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Internationales Wörterbuch der Lichttechnik

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Foreword

Standards produced by the Commission Internationale de l'Eclairage are concise documents on aspects of light and lighting that require a unique definition. They are a primary source of internationally accepted and agreed data which can be taken, essentially unaltered, into universal standard systems.

This CIE Standard has been produced following intensive work by the Divisions of the CIE. It presents definitions for terms related to the science and art of light and lighting, colour and vision, photobiology and image technology. It does not give extensive detail or explanations for the application of these terms; this information is available in the Technical Reports and Standards produced by the CIE.

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Introduction

This new edition of the International Lighting Vocabulary (ILV) is the result of intensive work carried out by the Divisions of the CIE to update, and supplement where necessary, the contents of the previous edition (1987). Many new terms have been added, to reflect changes in technologies and practices, existing terms have been updated as necessary, and obsolete terms have been removed.

The aim of this edition of the International Lighting Vocabulary, comprising more than 1400 terms and their definitions, is to promote international standardization in the use of quantities, units, symbols and terminology related to the science and art of light and lighting, colour and vision, photobiology and image technology. This vocabulary provides the definitions and essential information necessary for the understanding and correct usage of the terms included. It does not give extensive detail or explanations of the application of these terms; such information, relevant for experts in each specialized field, is available in the Technical Reports and Standards produced by the CIE.

The first edition of the ILV was published in 1938, the latest in 1987. Work to prepare this new edition began in the late 1990s, when the CIE Divisions were requested to review each and every term in the 4th edition and to propose any necessary amendments, additions or deletions. The CIE Central Bureau was tasked with the responsibility for coordinating this activity and collating the information provided by the Divisions. Several years of discussion were needed within the Divisions in order to prepare their recommendations, and it was not until 2008 that the final proposals were submitted to the CIE Central Bureau. The recommendations from each Division were then considered by a Working Group set up for the purpose, comprising of the CIE Vice President Technical, CIE Vice President Publications and the CIE Technical Manager, with additional inputs from the seven CIE Division Directors and the associated Division Editors as necessary. Approximately 18 months of discussion was necessary within the Working Group in order to harmonize the large amount of information provided from the Divisions and it was not until December 2009 that the Draft Standard, CIE DS 017.2/E:2009, was ready for submission to the National Committees of the CIE. A large number of detailed technical and editorial comments were received following the review and ballot of the Draft Standard, which were then taken into account by the Working Group in the preparation of this final document. This new edition represents the culmination of this extensive activity.

Previous editions of the ILV were organized into 11 separate sections according to the general area of application ('Radiation, quantities and units', 'Colorimetry', 'Light sources' etc.) and then grouped within these sections according to more specific applications (e.g. the section on 'Vision and colour rendering' was further subdivided into 'The eye', 'Light and colour', 'Visual phenomena' and 'Colour rendering'). Terms within each sub-section were organized somewhat arbitrarily. For this new edition it was decided to restructure the vocabulary to a fully alphabetical arrangement (based on the English terms), without any division into sections or sub-sections. This decision was taken in order to simplify the ILV and aid its use.

NOTE Terms that are used mainly in the US are indicated by the expression "(US)" following the term in question. Symbols for quantities are indicated in square brackets behind the term, symbols for units are indicated below the definition. Attributes to terms are printed in round brackets following the corresponding term. For the purpose of a proper referencing the terms are numbered sequentially, starting with the number of the Standard (17-).

ILV - International Lighting Vocabulary

1 Scope

This Standard defines terms regarding all matters relating to light and lighting, colour and vision, photobiology and image technology.

2 Terms and Definitions

A

17-1 Abney phenomenon

change of hue produced by decreasing the purity of a colour stimulus while keeping its dominant wavelength and luminance constant

17-2 Abney's law

empirical law stating that if 2 colour stimuli, A and B, are perceived to be of equal brightness and 2 other colour stimuli, C and D, are perceived to be of equal brightness, then the additive mixtures of A with C and B with D will also be perceived to be of equal brightness

NOTE The validity of Abney's law depends strongly on the observing conditions.

17-3 abnormal cathode fall

cathode fall which depends on the discharge current, which is distributed over the whole active surface of the cathode

17-4 absolute thermal detector

thermal detector of optical radiation which can compare radiant flux directly with electrical power

Equivalent term: "self-calibrating thermal detector"

17-5 absorptance [α]

ratio of the absorbed radiant flux or luminous flux to the incident flux under specified conditions

Unit: 1

17-6 absorption

process by which radiant energy is converted to a different form of energy by interaction with matter

17-7 accent lighting

directional lighting to emphasize a particular object or to draw attention to a spot in the visual field

17-8 access zone (of a road tunnel)

part of the open road immediately outside (in front of) the tunnel portal, covering the distance over which an approaching driver must be able to see into the tunnel

NOTE The access zone begins at the stopping distance point ahead of the portal and it ends at the portal.

17-9 access zone luminance

average of the luminances contained in a conical field of view, subtending an angle of 20° at the eye of the approaching driver and centred on a point at a height of one quarter of the height of the tunnel mouth

17-10 accommodation

adjustment of the dioptric power of the crystalline lens by which the image of an object, at a given distance, is focused on the retina

17-11 achromatic colour

1. in the perceptual sense: perceived colour devoid of hue

NOTE The colour names white, grey and black are commonly used or, for transmitting objects, colourless and neutral.

