3.2 SPECTRAL QUANTITIES

Spectral radiant power is defined as a source's radiant power per wavelength interval as a function of wavelength. In detail, the source's (differential) radiant power $d\phi_e$ emitted in the (differential) wavelength interval between λ and $\lambda + d\lambda$ is given by

$$d\phi_e = \phi_\lambda(\lambda)\, d\lambda$$

This equation can be visualised geometrically (see Fig. 3.2.1). As $d\lambda$ is infinitesimally small, spectral radiant power $\phi_\lambda(\lambda)$ is approximately constant in the interval between λ and $\lambda + d\lambda$.

Thus, the product $\phi_\lambda(\lambda)\, d\lambda$ equals the area under the graph of $\phi_\lambda(\lambda)$ in the interval between $\lambda + d\lambda$.

Thus area describes the contribution of this wavelength interval to the total value of radiant power ϕ_e. It is graphically represented by the total area under the graph of spectral radiant power $\phi_\lambda(\lambda)$.

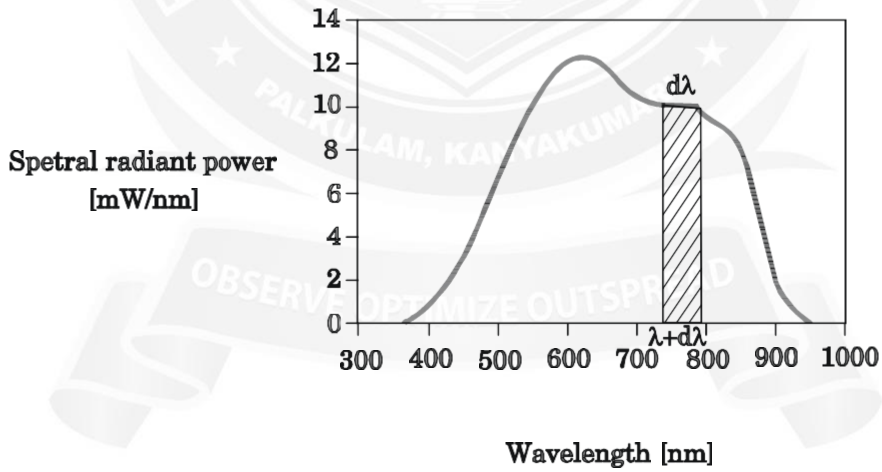

Fig. 3.2.1- Spectral radiant power $\phi_\lambda(\lambda)$ wavelength

Mathematically, this is expressed by the integral

$$\Phi_e = \int_0^\infty \phi_\lambda(\lambda)\,(d\lambda)$$

The unit of spectral radiant power is **W/nm** or **W/Å**.

The other spectral quantities are defined correspondingly and their units are given by the unit of the respective quantity, divided by nm or Å.

Generally, a radiant quantity is calculated from the respective spectral quantity by integration over wavelength from
$\lambda = 0$ to $\lambda = \infty$.

However, this integration is often restricted to a certain wavelength range, which is indicated by the respective prefix. For instance, UVA irradiance is defined as

$$E_{e,\,UVA} = \int_{315\,nm}^{400\,nm} E_{\lambda}(\lambda)\, d\lambda$$

as the UVA range is defined from $\lambda = 315$ nm to $\lambda = 400$ nm.