

Physique du Bâtiment II

Phénoménologie

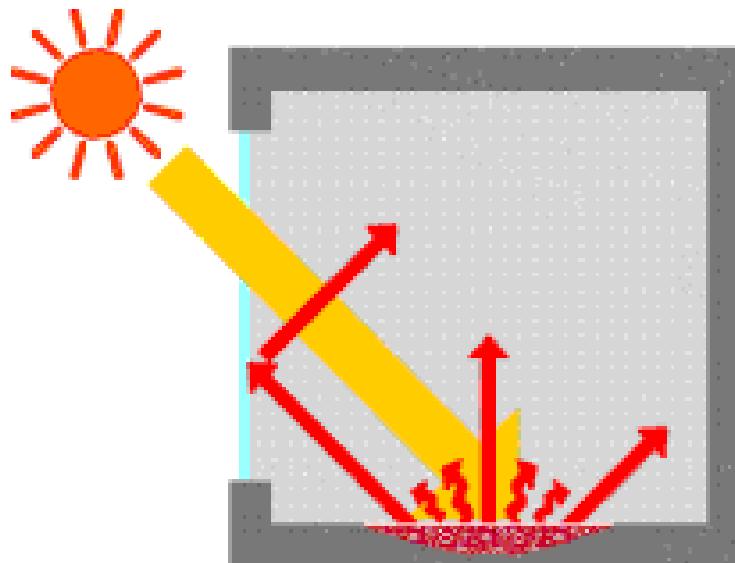
Chapitre 4.4 Rayonnement

Chapitre 9 Photométrie
(Ch 1) Propagation de la lumière

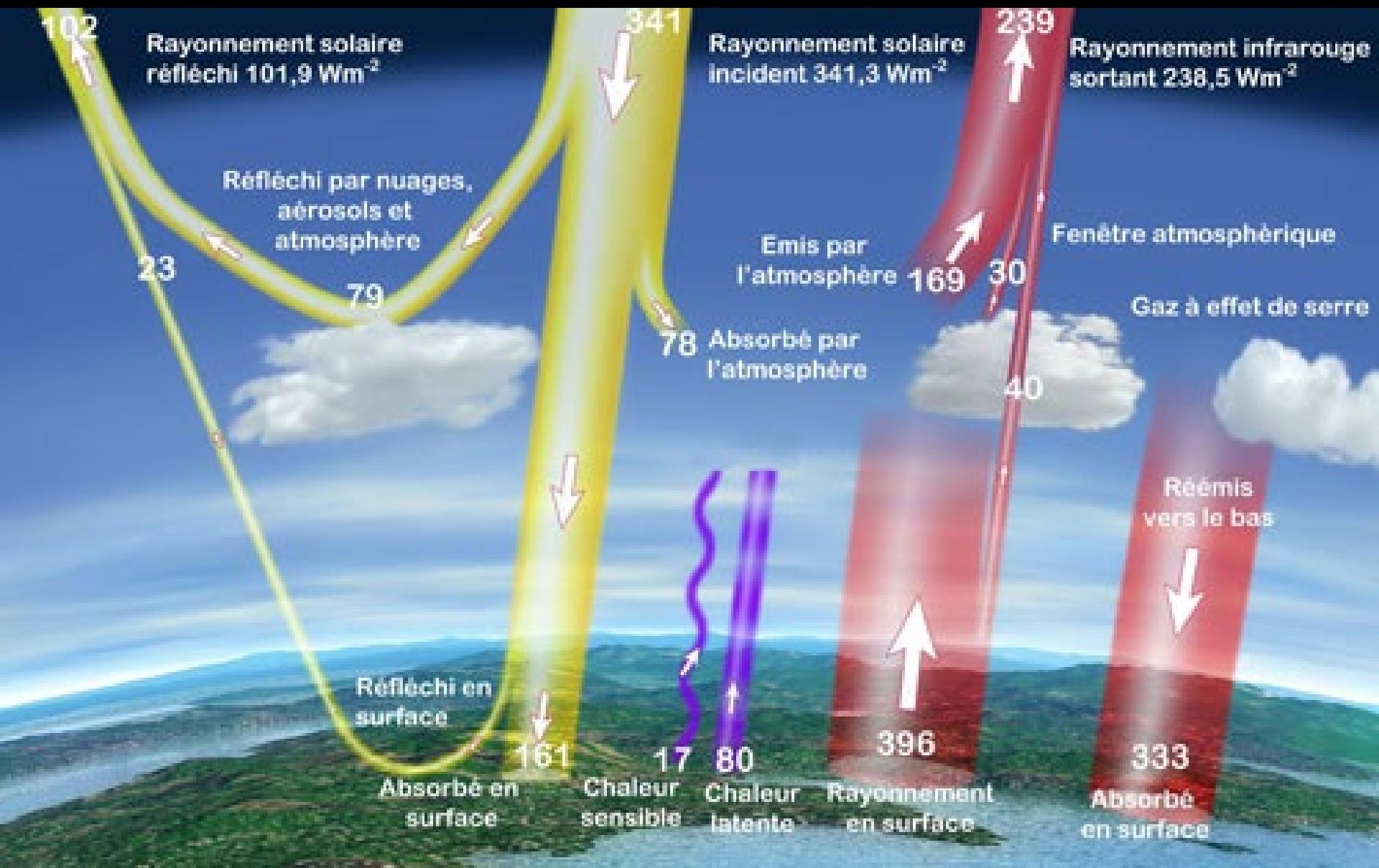
Chapitre 10 Colorimétrie
(Ch 2) Perception des couleurs
Diagramme chromatique

Chapitre 6 Propriétés des ondes sonores
Superposition des ondes
Propagation du son
Acoustique géométrique
 ondulatoire
 statistique

