Spectral Irradiance

光谱辐照度

The spectral irradiance as a function of photon wavelength (or energy), denoted by F, is the most common way of characterising a light source. It gives the power density at a particular wavelength. The units of spectral irradiance are in W·m^-2·µm^-1. The W·m-2 term is the power density at the wavelength λ (µm). Therefore, the m^-2 refers to the surface area of the light emitter and the µm^-1 refers to the wavelength of interest.

光谱辐照度是光子波长（或能量）的函数，通常用F表示，它是最常用的描述光的特征的方法，给出了特定波长所对应的功率密度。光谱辐照度的单位是瓦每平方米每微米。瓦每平方米是对应某一波长λ（单位：微米）的功率密度。因此，每平方米表示的是光辐射源的表面积，每微米表示的是所要研究的波长。

In the analysis of solar cells, the photon flux is often needed as well as the spectral irradiance. The spectral irradiance can be determined from the photon flux by converting the photon flux at a given wavelength to W/m2 as shown in the section on Photon Flux. The result is then divided by the given wavelength, as shown in the equation below.

对太阳能电池的分析既需要光子通量，也需要光谱幅照度。我们可以先将光子通量的值转化为能量密度来确定光谱幅照度，具体计算过程在“光子通量”一节中已提及。所得能量密度除以给定的波长即为光谱幅照度，计算过程如下所示。

$$F(\lambda) = \Phi E \frac{1}{\Delta\lambda} \text{ in SI units}$$

where in SI units:

$F(\lambda)$ is the spectral irradiance in $W \cdot m^{-2} \cdot m^{-1}$

Φ is the photon flux in $(\#\text{ photons}) \cdot m^{-2} sec^{-1}$

E and λ are the energy and wavelength of the photon in joules and meters respectively; and

$$\text{光谱幅照度} = \Phi E \frac{1}{\text{波长范围}} \text{ 适用于国际单位制}$$

在国际单位制中，光谱幅照度$F(\lambda)$的单位为瓦每平方米每米，光子通量Φ的单位为光子数每平方米每秒。E和λ分别表示光子的能量和波长，其单位分别为焦耳和米。

原文地址：http://www.pveducation.org/pvcdrom/properties-of-sunlight/spectral-irradiance
PDF 版本下载地址：https://dl.dropboxusercontent.com/u/52743103/PVCDROM/2.4%20Spectral%20Irradiance.pdf
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The spectral irradiance is more commonly expressed in terms of wavelength so that:

$$F(\lambda) = \Phi q \frac{1.24}{\lambda(\mu m)} \frac{1}{\Delta\lambda(\mu m)}$$

where:

$F(\lambda)$ is the spectral irradiance in $W \cdot m^{-2} \cdot m^{-1}$

Φ is the photon flux in $(\#\ \text{photons}) \cdot m^{-2} sec^{-1}$

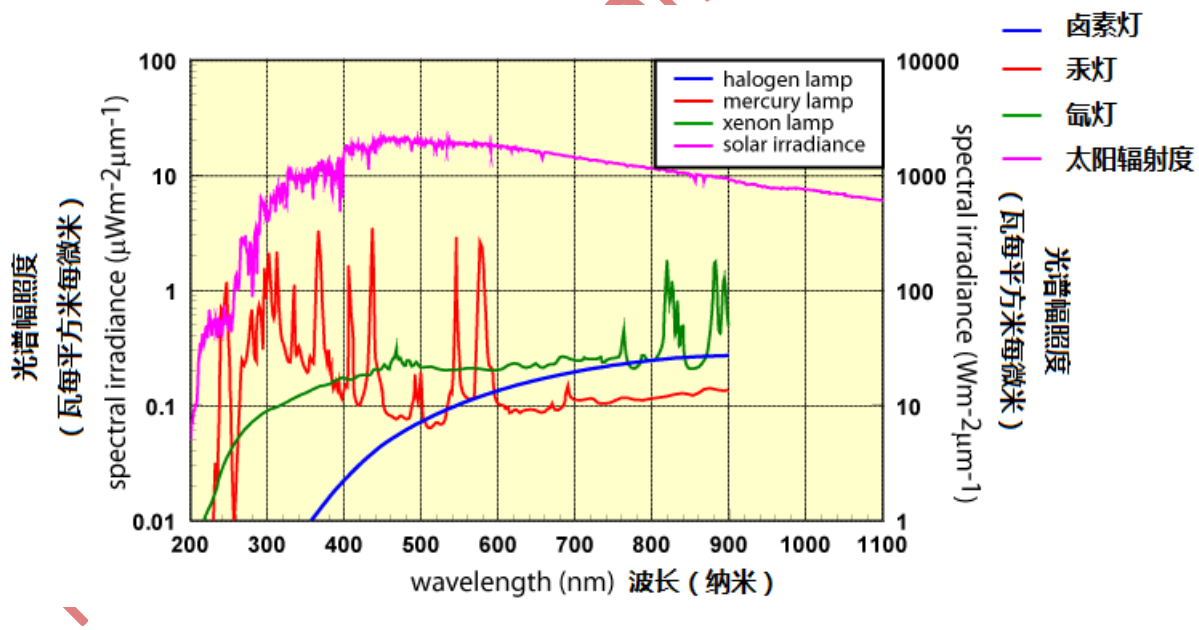
E and λ are the energy and wavelength of the photon in eV and μm respectively; and

q is a constant of $1.6 \times 10^{-19}\ C$

光谱幅照度更多情况下被表示为以下形式：

$$\text{光谱幅密度} = \Phi q \frac{1.24}{\text{波长（微米）}} \frac{1}{\text{波长范围（微米）}}$$

公式中的光谱幅照度$F(\lambda)$的单位为瓦每平方米每米，光子通量Φ的单位为光子数每平方米每秒。E和λ分别表示光子的能量和波长，其单位分别为焦耳和米。q为常量，它的值是1.6×10^{-19}库伦。



The spectral irradiance of artificial light sources (left axis) compared to the spectral irradiance from the sun (right axis).

人造光源的光谱幅照度（左坐标轴）与太阳的光谱幅照度的比较（右坐标轴）。