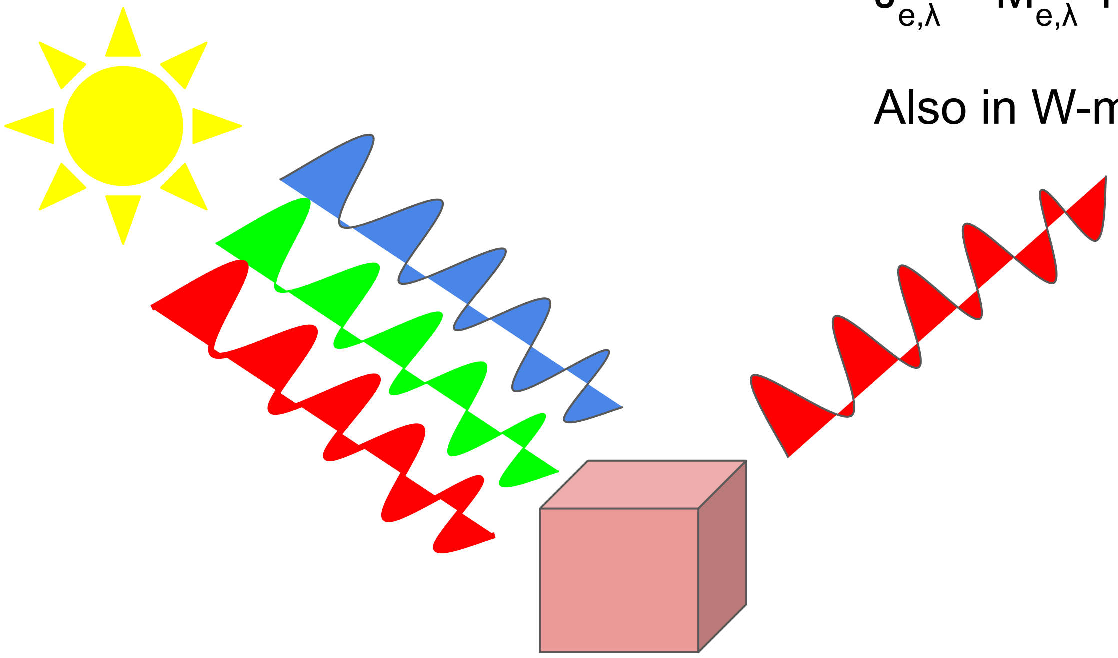
Color Signal and Spectrometry

Light Source
Spectral Exitance
$M_{e,\lambda}$ in $W\text{-}m^{-2}\text{-}nm^{-1}$
("Emittance")

Color Signal or
Spectral Radiosity
$J_{e,\lambda} = M_{e,\lambda} \, R_{\lambda}$

Also in $W\text{-}m^{-2}\text{-}nm^{-1}$



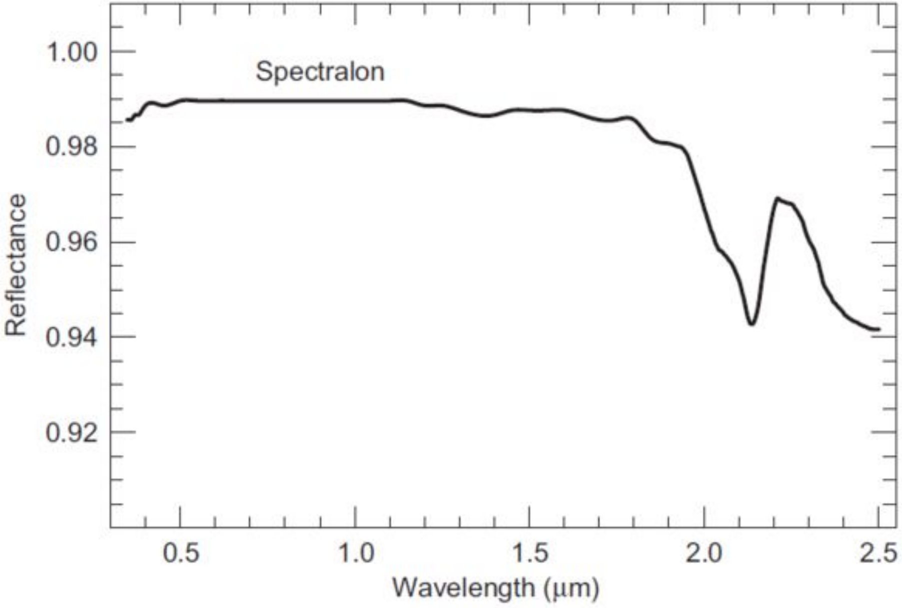
Object
Spectral Reflectance R_{λ} in % or (0 to 1)