L'effet de serre



L'effet de serre

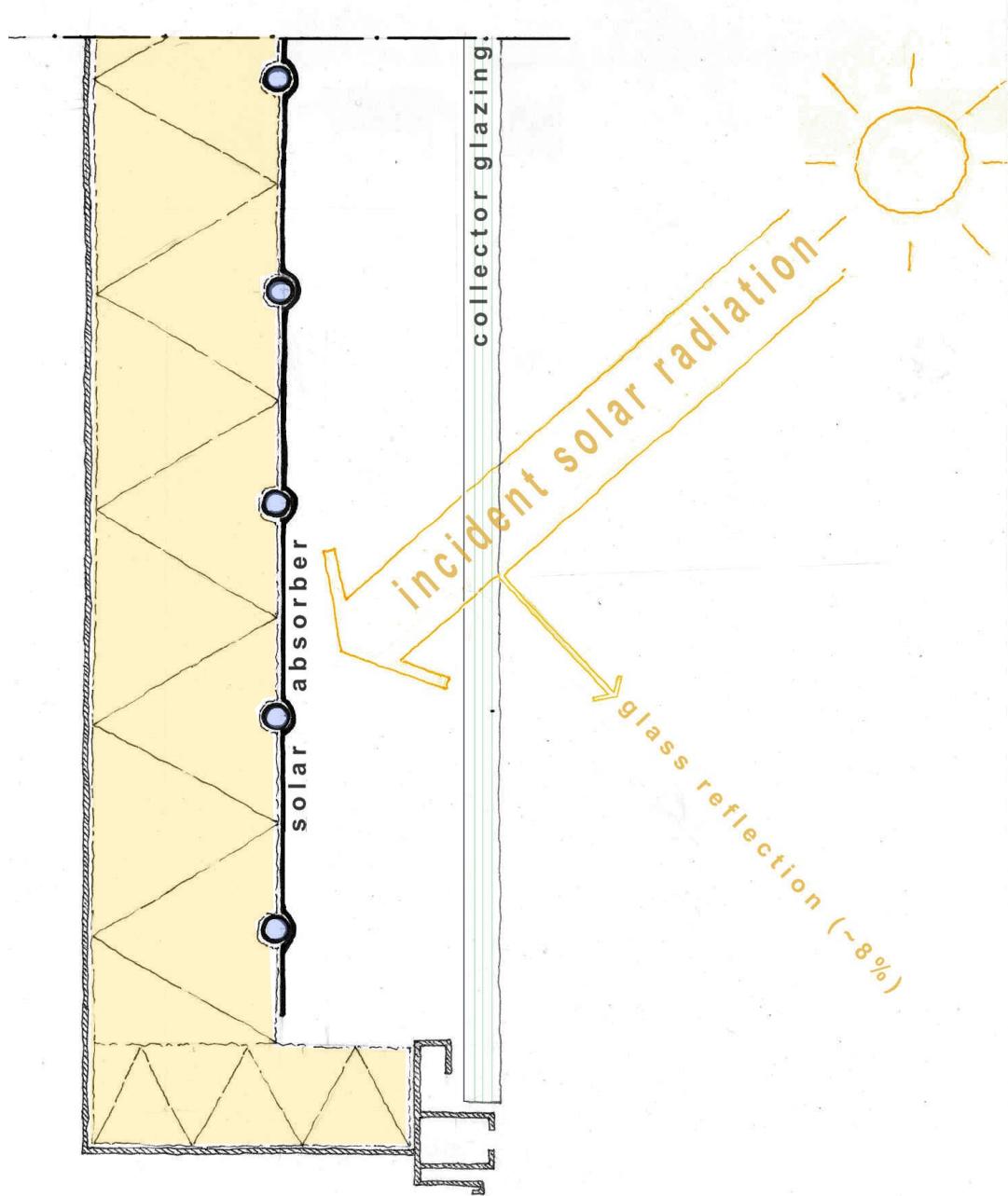


Glazed facade collectors

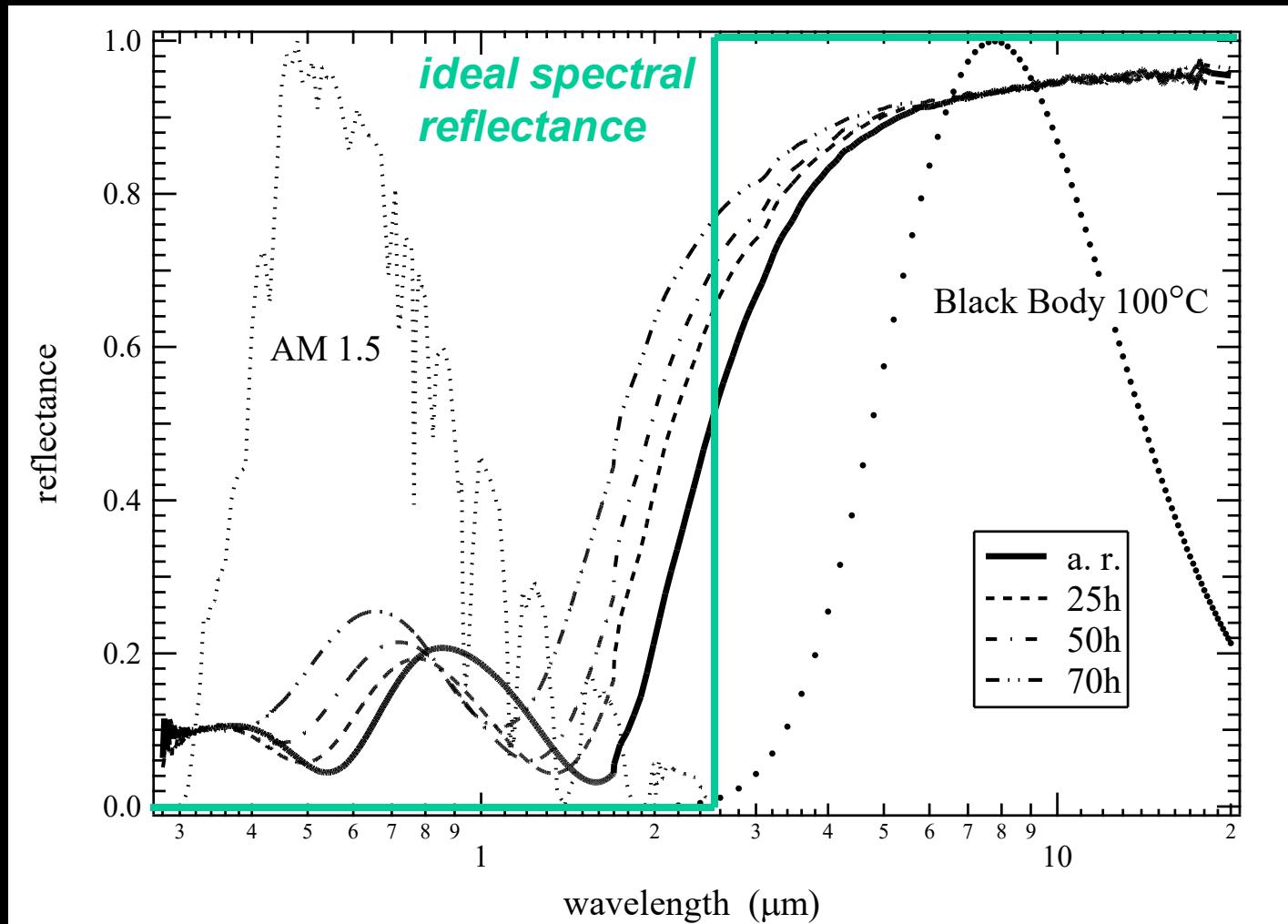


U p p e r s t a g e c e n t r e

source: questionnaire SOLABS



Optical selective solar absorber coating

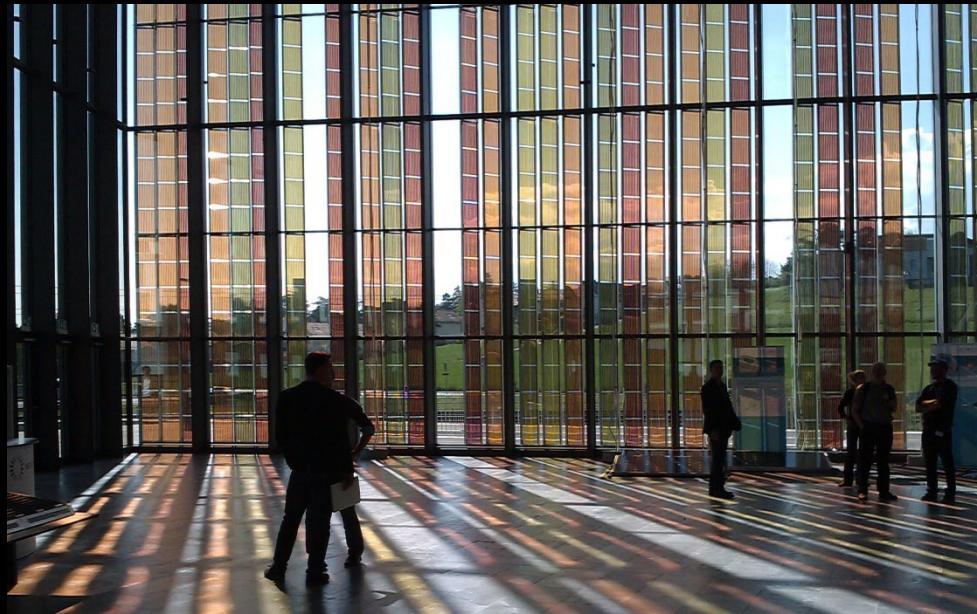


*coating based on a-C:H/Ti,
 (accelerated aging @ 250°C)*

A. Schüler et al., SEMSC (2001)

Centre des congrès EPFL

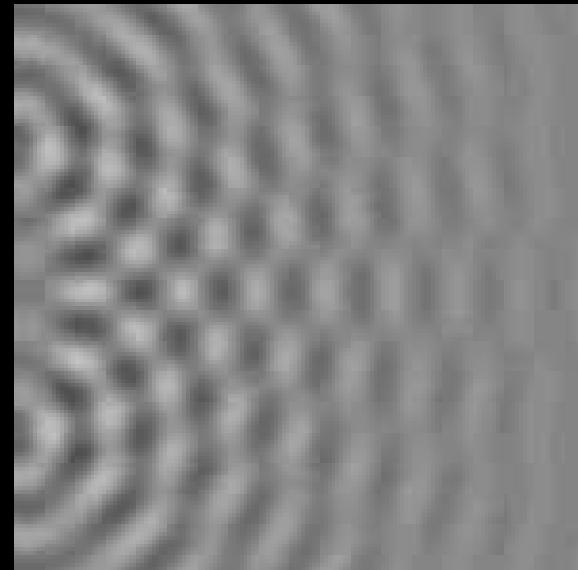
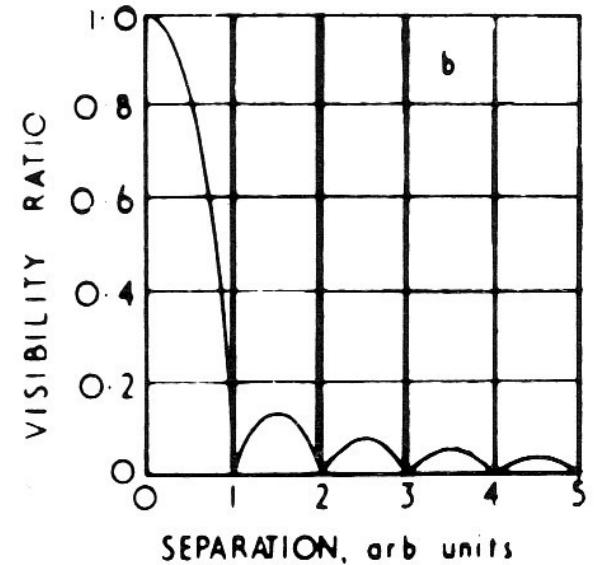
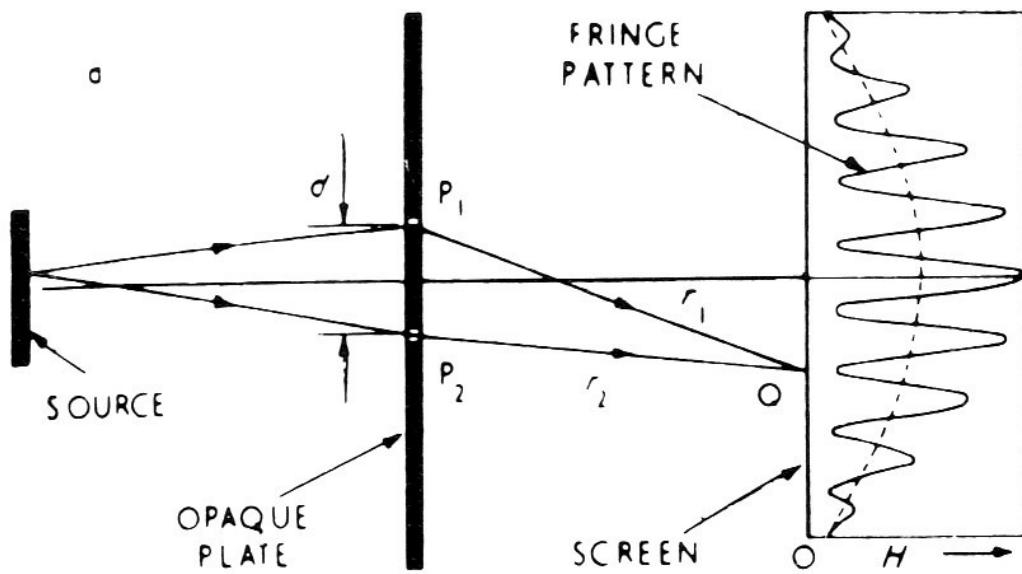
Architectes : Richter et Dahl Rocha Bureau d'architectes SA