2. in the psychophysical sense: see “achromatic stimulus”

17-12 achromatic stimulus

stimulus that, under the prevailing conditions of adaptation, gives rise to an achromatic perceived colour

NOTE In the colorimetry of object colours, the colour stimulus produced by the perfect reflecting or transmitting diffuser is usually considered to be an achromatic stimulus for all illuminants, except for those whose light sources appear to be highly chromatic.

17-13 actinic

1. applied to radiation: capable of producing a photochemical effect; exhibiting actinism
2. applied to other concepts or to devices: referring to actinism

NOTE 1 A natural actinic effect is a chemical change caused by natural radiation. Examples are: production of ozone in the atmosphere, photosynthesis, daylight vision.

NOTE 2 An artificially induced actinic effect is a photochemical change caused by artificially produced optical radiation under controlled conditions. Examples are: control of plant growth by time-programmed lighting, lighting of poultry to increase egg production, therapeutic treatment by means of special lamps.

NOTE 3 A direct actinic effect is one that occurs at the place where the radiant energy responsible for the effect is absorbed. An example of this is the conversion of 7-dehydrocholesterol to previtamin D3. An indirect actinic effect is one that occurs away from the place where the radiant energy responsible for the effect is absorbed. The distinction between a direct and an indirect actinic effect mainly applies to photobiological changes. The photostimulation of endocrine glands is an example of an indirect actinic effect, as is the conversion of previtamin D3 to vitamin D by a non-photochemical thermal reaction.

17-14 actinic dose [H_{act}]

quantity obtained by spectrally weighting the radiant exposure (dose) with the actinic action spectrum

$$H_{\text{act}} = \iint E_{\lambda}(t) s_{\text{act}}(\lambda) d\lambda dt$$

where $E_{\lambda}(t)$ is the spectral irradiance in $\text{W} \cdot \text{m}^{-2} \cdot \text{nm}^{-1}$ and $s_{\text{act}}(\lambda)$ is the actinic action spectrum normalized to 1 at its maximum

Unit: $\text{J} \cdot \text{m}^{-2}$

NOTE This definition implies that an action spectrum is adopted for the actinic effect considered, and that its maximum value is 1. When giving a quantitative amount, it is

essential to specify according to which actinic action spectrum the dose is meant, as the unit is the same.

17-15 actinic effect, indirect

actinic effect that occurs away from the place where the radiant energy responsible for the effect is absorbed

NOTE The distinction between direct and indirect actinic effect mainly applies to the biological changes. The photostimulation of endocrine glands is an example of an indirect actinic effect.

17-16 actinism

property of optical radiation which enables it to cause photochemical changes on certain living or non-living materials

NOTE This term is no longer widely used.

17-17 action spectrum

function representing the relative spectral effectiveness of optical radiation, for a specified actinic effect, in a specified system; also referred to as: actinic spectrum efficiency of equal intensities of monochromatic radiation for producing that phenomenon in that system as a function of wavelength

Equivalent term: “spectral weighting function”

NOTE 1 The normalized action spectrum is the wavelength dependence of the inverse of the dose of monochromatic radiation required to induce a certain (biologic) response; the action spectrum is commonly normalized to a value of 1 at the wavelength of “maximum action”, i.e., where the smallest dose suffices to induce the required effect.

NOTE 2 Also referred to as: actinic spectrum.

17-18 adaptation

process by which the state of the visual system is modified by previous and present exposure to stimuli that may have various luminance values, spectral distributions and angular subtenses

NOTE Adaptation to specific spatial frequencies, orientations, sizes, etc. is recognized as being included in this definition.

17-19 adaptation, incomplete

phenomenon in which the adopted (computational) white in a given viewing environment does not actually appear white to an observer

NOTE Familiar instances include colour images on newsprint or displays that appear “too yellow or too blue”.

17-20 adaptation, state of

state of the visual system after an adaptation process has been completed

NOTE The terms “light adaptation” and “dark adaptation” are also used, the former when the luminances of the stimuli are of at least $10 \text{ cd} \cdot \text{m}^{-2}$, and the latter when the luminances are of less than some hundredths of a $\text{cd} \cdot \text{m}^{-2}$.

17-21 adapted white

See “white, adapted”

17-22 adaptive colorimetric shift

mathematical adjustment in chromaticity and luminance factor of an object colour stimulus to correct for a change in chromatic adaptation

17-23 adaptive colour shift

change in the perceived colour of an object caused solely by change of chromatic adaptation

17-24 additive mixture of colour stimuli

stimulation that combines on the retina the actions of various colour stimuli in such a manner that they cannot be perceived individually

17-25 additivity law of von Krefeld

effective doses can be added to a total effective dose, even if the dose response curves for different wavebands are different

NOTE This means at the same time that no conductive, i.e. catalytic, or hindering, i.e. antagonistic, effects occur.

17-26 adjustable luminaire

luminaire, the main part of which may be turned or moved by means of appropriate devices

NOTE An adjustable luminaire may be fixed or portable.

