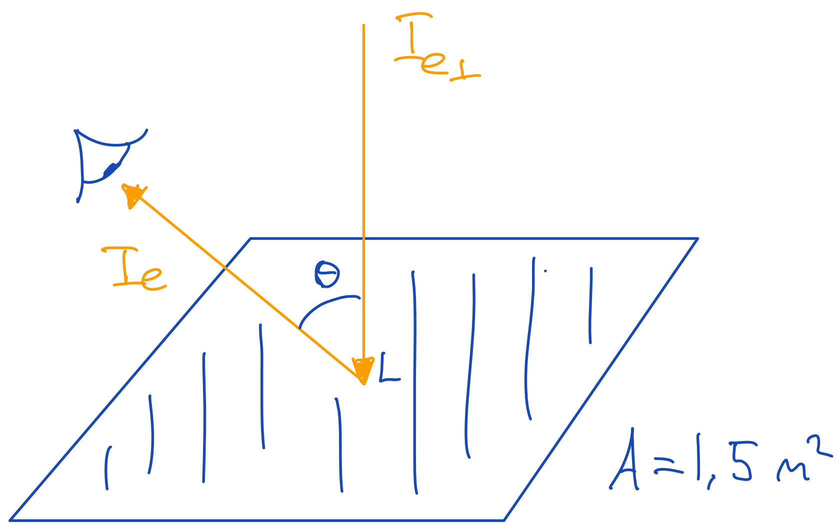
$$\Phi_e = E_{e\perp} \cdot A = 51.5\,W$$

flux énergétique

annexe

Pour surface noire: $\Phi_{ea} = 0.9 \cdot \Phi_e = 46.35\,W$

B2



a) Beer-Lambert :

$$I_e = I_{e\perp} \cdot \cos(\theta) \qquad (1)$$

b)

$$I_e(0°) = I_{e\perp} \cdot \overbrace{\cos(0°)}^{=1} = I_{e\perp} = L_e \cdot A = 40.5\ W/sr$$

$$I_e(45°) = I_{e\perp} \cdot \cos(45°) = L_e \cdot A \cdot \cos(45°) = 28.6\ W/sr$$

$$I_e(90°) = I_{e\perp} \cdot \underbrace{\cos(90°)}_{=0} = 0$$

c) surface homogène :

$$L_e = \frac{I_e}{A \cdot \cos(\theta)} \qquad (2)$$

$(1) \rightarrow (2)$

$$L_e = \frac{I_{e\perp} \cdot \cancel{\cos(\theta)}}{A \cdot \cancel{\cos(\theta)}} = \frac{I_{e\perp}}{A}$$

La luminance énergétique ne dépend pas de l'angle d'observation.

$$L_e(0°) = L_e(45°) = L_e(90°) = \underline{27 \ W/m^2 \cdot sr}$$