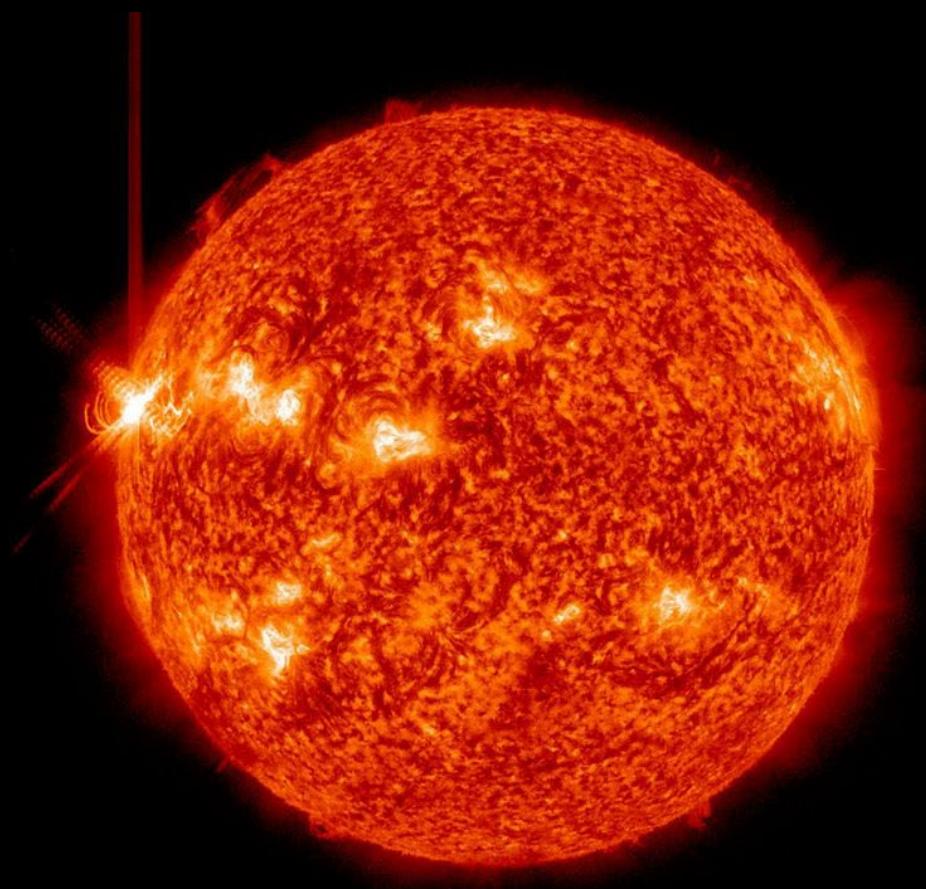
Expérience double fentes de Young (1801)



Interférence
des ondes sur l'eau

Thomas Young







National Gallery
Washington, D. C.
Architect I. M. Pei





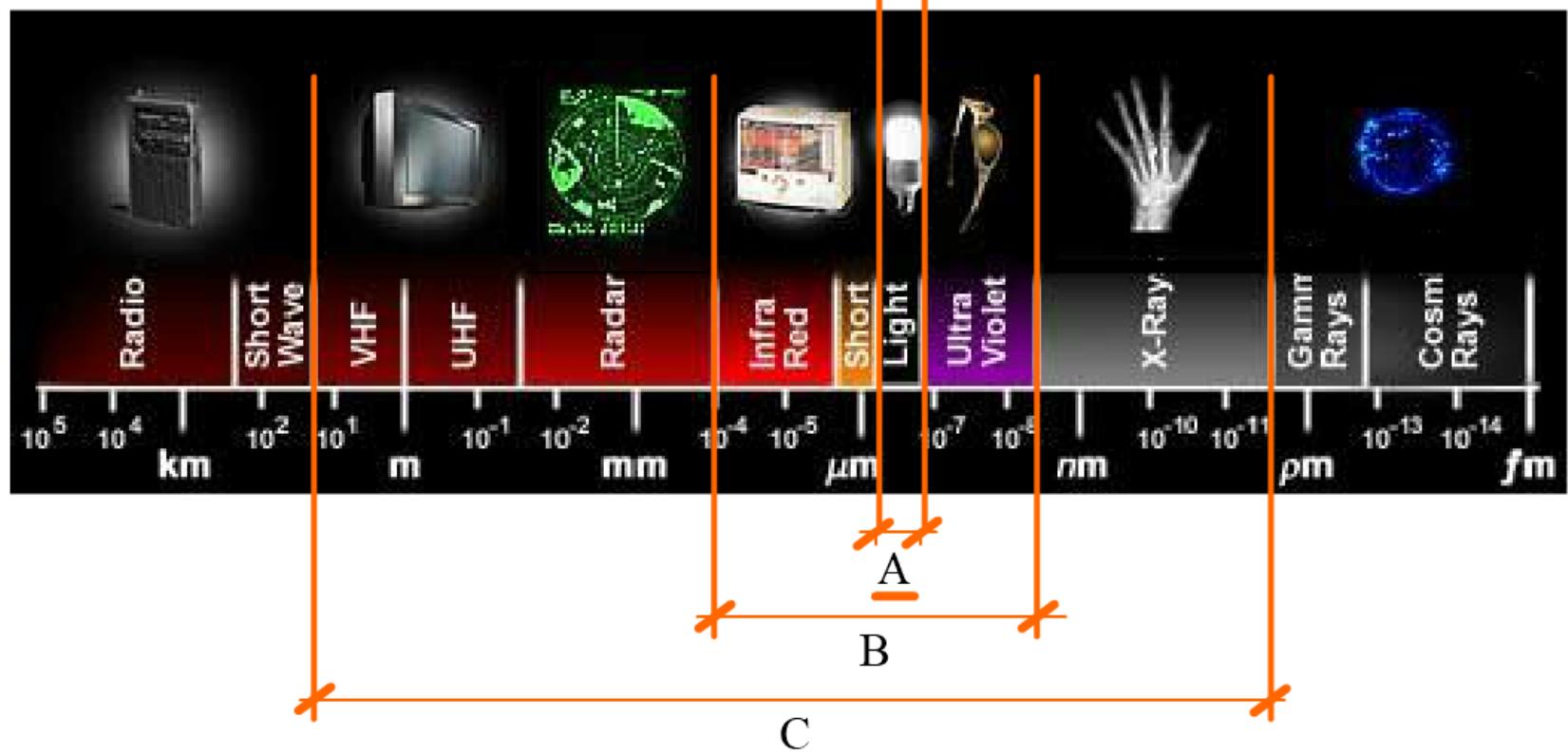
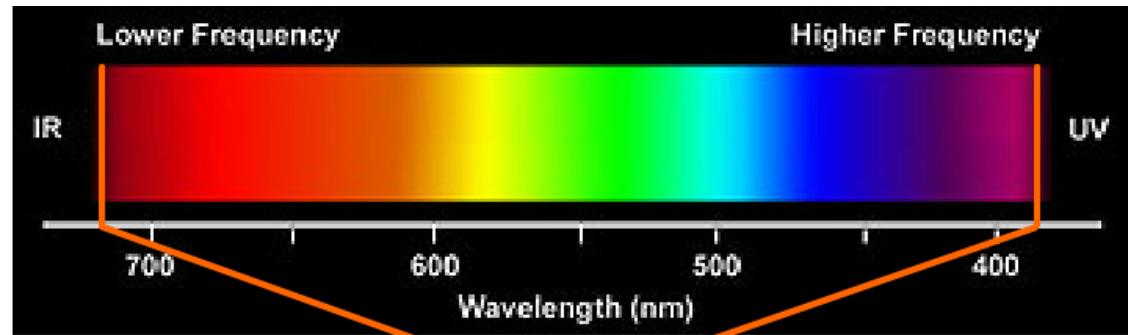
Mount Angel Library
St. Benedict, Oregon
Architect Alvar Aalto