17-27 adopted white

See “white, adopted”

17-28 aerodrome beacon

aeronautical beacon used to indicate the location of an aerodrome from the air

17-29 aeronautical ground light

any light specially provided as an aid to air navigation, other than a light displayed on an aircraft

17-30 afterglow

slowly decaying luminescence persisting after the excitation of the luminescent material has ceased, the duration of which may be from about 100 ms to several minutes

17-31 aggregates (of a road surface)

whole of the inert materials incorporated in the mix of a road surface construction

NOTE 1 The following can be distinguished:

chipping (stones): that part of the aggregates retained by a 2 mm test sieve,

sand: that part of the aggregates passing a 2 mm sieve but retained by a 0,075 mm sieve;

filler: that part of the aggregates passing a 0,075 mm sieve. These aggregates are generally obtained by crushing rocks or from the natural weathering of rocks (gravels or sands from pits, dredging and dunes): industrial wastes are also occasionally used (blast furnace slag, fly ash).

NOTE 2 Some countries use other limiting mesh sizes for distinguishing between sand and stones (for example 5 mm) and between sand and filler (for example 0,063 mm or 0,080 mm).

17-32 air-turbo lamp

luminaire energized by an alternator driven by compressed air

Equivalent term used in the US: “compressed air luminaire”

17-33 all-purpose road

road usable by all traffic (including pedestrians and cyclists)

NOTE Used to distinguish other roads from motorways.

17-34 Allard's law

law relating the illuminance, E , produced on a surface by a light source to the luminous intensity, I , of the source in the direction of the surface, to the distance, d , between the surface and the source, and to the atmospheric transmissivity, T , which is assumed to be uniform; the surface is normal to the direction of the source and sufficiently distant for the source to be considered as a point source

$$E = \frac{I}{d^2} T^{d/d_0}$$

where d_0 is the length specified in the definition of T

NOTE 1 The above formula is sometimes written:

$$E = \frac{I}{d^2} T^\delta$$

where the exponent, δ , in T^δ is the numerical value of the distance, d , measured with d_0 as “unit”.

NOTE 2 Taking into account the relationship given in “meteorological optical range” between T and the meteorological optical range, v , this law can also be written as:

$$E = \frac{I}{d^2} (0,05^{d/v}).$$

17-35 alternating light

signal light that shows different colours in a regularly repeated sequence

17-36 alychne

surface in tristimulus space that represents the locus of colour stimuli of zero luminance

NOTE This surface passes through the origin of the space. It intersects any chromaticity diagram in a straight line which is also called the alychne; this line lies wholly outside the domain of chromaticities bounded by the spectrum locus and the purple boundary.

17-37 ambient illuminance level (of a display)

illuminance level due to lighting in the viewing environment, excluding that from the display, measured in the plane of the display

17-38 ambient white point (of a display)

chromaticity coordinates representing the lighting in the viewing environment, excluding that from the display, measured in the plane of the display

17-39 amplitude of fluctuation of the luminous flux (of a source run on alternating current)

relative amplitude of the periodic fluctuation of the luminous flux as measured by the ratio of the difference between the maximum and the minimum instantaneous luminous flux, $\Phi_{\max}$ and $\Phi_{\min}$ respectively, to the sum of both of these values:

$$\frac{\Phi_{\max} - \Phi_{\min}}{\Phi_{\max} + \Phi_{\min}}$$

Unit: 1

NOTE 1 This ratio is usually expressed in % and is then known under the expression “percent flicker” which, however, should be deprecated.

NOTE 2 Another means sometimes used by the lighting industry to characterize the fluctuation in light output is “flicker index”, which is defined by the ratio of 2 areas deduced from the diagram representing the variation of the instantaneous flux over a period of time; the area of the diagram above the average value is divided by the total area under the curve (this total area is the product of the average value and the given period of time).

17-40 angle of incidence [ε]

angle that a light path makes with the normal to the plane of incidence

Unit: rad, °

17-41 angle of observation [α]

angle that the viewing direction makes with the normal of the surface being viewed

Unit: rad, °

17-42 angular subtense [α]

visual angle subtended by a source at the eye of an observer or at the point of measurement

Unit: rad, °

NOTE 1 Subtended angles are denoted by the full included angle, not the half angle.

NOTE 2 The angular subtense, α , will often be modified by incorporation of lenses and mirrors as projector optics, in which case the angular subtense of the apparent source will differ from the angular subtense of the physical source.

NOTE 3 The angular subtense of an oblong source shall be determined by the arithmetic mean of the maximum and minimum angular dimension of the source.

NOTE 4 In safety applications (IEC 62471/CIE S 009:2006 *Photobiological safety of lamp and lamp systems*) the term is used as: angle subtended by an apparent source as viewed from a point in space.

17-43 anomalous trichromatism

See NOTE 1 to “defective colour vision”

17-44 anti-collision light

signal light carried on an aircraft to indicate the presence of the aircraft

17-45 anti-Stokes luminescence

photoluminescence whose radiation is located in a spectral region of shorter wavelengths than that of the exciting radiation

NOTE This happens, for instance, when the energy of the emitted photons originates from the absorption of 2 exciting photons.

17-46 aperture

opening that defines the area over which average optical emission is measured

Equivalent term: “aperture stop”

NOTE For spectral irradiance measurements this opening is usually the entrance of a small sphere placed in front of the radiometer/spectroradiometer entrance slit.

