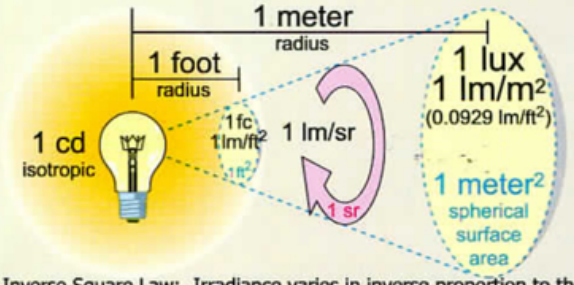
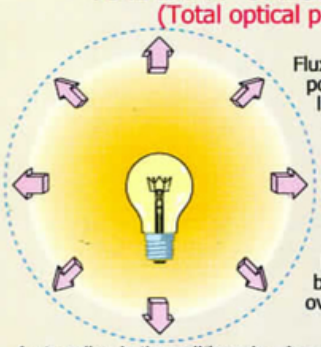
IRRADIANCE & ILLUMINANCE
(Flux per unit area, or flux density)



Inverse Square Law: Irradiance varies in inverse proportion to the square of the distance. $E=I/d^2$. If you measure 16 lm/m² at 1 meter from a point source, you will measure 4 lm/m² at 2 m, etc. Point source approx.(±1%): [distance : lamp diameter] > [5 : 1].

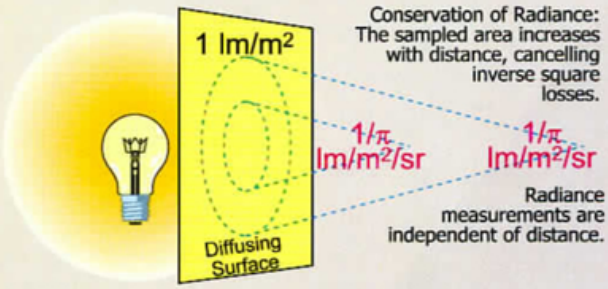
RADIANT & LUMINOUS FLUX
(Total optical power, or flux)



Flux is the basic unit of optical power, expressed in watts or lumens. An integrating sphere is often used to collect the ligh emitted in all directions (4π sr). Light in a narrow collimated beam can be measured directly with a planar receiver, provided the source underfills the receiver. Dose energy can be measured by integrating the optical power over time.

A steradian is the solid angle whose projected spherical surface area is equal to the square of its radius A sphere contains 4π sr

RADIANCE & LUMINANCE
(Flux density per unit solid angle)

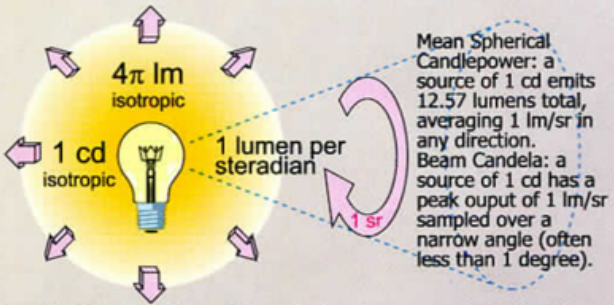


Conservation of Radiance: The sampled area increases with distance, cancelling inverse square losses.

Radiance measurements are independent of distance.

1 lux (1 lm/m²) of illuminance on a perfectly diffusing surface produces 1 apostilb (1/π lm/m²/sr) of luminance. Similarly, 1 foot-candle (1 lm/ft²) will result in 1 foot-lambert (1/π lm/ft²/sr).

RADIANT & LUMINOUS INTENSITY
(Flux per unit solid angle)



Mean Spherical Candlepower: a source of 1 cd emits 12.57 lumens total, averaging 1 lm/sr in any direction. Beam Candela: a source of 1 cd has a peak ouput of 1 lm/sr sampled over a narrow angle (often less than 1 degree).

1 cd (MSC) = 1 cd (Beam) for an isotropic source. A 1 cd (MSC) laser beam may have 1,000,000 cd (Beam) output.

POWER
watt (W)
lumen (lm)

ENERGY
joule (J)
lm sec

INTENSITY
watt/steradian (W/sr)
lumen/steradian (lm/sr
candela (cd)

IRRADIANCE
W/cm²
lm/m² (lux)
foot-candles (fc)

RADIANCE
W/cm²/sr
lm/m²/sr
candela/m² (cd/m²)
lamberts (L)
foot-lamberts (fL)