LIGHT SOURCE CHARACTERIZATION

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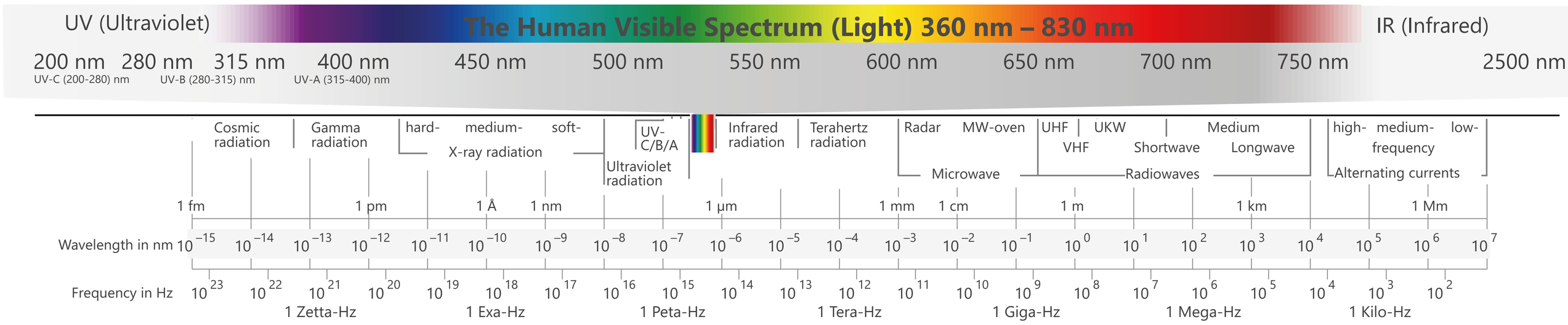
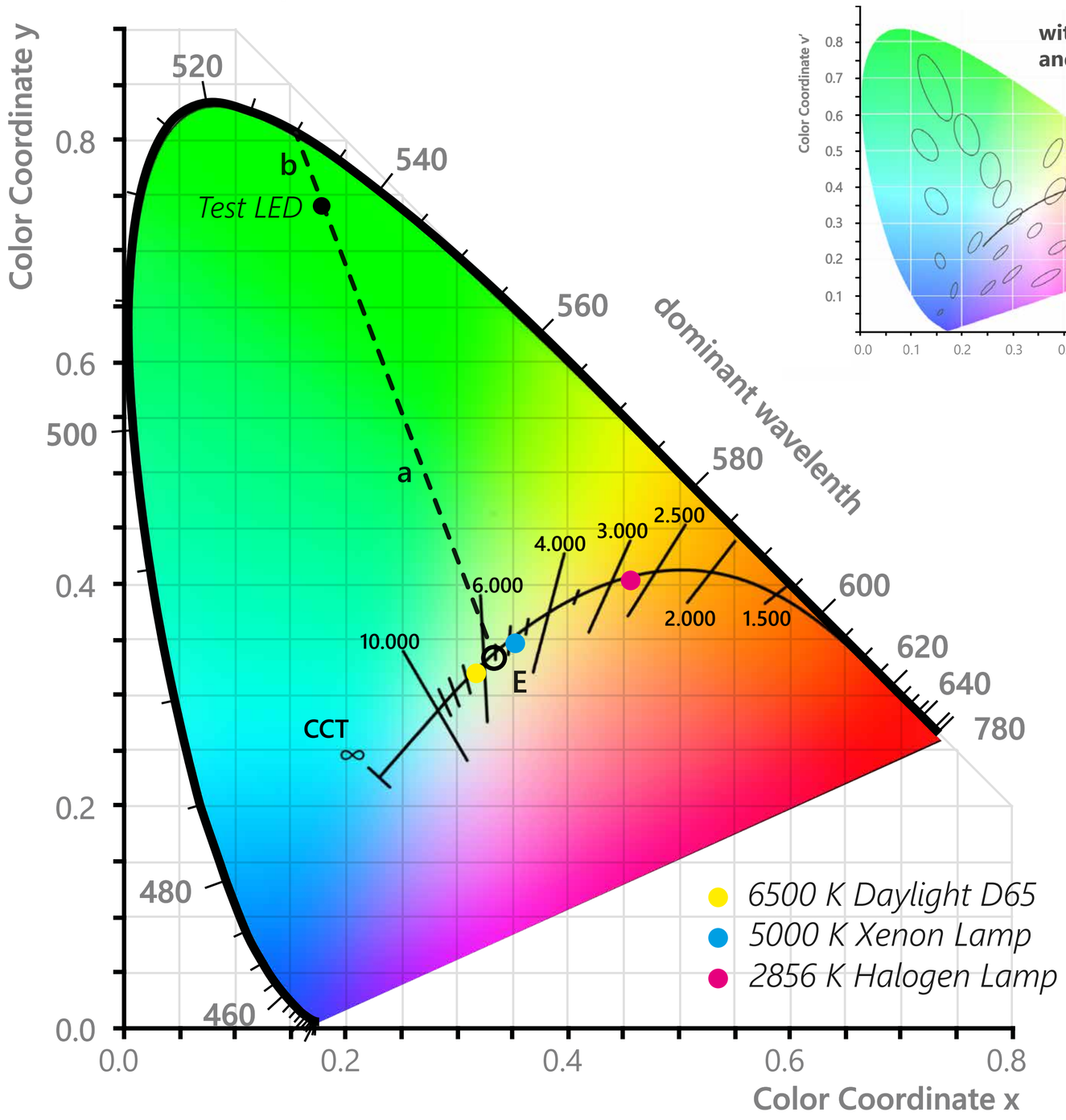
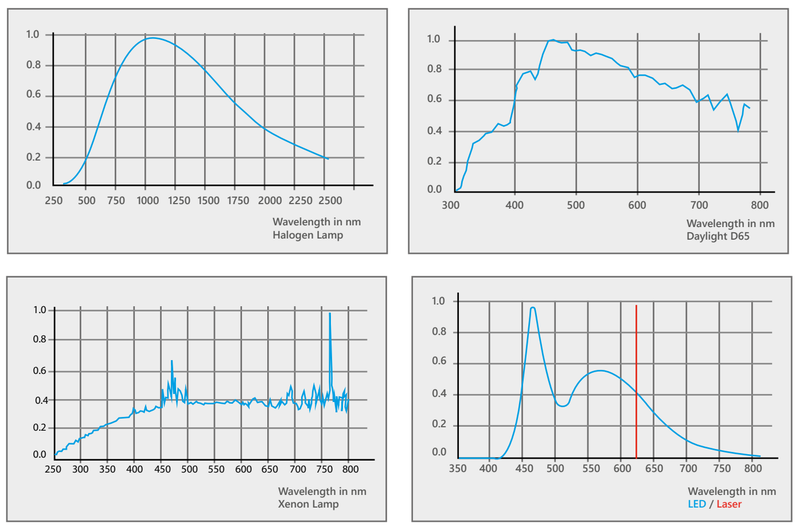


