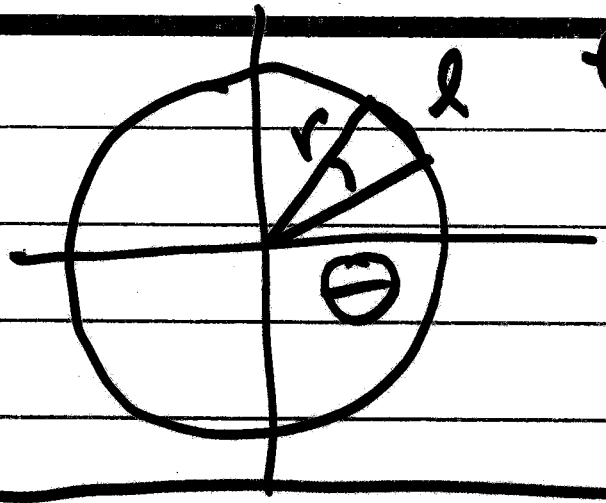
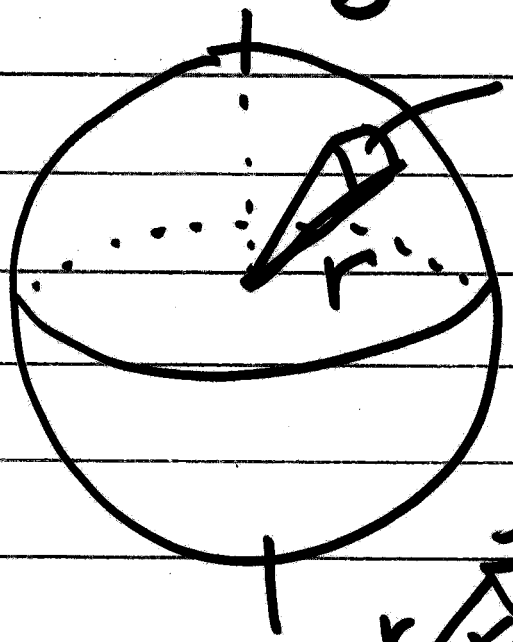


$\theta = \frac{l}{r}$ radians

$\theta : \frac{\pi d}{r} : \frac{\pi 2r}{r} : 2\pi$

solid angle : steradian



$\omega = \frac{\text{area}}{r^2}$ (Ω)

total solid angle

$\frac{4\pi r^2}{r^2} = 4\pi$

$\frac{l_1}{r} \cdot \frac{l_2}{r} = \frac{\text{area}}{r^2}$

Radiometry

Q: energy joules

Φ: power, energy/time Q/t dQ/dt

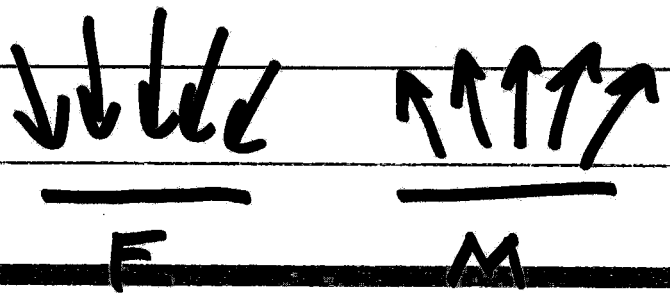
watt: joule/second

E: irradiance: power per unit area $\frac{\text{Watts}}{m^2}$

Φ/A

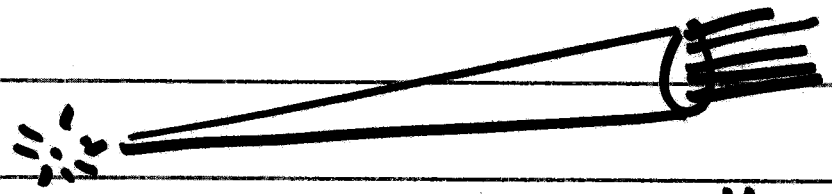
M: exitance: power per unit area $\frac{\text{Watts}}{m^2}$