Thus, to get Reflectance

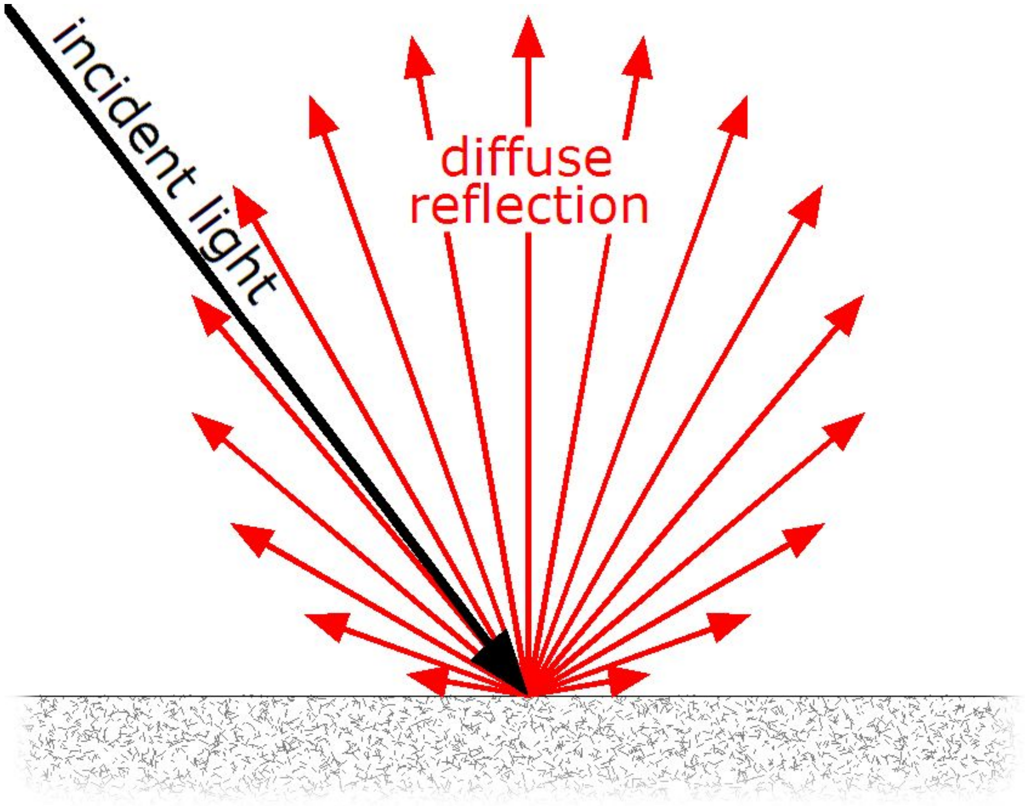
$$R_\lambda = \frac{J_{e,\lambda}}{M_{e,\lambda}}$$