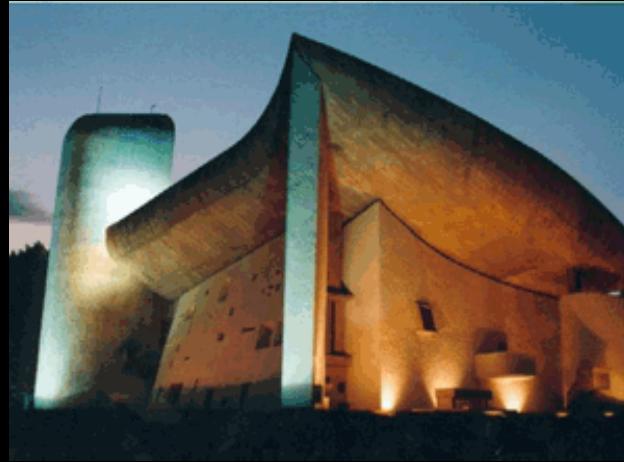




Kimbell Museum
Fort Worth
Architect Louis I. Kahn



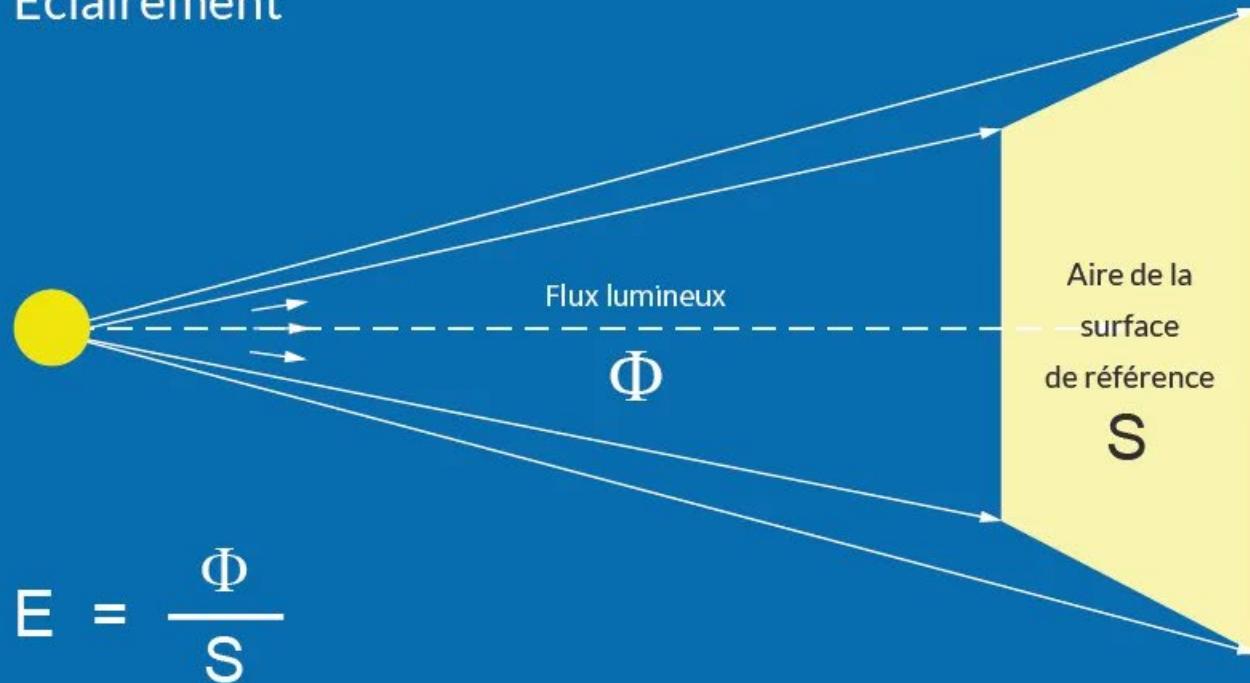


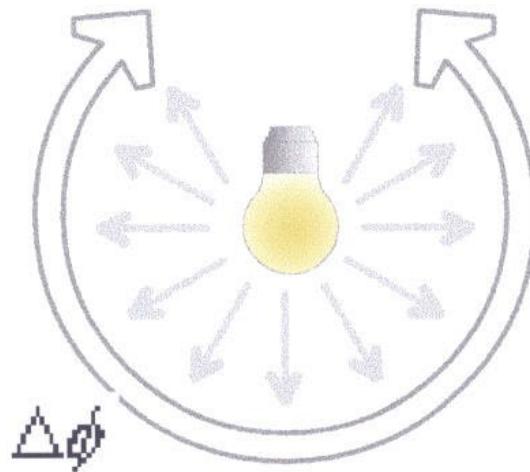


La Chapelle de Ronchamp
Le Corbusier

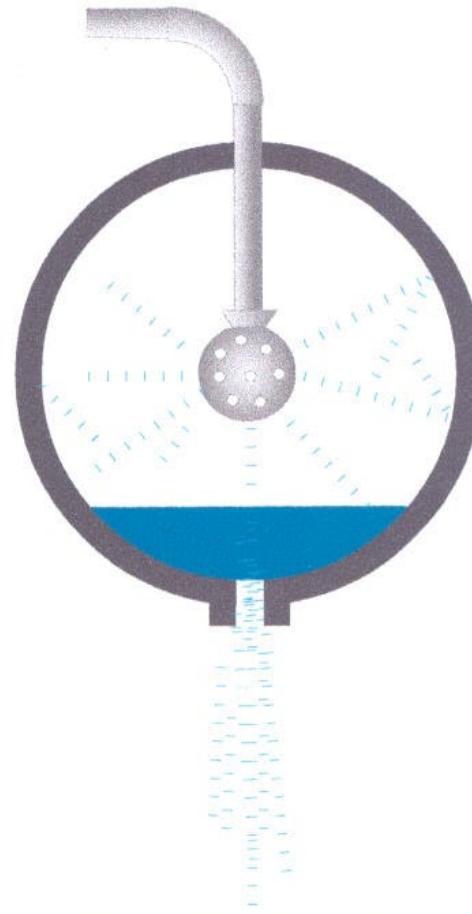


Éclairement

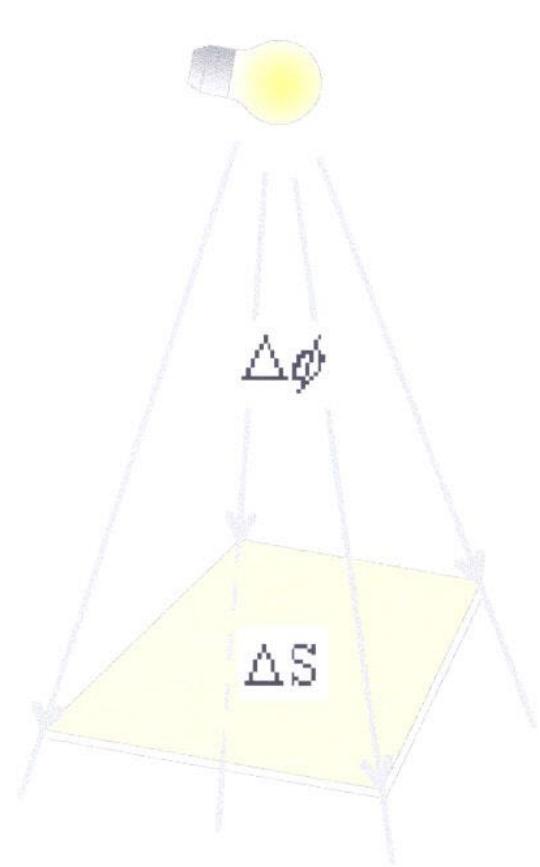




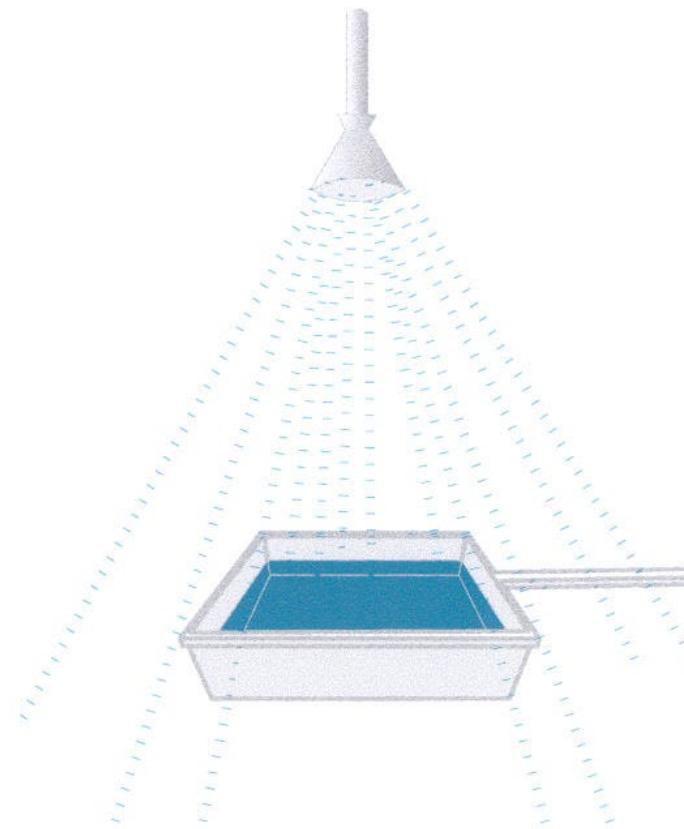
Flux lumineux émis par
une source poncuelle.
(Débit d'énergie)



(Analogie hydraulique).



Eclairage lumineux
d'une surface plane.



(Analogie hydraulique).

Cellules solaires (PV)



