2.5 Radiant Power Density

辐射功率密度

The total power density emitted from a light source can be calculated by integrating the spectral irradiance over all wavelengths or energies

通过在整个波长或者能量范围上对光谱幅照度积分，我们可以得到光源发出的总的能量密度。

$$H = \int_0^\infty F(\lambda) d\lambda$$

where:

H is the total power density emitted from the light source in W/m^2;

$F(\lambda)$ is the spectral irradiance in units of $W/(m^2 \cdot \mu m)$; and

$d\lambda$ is the wavelength.

公式中，H表示光源发出的总功率密度（单位：瓦每平方米），$F(\lambda)$ 表示光谱幅照度（单位：瓦每平方米每微米），$d\lambda$表示波长差。

However, a closed form equation for the spectral irradiance for a light source often does not exist. Instead the measured spectral irradiance must be multiplied by a wavelength range over which it was measured, and then calculated over all wavelengths. The following equation can be used to calculate the total power density emitted from a light source.

然而，光源的光谱幅照度并没有准确形式的表达式。因此，我们需要把测量得到的光谱幅照度乘以对应的某一波长的测量范围，而后对于所有波长都进行这一计算。下面的公式可以用来计算光源发出的总功率密度。

$$H = \sum_i F(\lambda) \Delta\lambda$$

H is the total power density emitted from the light source in W/m^2;

$F(\lambda)$ is the spectral irradiance in units of $W/(m^2 \cdot \mu m)$; and

$\Delta\lambda$ is the wavelength.

公式中，H表示光源发出的总功率密度（单位：瓦每平方米），$F(\lambda)$ 表示光谱幅照度（单位：瓦每平方米每微米），$\Delta\lambda$表示波长差。

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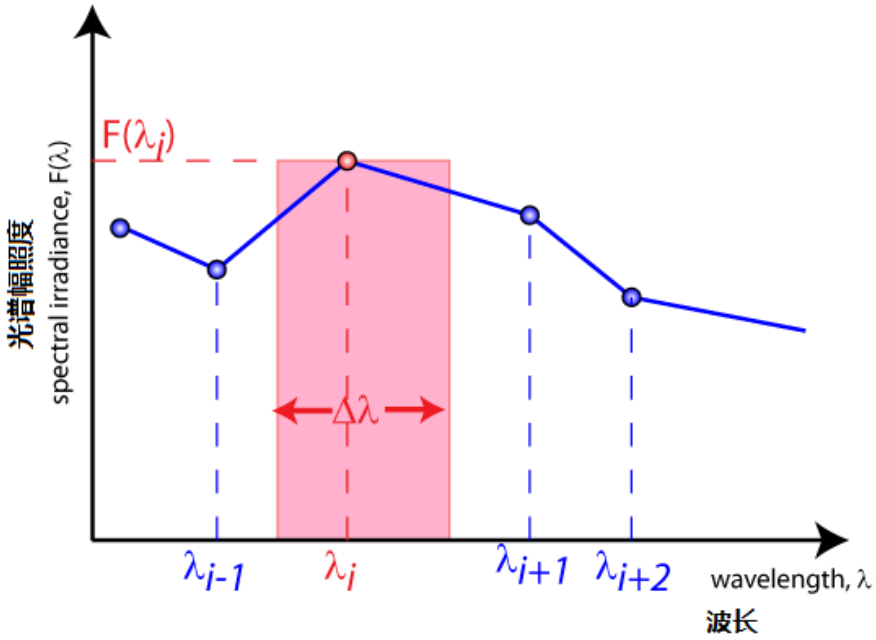

Calculating the total power density from a source requires integrating over the spectrum by calculating the area of each element and then summing them together.

我们需要在整个光谱上计算每一部分的面积，而后求和来计算光源的总功率密度。

Measured spectra are typically not smooth as they contain emission and absorption lines. The wavelength spacing is usually not uniform to allow for more data points in the rapidly changing parts of the spectrum. The spectral width is calculated from the mid-points between two the adjacent wavelengths.

测量所得光谱通常不是平滑的，因为它们包含了发射谱线和吸收谱线。波长的间隔选择通常不是均匀的，这使得我们可以在光谱上一些变化较快的地方获得更多的数据点。某一波长的宽度通过其与相邻的两个的波长的中点计算。

$$\Delta\lambda = \frac{\lambda_{i+1} + \lambda_i}{2} - \frac{\lambda_i + \lambda_{i-1}}{2} = \frac{\lambda_{i+1} - \lambda_{i-1}}{2}$$

Power in each segment is then:

$$H_i = \Delta\lambda \cdot F(\lambda_i)$$

Summing all the segments gives the total power H as in the equation above.

每一段的功率可以表示为：

$$H_i = \Delta\lambda \cdot F(\lambda_i)$$

把每一段的功率加起来就可以得到上述计算总功率H的公式了。

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