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.

Note 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 $\tilde{\theta}$. SI unit is $m^{-2}\ s^{-1}\ sr^{-1}$.

Note 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: $L_p = dq_p / (dS \cos\tilde{\theta})$. If q_p is constant over the surface area considered, $L_p = q_p / (S \cos\theta)$, SI unit is $m^{-2}\ s^{-1}$.

Note 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 $m^{-2}\ s^{-1}$.

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