Toiture solaire



Tuiles photovoltaïques

Rénovation Chalet G. Dietler, Grimentz

107 m², tuiles PV Freesun, Morges



Façades PV







Modules translucides





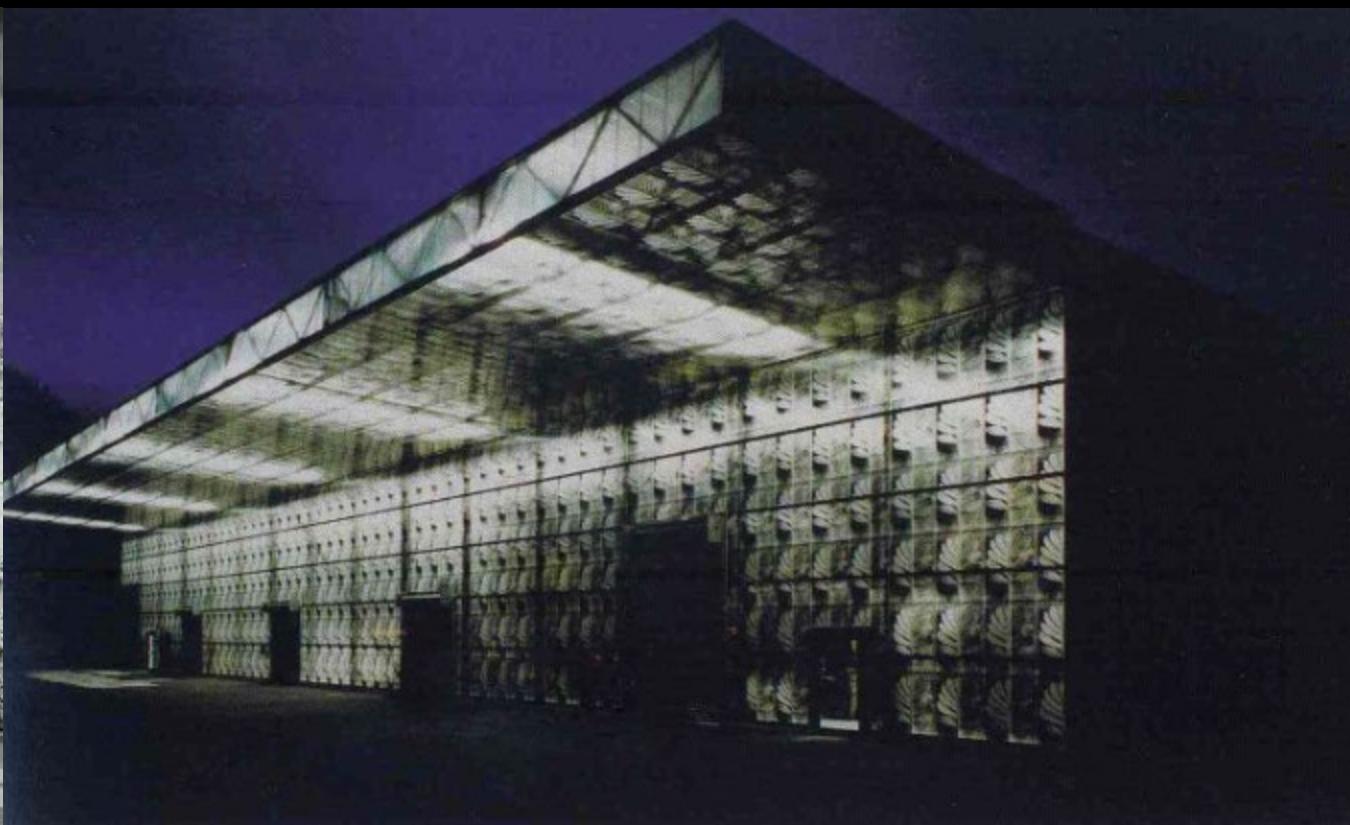
Centrale PV « ESOPP » @ EPFL

selon projet: 20'000 m², 2 MW peak



Partenaire: Romande Energie

Ricola Europe Factory and Storage Building, Mulhouse, France, 1992-93





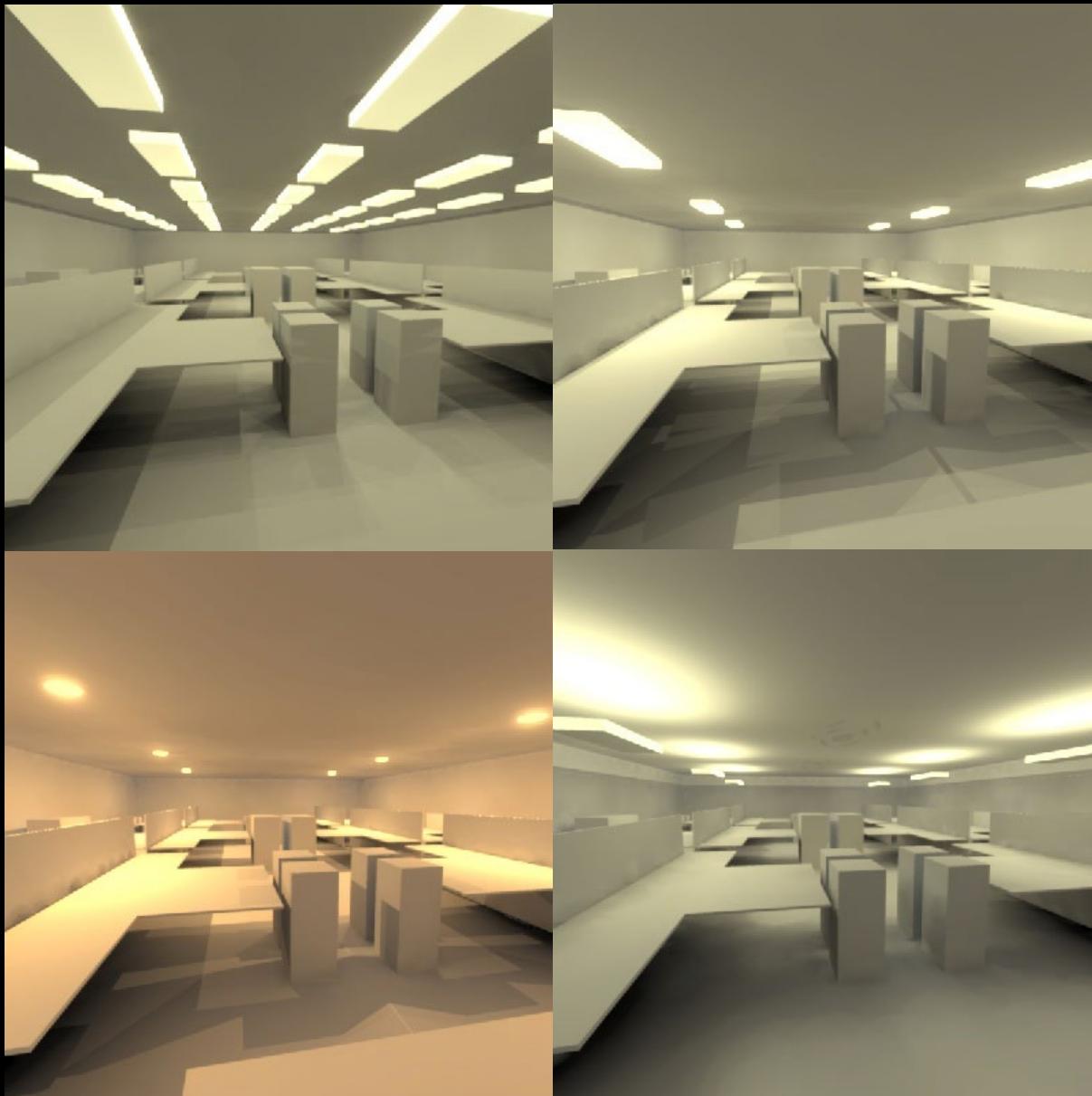
Indoor lighting design



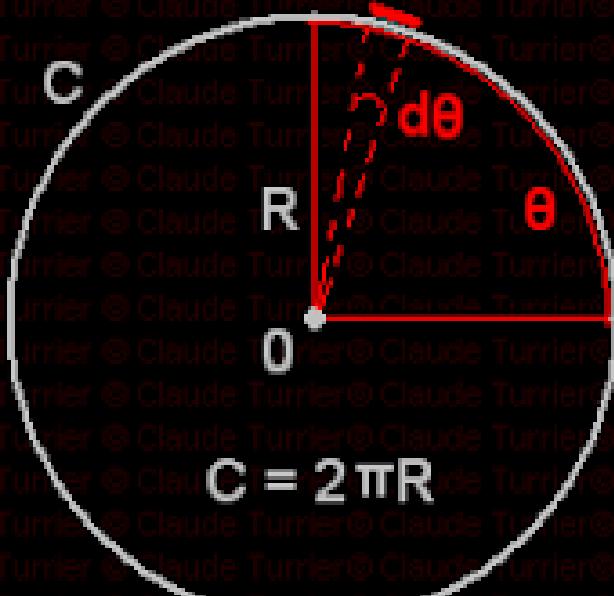
**Kossiakoff Center
John Hopkins Applied Physics Lab
Columbia**