17-47 aperture colour

perceived colour for which there is no definite spatial localisation in depth, such as that perceived as filling a hole in a screen

17-48 aperture mode (of colour appearance)

colour seen through an aperture which prevents its association with a specific object or source

17-49 aperture stop

See “aperture”

17-50 apparent magnitude (of an astronomical object) [*m*]

quantity that correlates with the more or less luminous aspect of a star and that is defined by the formula

$$m = m_0 - 2,5 \log_{10} (E/E_0)$$

where *E* is the point brilliance of the star considered, *m*₀ and *E*₀ are constants based on the magnitudes ascribed to certain standard stars

Unit: 1

NOTE In addition to the visual apparent magnitude defined here, other apparent magnitudes (photographic, bolometric, etc.) are defined by the same formula, but where *E* and *E*₀ are the responses of a detector having a specified spectral responsivity.

17-51 appearance

1. aspect of visual perception by which things are recognized
2. in psychophysical studies, visual perception in which the spectral and geometric aspects of a visual stimulus are integrated with its illuminating and viewing environment

17-52 appearance model, single-stimulus

mathematical model which uses information about viewing conditions to estimate the subjective appearance of a coloured patch from colorimetric measurements of that patch and its surround

NOTE The information about viewing conditions includes the adopted white point.

17-53 approach lighting system

system of aeronautical ground lights which is sited in front of the threshold of an aerodrome runway and designed to provide guidance to aircraft making an approach to land on the runway

17-54 arc discharge

electric discharge characterized by a cathode fall which is small compared to that in a glow discharge

Equivalent term: “electric arc”

NOTE The emission of the cathode results from various causes (thermionic emission, field emission, etc.) acting simultaneously or separately, secondary emission plays only a small part.

17-55 arc lamp

discharge lamp in which the light is emitted by an arc discharge and/or by its electrodes

NOTE The electrodes may be either of carbon (operating in air) or of metal.

17-56 arc tube

enclosure in which the arc of the lamp is confined

17-57 array detector

physical arrangement of detector elements that are able to sense the output e.g. of a polychromator

NOTE In some cases, optical components may form a part of the array as in, for example, a fibre optics faceplate coupled array detector.

17-58 astronomical sunshine duration

sum of the time intervals within a given time period during which the sun is above an even, unobscured horizon

17-59 asymmetrical luminaire

luminaire with an asymmetrical luminous intensity distribution

17-60 atmospheric transmissivity $[T]$

regular luminous transmittance of the atmosphere over a path of a specified length d_0

NOTE In German, the terms “Transmissionsfaktor” and “Sichtwert” refer to lengths of one kilometre and one nautical mile respectively.

17-61 atmospheric transmittance $[P]$

transmittance when the solar radiation is incident perpendicularly on the Earth’s atmosphere

17-62 avalanche photodiode

photodiode operating with a bias electromotive force such that the primary photocurrent undergoes amplification through avalanche breakdown at the junction

17-63 average illuminance (over a surface) $[E_{av}, \bar{E}]$

illuminance averaged over the specified surface

Unit: lx = lm·m⁻²

NOTE 1 In practice, this may be approximated by an average of the illuminance at a representative number of points on the surface. The number and positions of these points should be specified in the relevant application guide.

NOTE 2 The specification must include a clear indication of the type of illuminance at the points of the surface, i.e. horizontal, vertical, spherical, cylindrical or semi-cylindrical.

17-64 average life

average of the individual lives of the lamps subjected to a life test, the lamps being operated under specified conditions and the end of life judged according to specified criteria

17-65 average luminance (of a surface) [L_{av} , $\bar{L}$]

luminance averaged over the specified surface

Unit: $\text{cd}\cdot\text{m}^{-2}$

NOTE In practice, this may be approximated by an average of the luminances at a representative number of points on the surface. The number and position of these points should be specified in the relevant application guide.

B

17-66 backboard

See “backing board”

17-67 background (of a sign)

part of a sign immediately behind a symbol or word, or on which a symbol or word is superimposed

17-68 background, single stimulus

region surrounding the stimulus subtending approximately 10°

17-69 backing board (of a traffic control device)

surround or extension to traffic control device used for the reasons listed below:

- to improve conspicuity of a sign by increasing its size and isolating it from its background;
- to improve conspicuity of a sign by virtue of the colour of the backing board;
- to reduce the effects of glare when the sun is low and behind the sign

Equivalent term: “backboard”

17-70 backup light (US)

signal light carried on a vehicle to illuminate the way behind the vehicle and to indicate rearwards an intended, or actual, backward movement by the vehicle

Equivalent term used outside US: “reversing light”

17-71 bactericidal lamp

low pressure mercury vapour lamp with a bulb which transmits bactericidal UV-C radiation

Equivalent term: “germicidal lamp”

17-72 bactericidal radiation

optical radiation capable of inactivating or killing bacteria

NOTE The more general term is “germicidal radiation” or “microbiocidal radiation”.

17-73 ballast

unit inserted between the supply and one or more discharge lamps which by means of inductance, capacitance, or a combination of inductance and capacitance, serves mainly to limit the current of the lamp(s) to the required value

NOTE It may also include means for transforming the supply voltage and arrangements which help provide starting voltage and pre-heating current.

17-74 ballast lumen factor

ratio of the luminous flux emitted by a reference lamp when operated with a particular production ballast to the luminous flux emitted by the same lamp when operated with its reference ballast

Unit: 1

Abbreviation: "BLF"

17-75 barrette (aeronautical ground lights)

line of closely spaced aeronautical ground lights which is designed to appear from a distance as a short bar of light orthogonal to the centre line of an aerodrome runway

17-76 base (US)

part of a lamp which provides connection to the electrical supply by means of a lampholder or lamp connector and, in most cases, also serves to retain the lamp in the lampholder

Equivalent term used outside US: "cap"

NOTE See NOTES to non-US term "cap".

