

Exercise on light scattering

Exercise for week 8

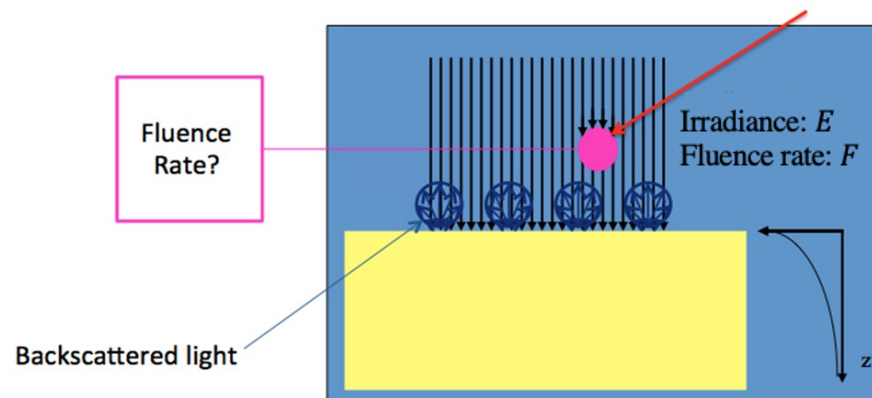
A thick (thickness $\gg \mu_{\text{eff}}^{-1}$) absorbing and scattering sample, indicated in yellow below, is illuminated at 660 nm by a collimated and 'broad' (spot diameter $\gg \mu_{\text{eff}}^{-1}$) light beam directed perpendicularly to the interface (let's consider a matching of the refractive indexes) with an unknown irradiance. A «small» and calibrated isotropic detector, which measures the fluence rate, is placed in the beam just above the solution (Neglect the shadow produced by the detector). A fraction of the light is backscattered and re-emitted by the tissue surface with a Lambertian profile.

The optical properties of the tissue at 660 nm are: $\mu_a = 0.001 \text{ mm}^{-1}$, $\mu_s = 10 \text{ mm}^{-1}$, $g = 0.9$, $k = 7.95$, $R = 93 \%$.

Q1: Knowing that the fluence rate (F) = 250 mW/cm² at a depth of 3 mm, what is the fluence rate measured by the detector outside the tissue in the light beam.

Q2: What is the depth inside the tissue at which the fluence rate F equals the irradiance E ?

Q3: Discuss the evolution of the reflection coefficient R with changes of μ_a , μ_s and n_2 .



Hint !