Lighting design of office spaces

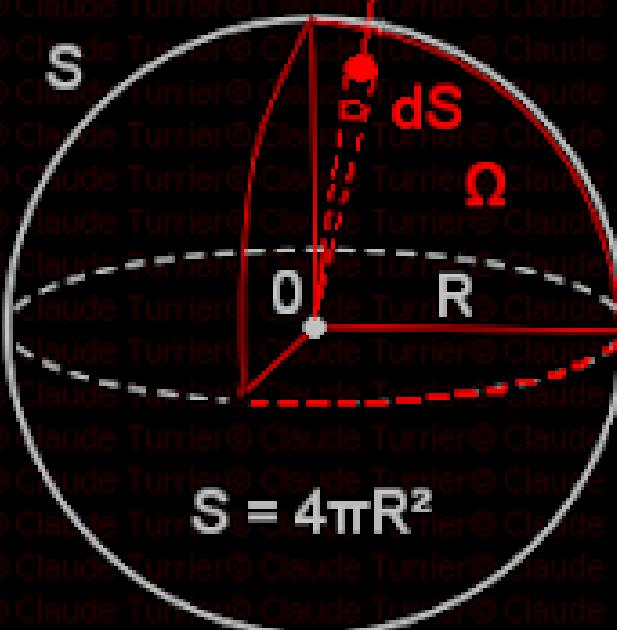


$$d\theta = \frac{dL}{R}$$



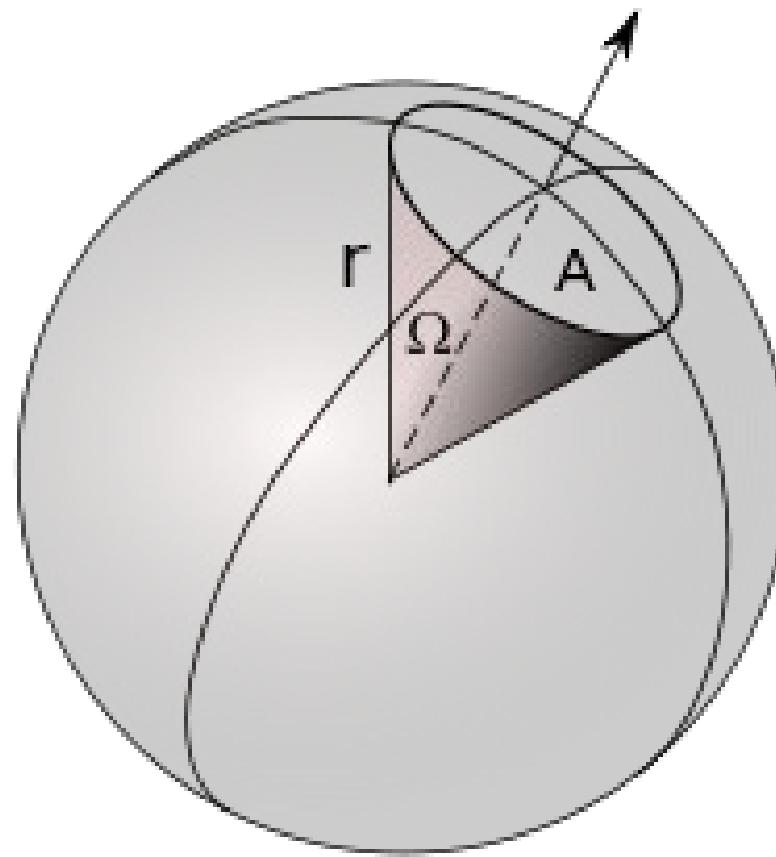
$$C = 2\pi R$$

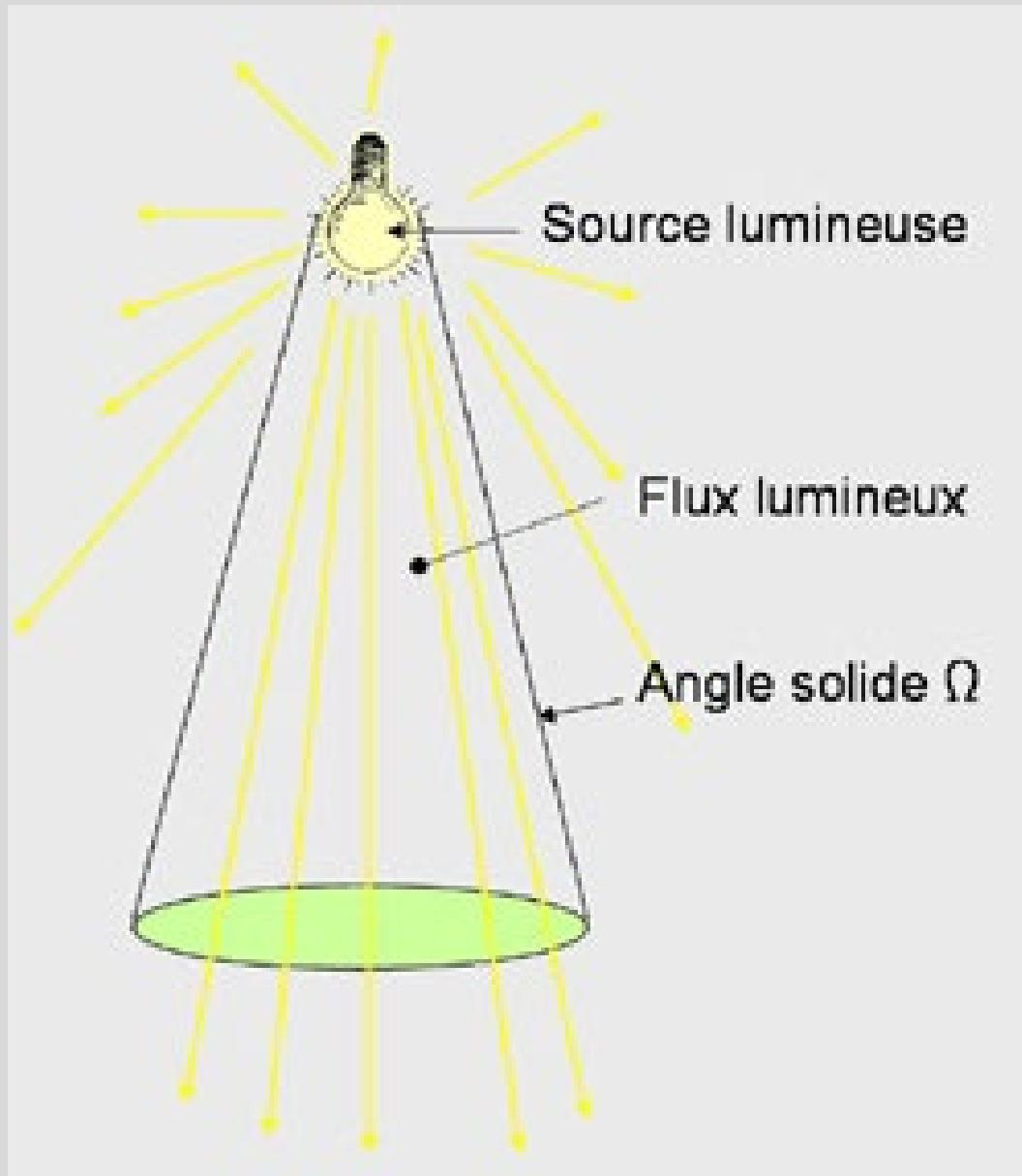
$$d\Omega = \frac{dS}{R^2}$$

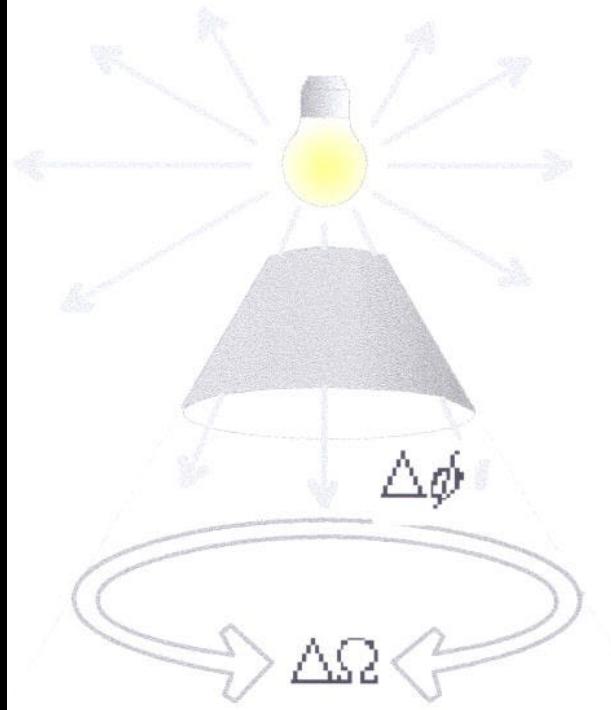


$$S = 4\pi R^2$$

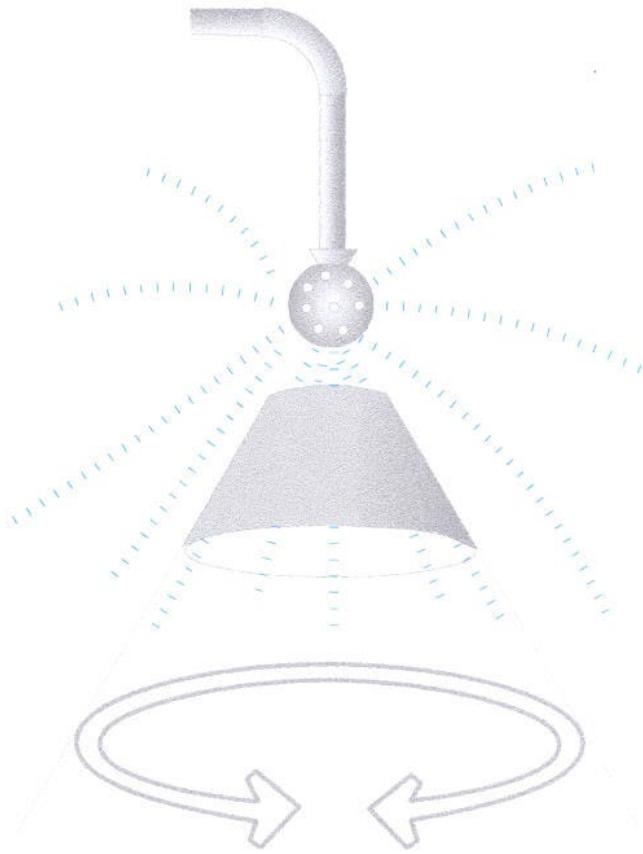
L'angle solide







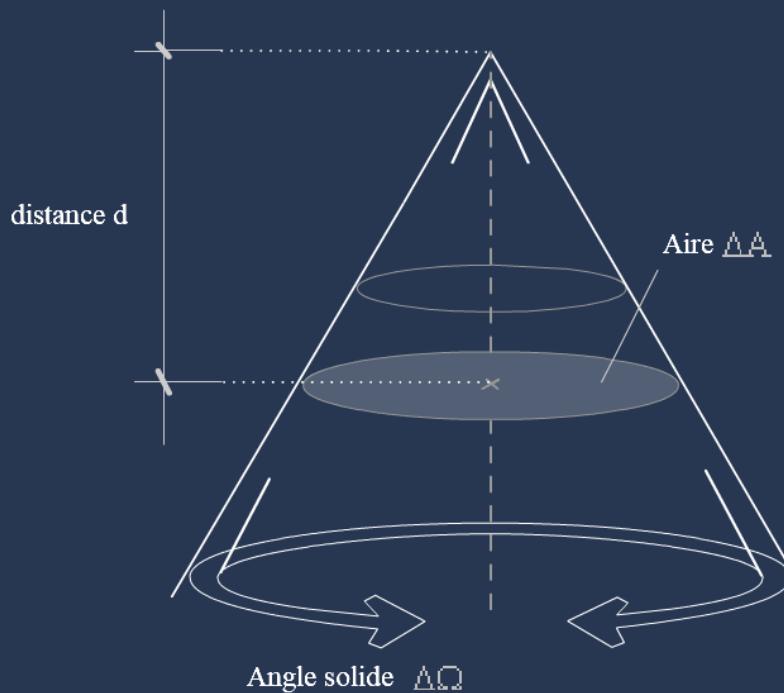
Intensité lumineuse
d'une source ponctuelle
dans une direction donnée.



(Analogie hydraulique).

Quelques notions de géométrie