17-77 basic colour names

group of eleven colour names found in anthropological surveys to be in wide use in fully developed languages: white, black, red, green, yellow, blue, brown, grey, orange, purple, pink

17-78 basic law of radiometry and photometry

See NOTE 7 to "radiance"

17-79 basic photon radiance

See NOTE 6 to "radiance"

17-80 basic radiance

See NOTE 6 to "radiance"

17-81 bayonet base (US)

base with bayonet pins on its shell which engage in slots in a lampholder

Equivalent term used outside US: "bayonet cap"

NOTE The international designation is B.

17-82 bayonet cap

cap with bayonet pins on its shell which engage in slots in a lampholder

Equivalent term used in the US: "bayonet base"

NOTE The international designation is B.

17-83 bayonet pin

small piece of metal which projects from the shell of a cap, particularly a bayonet cap, and which engages in a slot in a lampholder to fix the cap

17-84 beacon

1. fixed artificial navigation mark that may carry a signal light
2. signal light used to indicate a designated geographical location

NOTE In French, the term "balise" refers also to an artificial object that is used to regulate vehicular or pedestrian traffic.

17-85 beam spread

See “half-peak divergence” or “one-half-peak spread (US)”

17-86 Bezold-Brücke phenomenon

change of hue produced by changing the luminance (within the range of photopic vision) of a colour stimulus while keeping its chromaticity constant

NOTE 1 With certain monochromatic stimuli, hue remains constant over a wide range of luminances (for a given condition of adaptation). The wavelengths of these stimuli are sometimes referred to as “invariant wavelengths”.

NOTE 2 With increasing intensity, below 500 nm hues shift more toward blue, and above 500 nm hues shift more toward yellow (reds become yellower with increasing brightness).

17-87 bi-directional reflectance distribution function (at a surface element of a medium, in a given direction, for a given direction of irradiation) [$\rho(\theta_i, \theta_r, \lambda)$]

function describing the change with angle of irradiation, θ_i , and angle of view, θ_r , of the quotient of the radiance of the surface element in the given direction of view at the given wavelength λ , $dL_r(\theta_i, \theta_r, \lambda)$, by the irradiance incident on the medium from the given direction of irradiation at the given wavelength, $dE_i(\theta_i, \lambda)$:

$$\rho(\theta_i, \theta_r, \lambda) = \frac{dL_r(\theta_i, \theta_r, \lambda)}{dE_i(\theta_i, \lambda)}$$

Unit: sr^{-1}

See also “radiance coefficient”

Abbreviation: “BRDF”

17-88 binary hue

hue that can be described as a combination of 2 unitary hues

NOTE For example: orange is a yellowish-red or reddish-yellow; violet is reddish-blue, etc.

17-89 biological rhythm

characteristic periodic change in a living organism or life-related process, e.g. the circadian rhythm has a period of approximately 24 h

NOTE Biological rhythms may be influenced by optical radiation.

17-90 bioluminescence

chemiluminescence occurring in living organisms

17-91 bispectral luminescent radiance factor [$\beta_{L,\lambda}(\mu)$]

ratio of the radiance per unit emission bandpass, $d\lambda$, at wavelength, λ , due to photoluminescence from the specimen when irradiated at wavelength, μ , to the radiance of the perfect reflecting diffuser identically irradiated and viewed

Unit: nm^{-1}

NOTE 1 Spectral quantities with a subscript λ in their designation indicate differential spectral radiometric quantities.

NOTE 2 When integrated or summed over the spectral bandpass of the instrument, this quantity becomes the bandpass-weighted bispectral luminescent radiance factor, $\beta_{L,\lambda}(\mu)\Delta\lambda$.

NOTE 3 The tabular form of complete bispectral luminescent radiance factor and reflected radiance factor data is the Donaldson matrix representation of bispectral radiance factor, $D(\mu, \lambda)$. The excitation wavelengths, μ , are tabulated in the vertical direction, the emission wavelengths, λ , in the horizontal direction, the reflected radiance factors, $\beta_R(\lambda)$, appear on the diagonal where the excitation and emission (detection) wavelengths are equal, and the array of bandpass-weighted bispectral luminescent radiance factor data, $\beta_{L,\lambda}(\mu)\Delta\lambda$, appear on the off-diagonals.

17-92 black light lamp

lamp designed to emit UV-A radiation and very little visible radiation

Equivalent term: "Wood's glass lamp"

NOTE Such a lamp is generally mercury discharge or fluorescent.

17-93 blackbody

See "Planckian radiator"

17-94 blended lamp

lamp containing in the same bulb certain elements of a mercury vapour lamp and an incandescent lamp filament connected in series

Equivalent term used in the US: "self-ballasted mercury lamp"

NOTE The bulb may be diffusing or coated with phosphors.

17-95 BLF (abbreviation)

See "ballast lumen factor"

17-96 BLH (abbreviation)

See "blue light hazard"

17-97 blue light hazard

potential for a photochemically induced retinal injury resulting from optical radiation exposure at wavelengths primarily between 400 nm and 500 nm

NOTE 1 This damage mechanism dominates over the thermal damage mechanism for exposure durations exceeding 10 s.