Φ/A



E M

I: intensity ☼ power from point source per unit solid angle

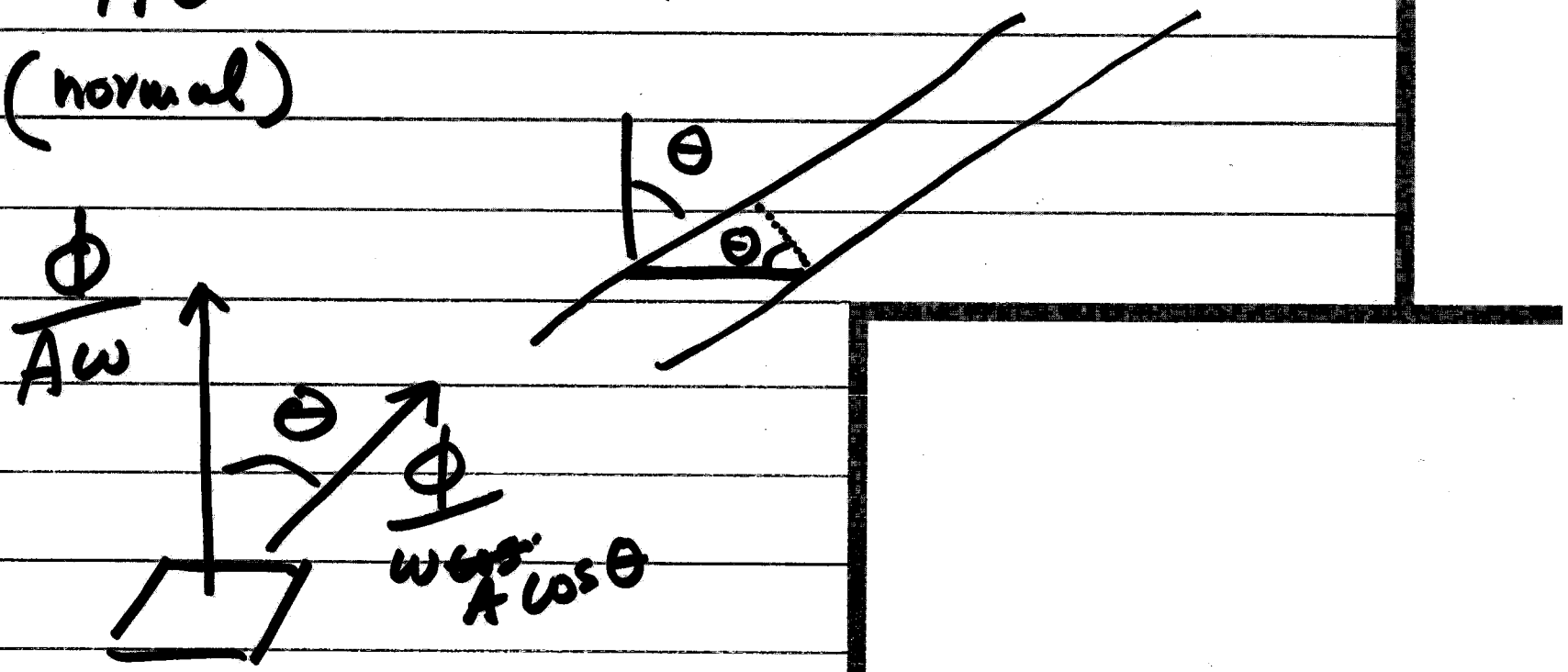


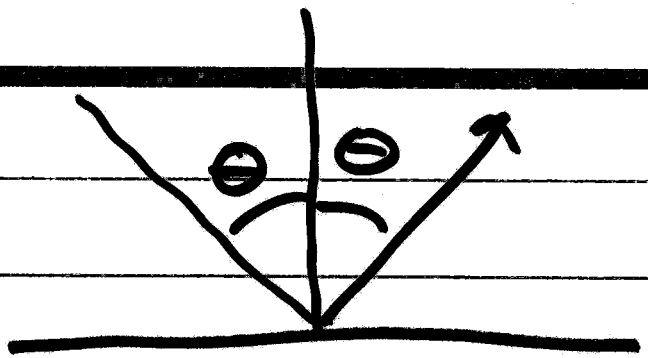
Φ/ω watts/sr

L : radiance power per unit solid angle per <u>unit projected area</u>

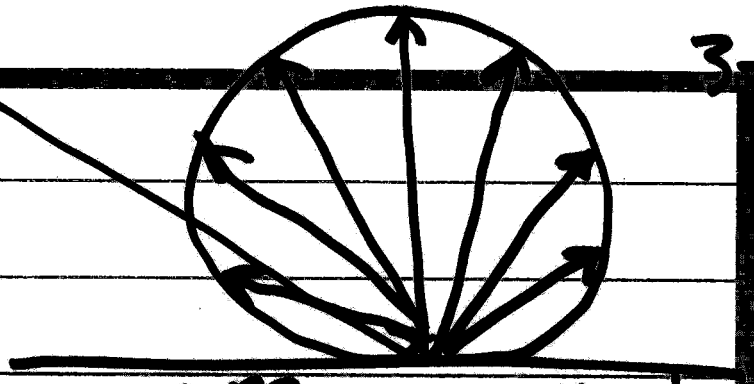
$\frac{\Phi}{A\omega}$: $\frac{\Phi}{\omega A \cos\theta}$ watts / m^2 sr