Relation liant intensité et éclairement (énergétiques ou lumineux)



$$\Delta A = \Delta\Omega \cdot d^2$$
$$\Delta\Omega = \frac{\Delta A}{d^2}$$

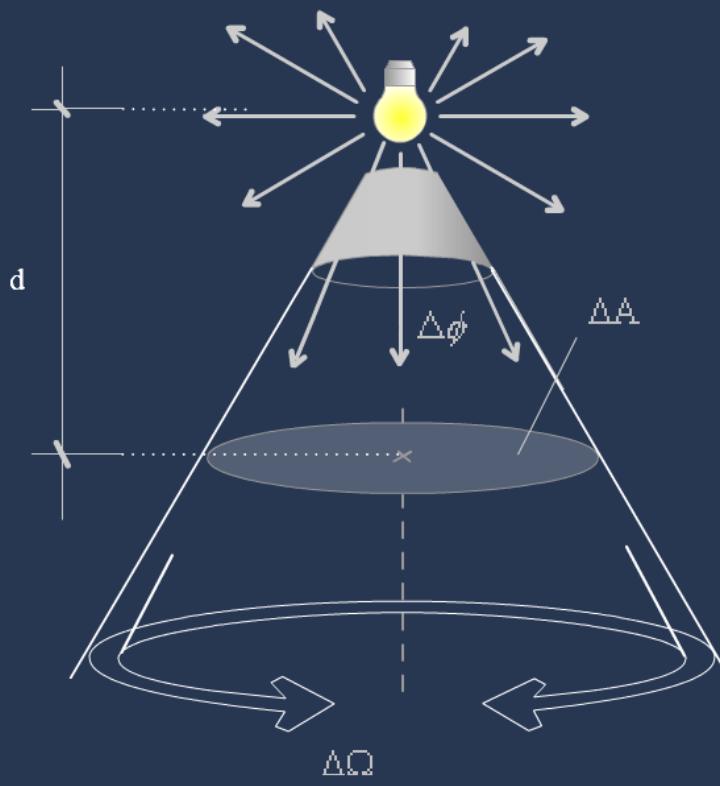
Unité de l'angle solide : steradian [sr]
(Voir précisions sur cette unité)

Generalisé à d'autres surfaces homothétiques :

$$\Delta\Omega = \frac{\Delta A_1}{d_1^2} = \frac{\Delta A_2}{d_2^2} = \dots = \frac{\Delta A_n}{d_n^2}$$

Quelques notions de géométrie

Relation liant intensité et éclairement (énergétiques ou lumineux)