NOTE 2 The action spectrum extends into the UV-A for persons without a normal UV-A absorbing lens.

Abbreviation: "BLH"

17-98 blue light hazard irradiance [E_b]

effective irradiance with the spectral irradiance, E_λ , spectrally weighted with the blue light hazard spectral weighting function, $b(\lambda)$, in the wavelength range λ_1 to λ_2

Unit: $\text{W}\cdot\text{m}^{-2}$

NOTE 1 This quantity is typically of interest for small sources subtending less than 0,011 rad.

NOTE 2 Specified in ICNIRP-recommendations: $\lambda_1 = 300 \text{ nm}$, $\lambda_2 = 700 \text{ nm}$.

NOTE 3 This definition implies that an action spectrum is adopted for the actinic effect considered, and that its maximum value is 1. When giving a quantitative amount, it is essential to specify according to which actinic action spectrum the irradiance is meant, as the unit is the same.

17-99 blue light hazard radiance [L_b]

effective photobiological radiance with the spectral radiance, L_λ , spectrally weighted with the blue light hazard spectral weighting function, $b(\lambda)$, in the wavelength range λ_1 to λ_2

Unit: $\text{W}\cdot\text{m}^{-2}\cdot\text{sr}^{-1}$

NOTE 1 Specified in ICNIRP-recommendations: $\lambda_1 = 300 \text{ nm}$, $\lambda_2 = 700 \text{ nm}$.

NOTE 2 This definition implies that an action spectrum is adopted for the actinic effect considered, and that its maximum value is 1. When giving a quantitative amount, it is essential to specify according to which actinic action spectrum the radiance is meant, as the unit is the same.

17-100 blue light hazard radiance dose [$L_{b,t}$]

See “blue light hazard (time) integrated radiance”

17-101 blue light hazard radiant exposure [H_b]

effective radiant exposure with the radiant exposure, H_λ , spectrally weighted with the blue light hazard spectral weighting function, $b(\lambda)$, in the wavelength range λ_1 to λ_2

Unit: $\text{J}\cdot\text{m}^{-2}$

NOTE 1 Specified in ICNIRP-recommendations: $\lambda_1 = 300 \text{ nm}$, $\lambda_2 = 700 \text{ nm}$.

NOTE 2 This definition implies that an action spectrum is adopted for the actinic effect considered, and that its maximum value is 1. When giving a quantitative amount, it is essential to specify according to which actinic action spectrum the radiant exposure is meant, as the unit is the same.

17-102 blue light hazard spectral weighting function [$b(\lambda)$]

function representing the relative spectral sensitivity of the human eye to blue light hazards; based upon the relative spectral effectiveness of optical radiation to induce retinal photochemical injury (photoc maculopathy)

Unit: 1

NOTE Specified in ICNIRP-recommendations for $\lambda = 300 \text{ nm}$ to 700 nm .

17-103 blue light hazard (time) integrated radiance [$L_{b,t}$]

time integral of the blue light hazard radiance, L_b , as integrated with respect to the duration of exposure

Unit: $\text{J}\cdot\text{m}^{-2}\cdot\text{sr}^{-1}$

Equivalent term: “blue light hazard radiance dose”

NOTE This definition implies that an action spectrum is adopted for the actinic effect considered, and that its maximum value is 1. When giving a quantitative amount, it is essential to specify according to which actinic action spectrum the integrated radiance is meant, as the unit is the same.

See also “radiance dose”

17-104 bollard

post used to indicate an obstruction or to regulate traffic

NOTE A bollard may be internally illuminated and may incorporate a regulatory traffic sign.

17-105 bolometer

thermal detector of optical radiation in which the heating of the part that absorbs the radiation causes a change in its electrical resistance

17-106 border (of a sign)

part of the sign face which outlines its shape

17-107 bowl

diffuser, refractor or reflector in the form of a bowl, intended to be placed below the lamp

17-108 brake light

See “stop light”

17-109 BRDF (abbreviation)

See “bi-directional reflectance distribution function”

17-110 bright

adjective used to describe high levels of brightness

17-111 brightness

attribute of a visual perception according to which an area appears to emit, or reflect, more or less light

NOTE The use of this term is not restricted to primary light sources.

17-112 bulb

transparent or translucent gas-tight envelope enclosing the luminous element(s)

17-113 bulkhead luminaire

protected luminaire of compact design intended to be fixed directly on a vertical or horizontal surface

17-114 Bunsen-Roscoe law

1. the total radiant exposure required to elicit a given photobiological or photochemical response is independent of the duration over which the exposure occurs
2. equivalent definition: the exposure duration required to elicit a given photobiological or photochemical response varies as the reciprocal of the incident irradiance

Equivalent term: “reciprocity law”

NOTE This relationship generally holds only over a given limited range of exposure durations. Reciprocity failure can occur due to repair mechanisms, recombination effects over long periods, or photon saturation for extremely short periods.

17-115 buoy

floating, and moored, artificial navigation mark

C**17-116 C, γ coordinate system**

coordinate system commonly used in the photometry of luminaires in which the C-planes are half-planes that rotate round the vertical line through the photometric centre of the luminaire,

and the γ -angles are measured up to 180° from the direction of the perpendicular to the rotation axis of the C -planes

NOTE Other coordinate systems (A, α) and (B, β) exist as well. See CIE 121-1996.