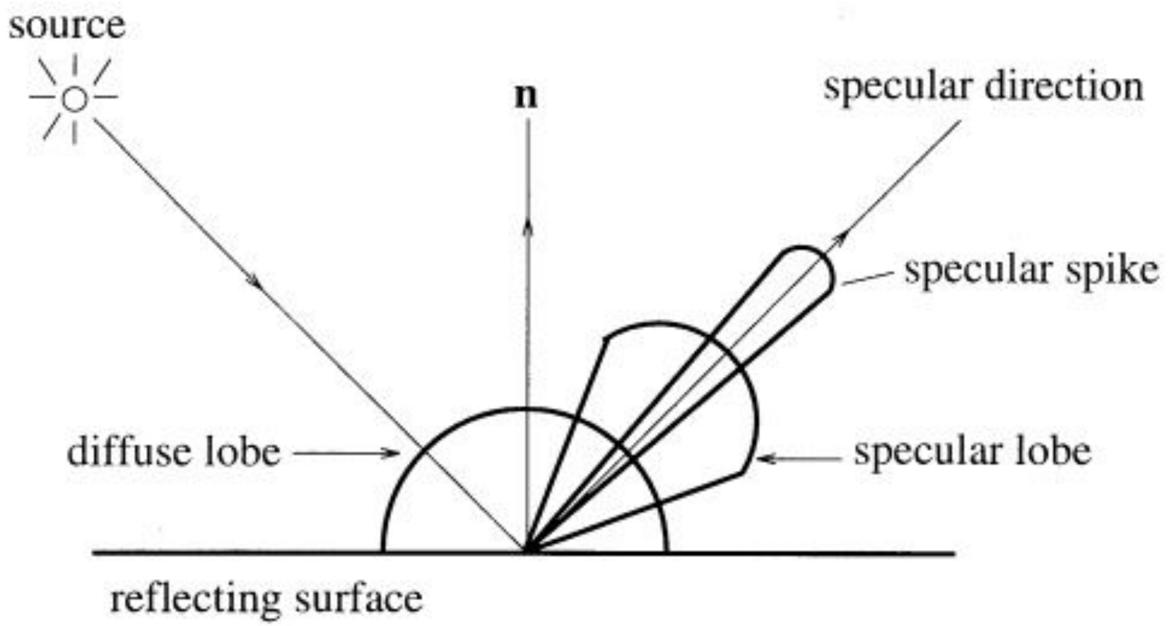
Spectrometers can automatically do this calculation.
But first you have to measure emittance and dark current.

Pointing the spectrometer straight to the light source can saturate its sensor. Instead a white reference is used.