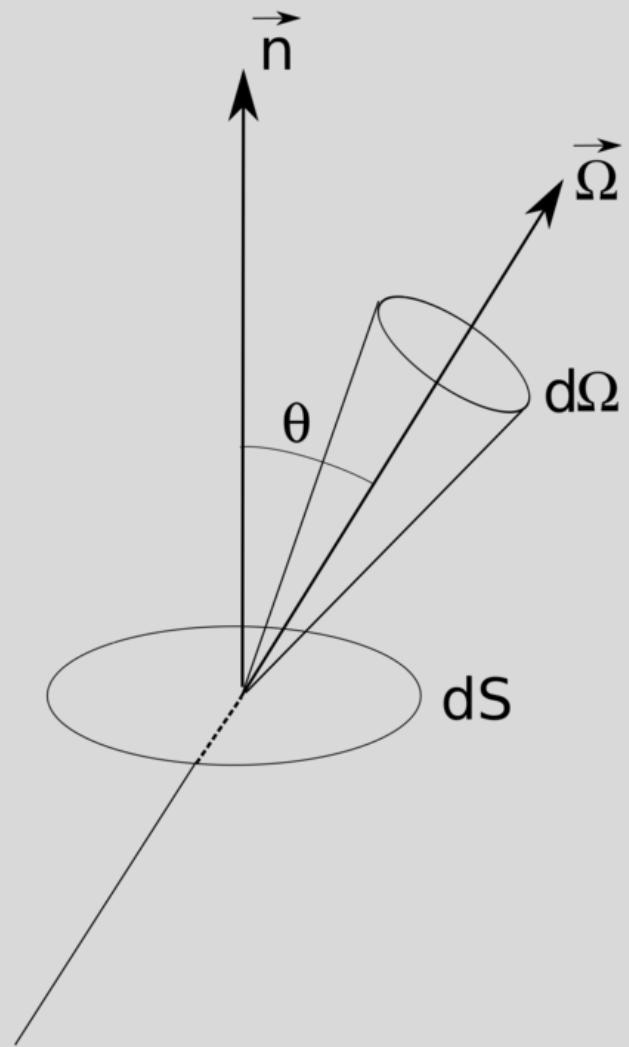
L'éclairement d'une surface ΔA par un source ponctuelle s'écrit :

$$E = \frac{\Delta\phi}{\Delta A} = \frac{\Delta\phi}{\Delta\Omega \cdot d^2} = \frac{I}{d^2} \quad (\text{Flux d'incidence perpendiculaire})$$

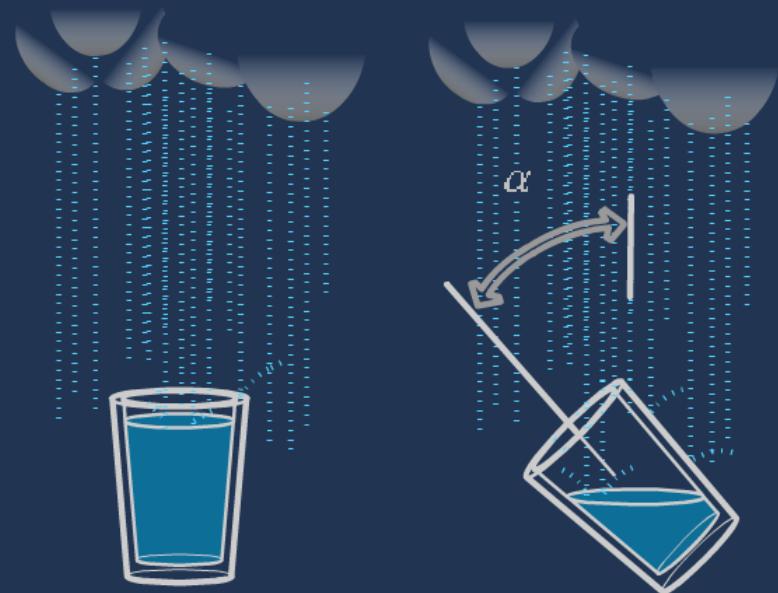
(Généraliser)

En appliquant le principe de la conservation du flux :

$$\left. \begin{array}{l} E_1 = \frac{I}{d_1^2} \\ E_2 = \frac{I}{d_2^2} \\ \dots \\ E_n = \frac{I}{d_n^2} \end{array} \right\} \quad I = E_1 \cdot d_1^2 = E_2 \cdot d_2^2 = \dots = E_n \cdot d_n^2$$



~ Eclairage (énergétique ou lumineux) d'une surface plane pour un angle d'incidence quelconque :



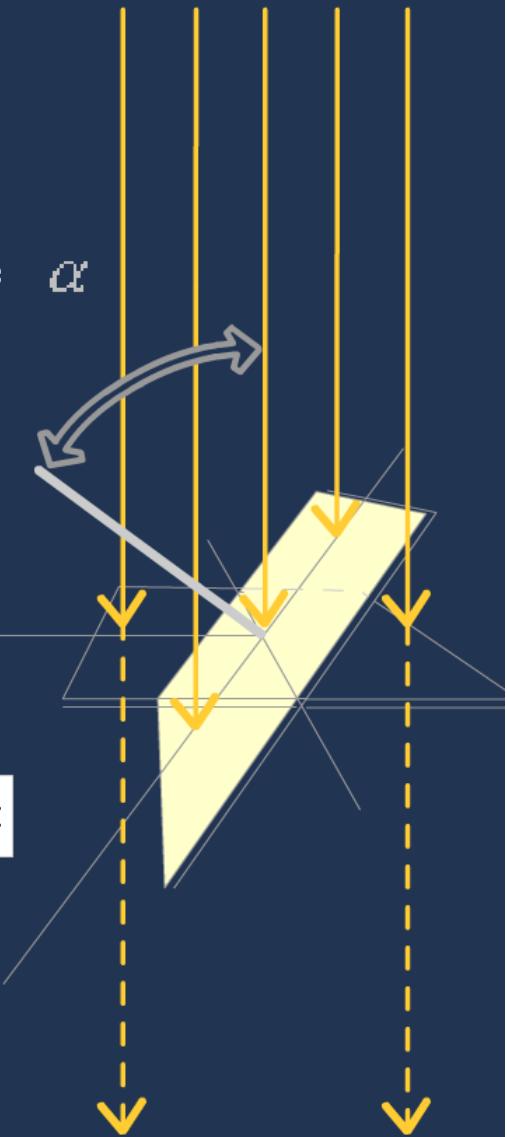
Rayons parallèles provenant d'une source distante

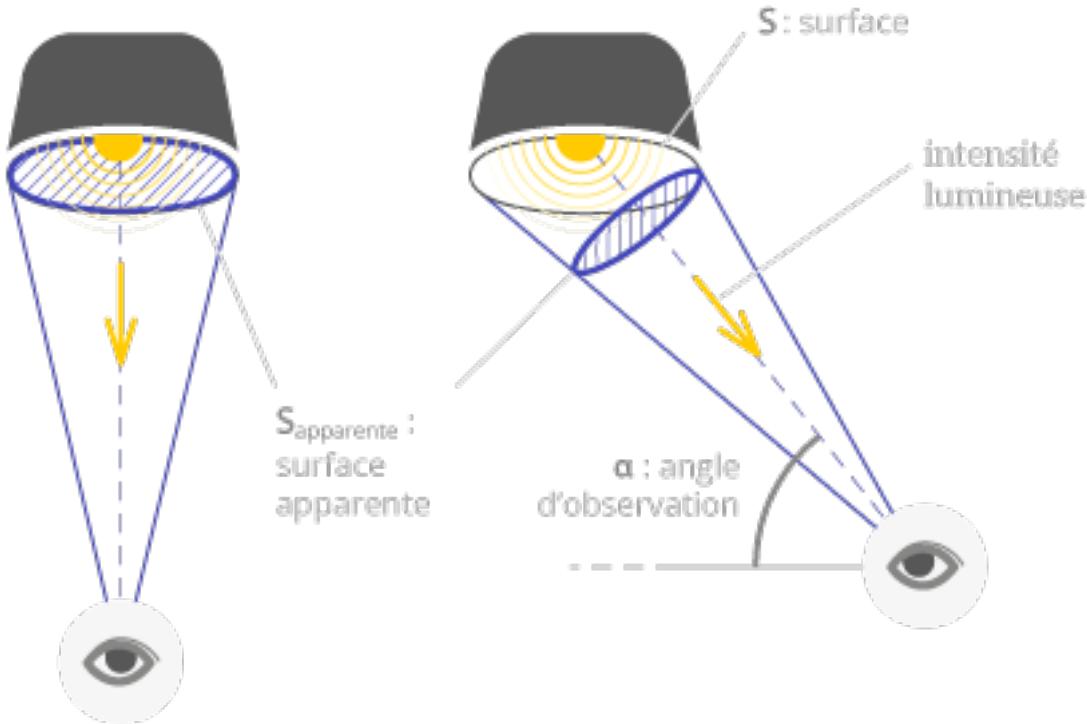
Angle d'incidence α

$$E_{\perp} = \frac{\Delta\phi}{\Delta S}$$

$$E_{\alpha} = E_{\perp} \cdot \cos \alpha$$

Retour





luminaire vu de côté :
la surface apparente diminue,
et généralement le flux dans
cette direction aussi.