17-117 candela

SI base unit for photometry: luminous intensity, in a given direction, of a source that emits monochromatic radiation of frequency 540×10^{12} Hz and that has a radiant intensity in that direction of $1/683 \text{ W} \cdot \text{sr}^{-1}$

Symbol: $\text{cd} = \text{lm} \cdot \text{sr}^{-1}$

NOTE Defined by the 16th General Conference of Weights and Measures, 1979.

17-118 candela per square metre

SI unit of luminance

Symbol: $\text{cd} \cdot \text{m}^{-2}$

NOTE 1 This unit was sometimes called the nit (symbol: nt) (name discouraged).

NOTE 2 Other units of luminance:

metric, non-SI: lambert (symbol: L), $1 \text{ L} = \frac{10^4}{\pi} \text{ cd} \cdot \text{m}^{-2}$;

non-metric, non-SI: footlambert (symbol: fL), $1 \text{ fL} = 3,426 \text{ cd} \cdot \text{m}^{-2}$.

17-119 cap

part of a lamp which provides connection to the electrical supply by means of a lampholder or lamp connector and, in most cases, also serves to retain the lamp in the lampholder

Equivalent term used in the US: “base”

NOTE 1 The term “base” is used in both outside and in the US to denote an integral part of a lamp envelope which has been shaped so that it fulfils the function of a cap. It may engage also either a holder or a connector, depending on other design features of the lamp-and-holder system.

NOTE 2 The cap of a lamp and its corresponding holder are generally identified by one or more letters followed by a number which indicates approximately the principal dimension (generally the diameter) of the cap in millimetres. The standard code is to be found in IEC Publication 60061.

17-120 cap lamp

miner's personal lamp designed to be attached to a miner's helmet

17-121 carbon filament lamp

incandescent lamp whose luminous element is a filament of carbon

17-122 cardinal light

signal light used to indicate, with reference to the cardinal points of the compass, where navigable water may be found

Equivalent term: “cardinal mark”

17-123 cardinal mark

See “cardinal light”

17-124 carriageway

part of the road normally used by motorized vehicular traffic

Equivalent term used in the US: “pavement”

NOTE It can include emergency lanes.

17-125 carriageway marking

traffic control device consisting of lines, patterns, or words on the road surface or curbs within or adjacent to a traffic or parking lane meant to guide or control traffic

Equivalent term: “road marking”

Equivalent term used in the US: “pavement marking”

17-126 cathode drop

See “cathode fall”

17-127 cathode fall

difference in potential due to the space charge near the cathode

Equivalent term: “cathode drop”

17-128 cathode luminescence

luminescence caused by the impact of electrons on certain types of luminescent materials, such as the coating on a television screen

17-129 CBL (abbreviation)

See “counter-beam lighting”

17-130 CCT (abbreviation)

See “correlated colour temperature”

17-131 ceiling cavity index

number representative of the geometry of the part of a room between the ceiling and the plane of the luminaires, used in calculation of utilization factor or utilisation

Unit: 1

NOTE The ceiling cavity index is given by the formula

$$K = \frac{ab}{h_c(a+b)}$$

where a and b are the dimensions of the sides of the room and h_c is the distance from the ceiling to the plane of the luminaires.

See also “room index”

See also US term “ceiling cavity ratio”

17-132 ceiling cavity ratio (US)

number representative of the geometry of the part of a room between the ceiling and the plane of the luminaires, used in calculation of utilization factor or utilisation

Unit: 1

NOTE The ceiling cavity ratio is given by the formula

$$K = \frac{5h_c (a+b)}{ab}$$

where a and b are the dimensions of the sides of the room and h_c is the distance from the ceiling to the plane of the luminaires.

See also “ceiling cavity index”, term used outside the US

17-133 character (of a light signal)

distinctive rhythm and colour, or colours, of a light signal that provide the identification or a message

Equivalent term used in the US: “characteristic (of a light signal)”

17-134 character height

height of an upper case character

Unit: m

See also ““x” height”

17-135 character matrix

number of elements constructed in a square lattice or other arrangement from which characters may be formed

17-136 character separation

separation between character elements expressed in terms of the number of unit elements or the distance between centres of elements of adjacent characters

17-137 characteristic (of a light signal) (US)

distinctive rhythm and colour, or colours, of a light signal that provide the identification or a message

Equivalent term used outside US: “character (of a light signal)”

17-138 chemiluminescence

luminescence caused by energy released by a chemical reaction

17-139 chroma

colourfulness of an area judged as a proportion of the brightness of a similarly illuminated area that appears white or highly transmitting

NOTE For given viewing conditions and at luminance levels within the range of photopic vision, a colour stimulus perceived as a related colour, of a given chromaticity and from a surface having a given luminance factor, exhibits approximately constant chroma for all levels of illuminance except when the brightness is very high. In the same circumstances, at a given level of illuminance, if the luminance factor is increased, the chroma usually increases.

17-140 chromatic adaptation

visual process whereby approximate compensation is made for changes in the colours of stimuli, especially in the case of changes in illuminants

17-141 chromatic colour

1. in the perceptual sense: perceived colour possessing hue

NOTE In everyday speech, the word colour is often used in this sense in contradistinction to white, grey or black. The adjective coloured usually refers to chromatic colour.