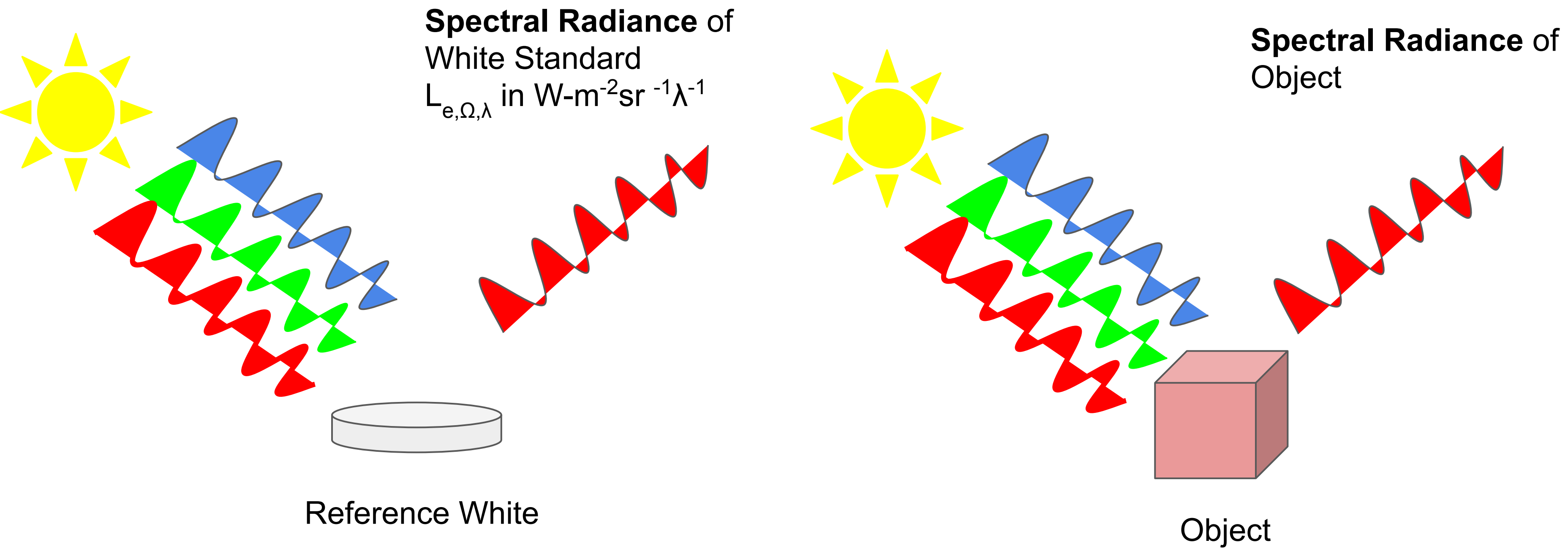


Lambertian Surface - Ideal matte surface




source
n
specular direction
specular spike
diffuse lobe
specular lobe
reflecting surface

To get reflectance using a white reference standard

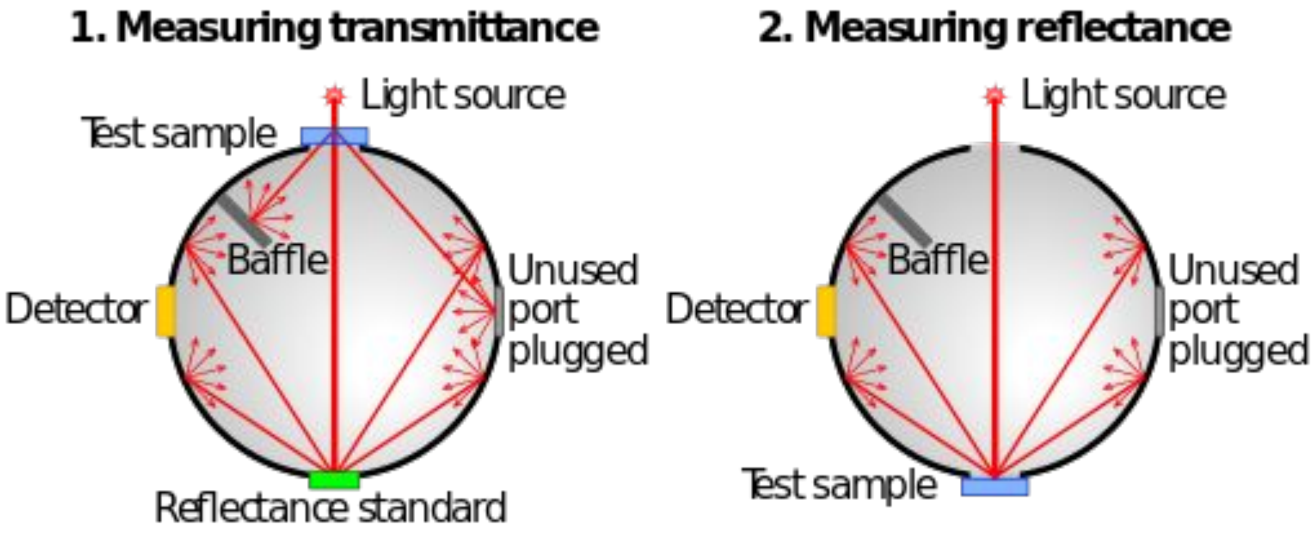


NOTE: Spectral Radiance is a DIRECTIONAL quantity.

To get reflectance of object

$$R_\lambda = \frac{L(object)_{e,\Omega,\lambda}}{L(white)_{e,\Omega,\lambda}}$$

Use of Integrating Sphere for Spectrometry



- Instead of **integrating sphere** you will use your **lightbox.**
- Instead of a **spectralon reference** you will use several layers of **white matte paper**.
- To remove directional dependence, **fix the optical fiber on a holder**.