($\frac{\Phi}{A\omega}$ (normal))



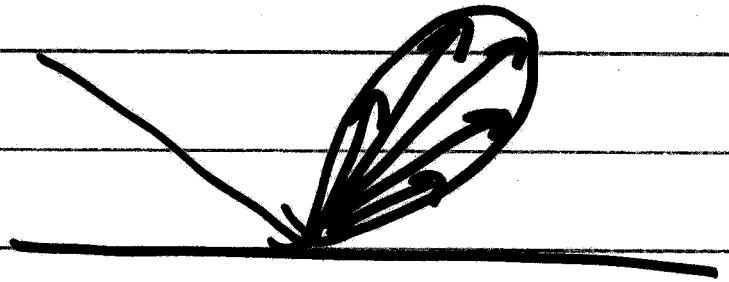


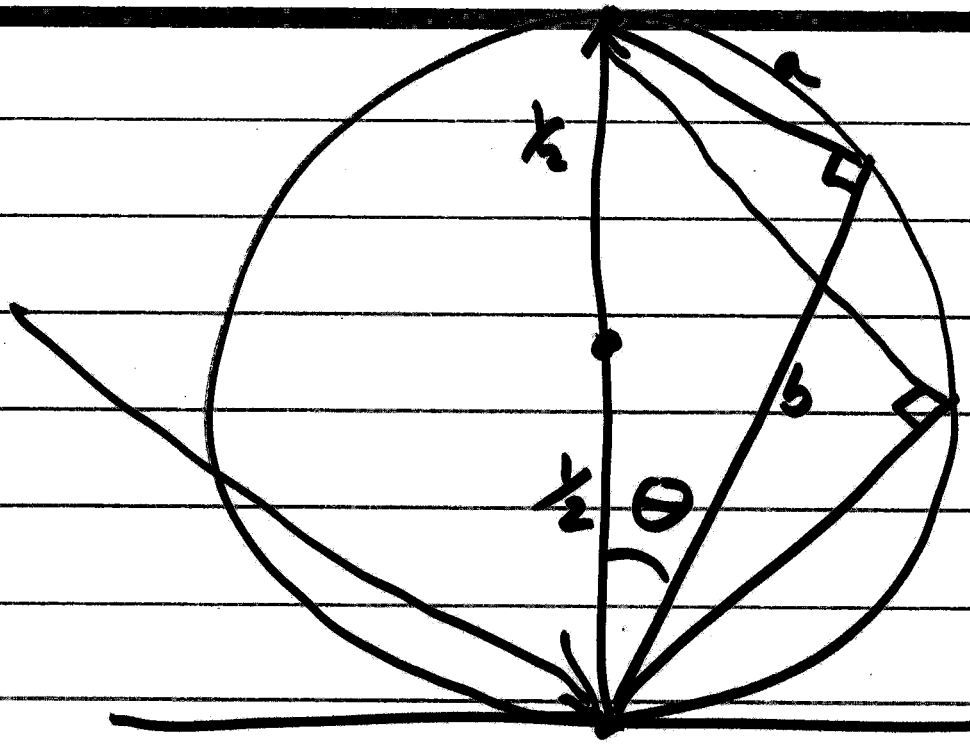
Specular reflection
(mirror)