2. in the psychophysical sense: see “chromatic stimulus”

17-142 chromatic induction

modification of the visual response that occurs when 2 colour stimuli (of any spectral irradiance distribution) are viewed side-by-side in which each stimulus alters the appearance of the other

NOTE 1 It is often referred to as simultaneous or spatial contrast because the effect is one of enhancement of colour difference.

NOTE 2 The effect is virtually instantaneous, in contrast to chromatic adaptation which is considered to develop slowly in the visual system.

17-143 chromatic stimulus

stimulus that, under the prevailing conditions of adaptation, gives rise to a chromatic perceived colour

NOTE In the colorimetry of object colours, stimuli having values of purity greater than 0 are usually considered to be chromatic stimuli.

17-144 chromaticity

property of a colour stimulus defined by its chromaticity coordinates, or by its dominant or complementary wavelength and purity taken together

17-145 chromaticity coordinates

ratio of each of a set of 3 tristimulus values to their sum

Unit: 1

NOTE 1 As the sum of the 3 chromaticity coordinates is equal to 1, 2 of them are sufficient to define a chromaticity.

NOTE 2 In the CIE standard colorimetric systems, the chromaticity coordinates are represented by the symbols x , y , z and x_{10} , y_{10} , z_{10} .

17-146 chromaticity coordinates, spectral

See “spectral chromaticity coordinates”

17-147 chromaticity diagram

plane diagram in which points specified by chromaticity coordinates represent the chromaticities of colour stimuli

NOTE In the CIE standard colorimetric systems y is normally plotted as ordinate and x as abscissa, to obtain an x, y chromaticity diagram.

17-148 CIE

acronym of the International Commission on Illumination, derived from the French name: Commission Internationale de l'Eclairage

17-149 CIE 1931 standard colorimetric observer

ideal observer whose colour-matching properties correspond to the CIE colour-matching functions $\bar{x}(\lambda)$, $\bar{y}(\lambda)$, $\bar{z}(\lambda)$ adopted by the CIE in 1931

17-150 CIE 1931 standard colorimetric system $[X, Y, Z]$

system for determining the tristimulus values of any spectral power distribution using the set of reference colour stimuli $[X]$, $[Y]$, $[Z]$ and the 3 CIE colour-matching functions $\bar{x}(\lambda)$, $\bar{y}(\lambda)$, $\bar{z}(\lambda)$ adopted by the CIE in 1931

NOTE 1 $\bar{y}(\lambda)$ is identical to $V(\lambda)$ and hence the tristimulus values Y are proportional to values of luminance.

NOTE 2 This standard colorimetric system is applicable to centrally-viewed fields of angular subtense between about 1° and about 4° (0,017 rad and 0,07 rad).

NOTE 3 The CIE 1931 standard colorimetric system can be derived from the CIE 1931 RGB colorimetric system using a transformation based on a set of 3 linear equations. The CIE 1931 RGB system is based on 3 real monochromatic reference stimuli.

See also CIE 15 *Colorimetry*

17-151 CIE 1964 standard colorimetric observer

ideal observer whose colour-matching properties correspond to the CIE colour-matching functions $\bar{x}_{10}(\lambda)$, $\bar{y}_{10}(\lambda)$, $\bar{z}_{10}(\lambda)$ adopted by the CIE in 1964

See also ISO 11664-1:2007(E)/CIE S 014-1/E:2006 *Colorimetry - Part 1: CIE Standard Colorimetric Observers*

17-152 CIE 1964 standard colorimetric system $[X_{10}, Y_{10}, Z_{10}]$

system for determining the tristimulus values of any spectral power distribution using the set of reference colour stimuli $[X_{10}]$, $[Y_{10}]$, $[Z_{10}]$ and the 3 CIE colour-matching functions $\bar{x}_{10}(\lambda)$, $\bar{y}_{10}(\lambda)$, $\bar{z}_{10}(\lambda)$ adopted by the CIE in 1964

NOTE 1 This standard colorimetric system is applicable to centrally-viewed fields of angular subtense greater than about 4° (0,07 rad).

NOTE 2 When this system is used, all symbols that represent colorimetric measures are distinguished by use of the subscript 10.

See also CIE 15 *Colorimetry*

17-153 CIE 1964 uniform colour space

3-dimensional, approximately uniform colour space produced by plotting in rectangular coordinates U^* , V^* , W^* quantities defined by the equations:

$$W^* = 25 Y^{1/3} - 17$$

$$U^* = 13 W^* (u - u_n)$$

$$V^* = 13 W^* (v - v_n)$$

NOTE 1 Y , u , v describe the colour stimulus considered, and u_n , v_n describe a specified white achromatic stimulus, where $u = u'$, $v = \frac{2}{3} v'$; $u_n = u'_n$, $v_n = \frac{2}{3} v'_n$.

See also "CIE 1976 uniform chromaticity scale diagram"

NOTE 2 The difference between 2 stimuli, ΔE^* , is defined as the Euclidean distance between the points representing them in $U^*V^*W^*$ space and calculated as:

$$\Delta E^* = [(\Delta U^*)^2 + (\Delta V^*)^2 + (\Delta W^*)^2]^{1/2}.$$

NOTE 3 This colour space is obsolete (except that it is still used in the calculation of colour rendering index). The currently recommended object colour spaces are CIELAB and CIELUV.