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photon radiance, L_p

Number of photons (quanta of radiation, N_p) per time interval (photon flux), q_p, leaving or passing through a small transparent element of surface in a given direction from the source about the solid angle Ω, divided by the solid angle and by the orthogonally projected area of the element in a plane normal to the given beam direction, $dS_\perp = dS \cos\theta$, with θ the angle between the normal to the surface and the direction of the beam. Equivalent definition: Integral taken over the hemisphere visible from the given point, of the expression $L_p \cos\theta \; d\Omega$, with L_p the photon radiance at the given point in the various directions of the incident beam of solid angle Ω and θ the angle between any of these beams and the normal to the surface at the given point.

Notes:

1. Mathematical definition:

$$L_p = \frac{d^2 q_p}{d\Omega \, dS_\perp} = \frac{d^2 q_p}{d\Omega \, dS \cos\theta}$$

   for a divergent beam propagating in an elementary cone of the solid angle Ω containing the direction θ. SI unit is $m^{-2}\,s^{-1}\,sr^{-1}$.
2. For a parallel beam it is the number of photons (quanta of radiation, N_p) per time interval (photon flux), q_p, leaving or passing through a small element of surface in a given direction from the source divided by the orthogonally projected area of the element in a plane normal to the given direction of the beam, θ. Mathematical definition in this case: $L_p = dq_p / (dS \cos\theta)$ If q_p is constant over the surface area considered, $L_p = q_p / (S \cos\theta)$, SI unit is $m^{-2}\,s^{-1}$.
3. This quantity can be used on a chemical amount basis by dividing L_p by the Avogadro constant, the symbol then being $L_{n,p}$, the name 'photon radiance, amount basis'. For a divergent beam SI unit is $mol\,m^{-2}\,s^{-1}\,sr^{-1}$; common unit is $einstein\,m^{-2}\,s^{-1}\,sr^{-1}$. For a parallel beam SI unit is $mol\,m^{-2}\,s^{-1}$; common unit is $einstein\,m^{-2}\,s^{-1}$.

Source:

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