diffuse scattering

Lambertian scattering





$I_\perp = 1$

$b/1 = \cos\theta$

$I_\theta = \cos\theta$

$$\boxed{I_\theta = I_\perp \cdot \cos\theta}$$

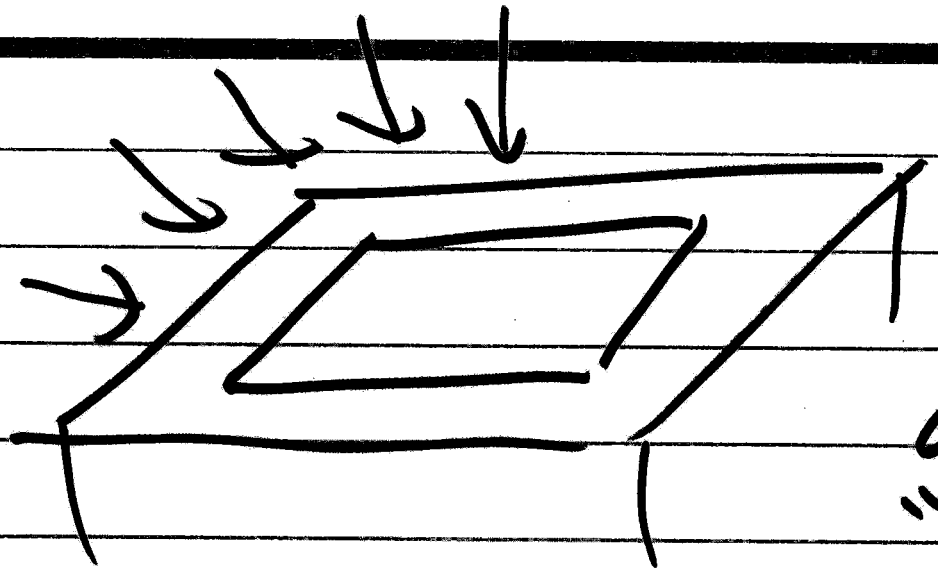
Lambert's Law

Radiance :

$$L : \frac{\Phi}{\omega A \cos\theta} : \frac{I}{A\cos\theta}$$

assume Lambertian

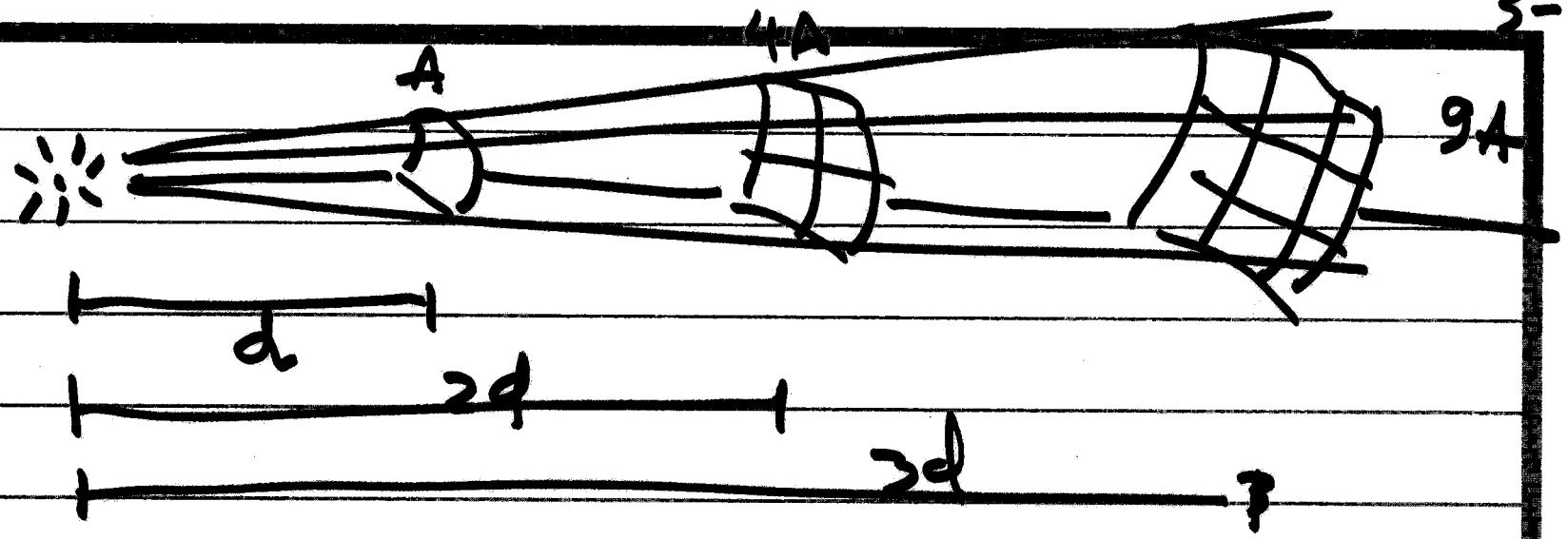
$$\frac{I_\perp \cos\theta}{A\cos\theta} \qquad \boxed{L = \frac{I_\perp}{A}}$$



apparent constant "brightness"

constant radiance independent of view angle

radiance



$$\text{Intensity} = \frac{\Phi}{\omega} = \frac{\text{total}}{4\pi}$$

$$I = \frac{\Phi}{\omega}$$