CIE 1931 Color Space



CIE 1976 Color Space



Different Light Sources

$$X = k \int_{\lambda} \varphi_\lambda(\lambda) \cdot \bar{x}(\lambda) \cdot d\lambda$$

$$Y = k \int_{\lambda} \varphi_\lambda(\lambda) \cdot \bar{y}(\lambda) \cdot d\lambda$$

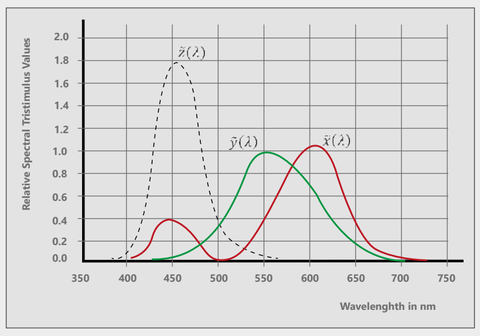
$$Z = k \int_{\lambda} \varphi_\lambda(\lambda) \cdot \bar{z}(\lambda) \cdot d\lambda$$

$$x = \frac{X}{X+Y+Z} \qquad u' = \frac{4X}{X+15Y+3Z}$$

$$y = \frac{Y}{X+Y+Z} \qquad v' = \frac{9Y}{X+15Y+3Z}$$

$$x + y + z = 1$$

$$purity: a/(a+b)$$

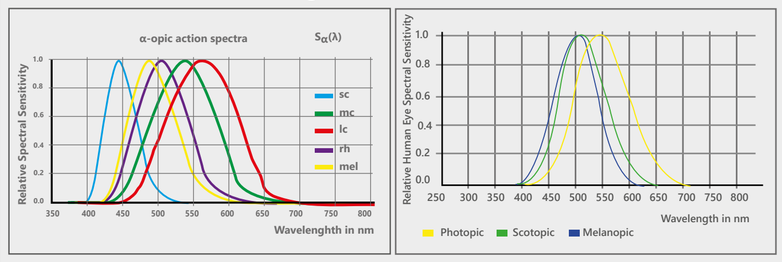


Color Calculations

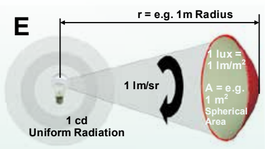
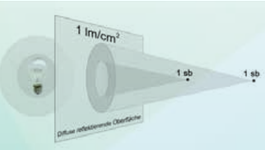
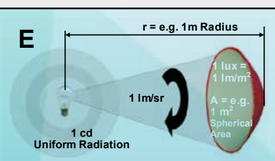
Color Rendering and Color Fidelity, etc.

$$R_i = 100 - 4.6\,\Delta E_i \qquad R_a = {}^1\!/_8 \sum_{i=1}^{8} R^i$$

ΔE_i : Color distance between reference and test light source



Many further metrics exist, like CIE 224, CQS, CIE 170, TM-30-20, CIE S 026 (α-opic, see plot) or Temporal Light Effects (TLA/TLM) as Flicker (SVM, Pst, etc.) according to CIE TN 006, CIE TN 012, IEC 61000-4-15, IEC 61547.
For further infromation please visit: **www.gigahertz-optik.com**

Radiometry		Photometry		Typical Values		
Physical Quantity	**Symbol/Unit**	**Physical Quantity**	**Symbol/Unit**	**Light Source**	**Radiometry (200 - 2500) nm**	**Photometry (360 - 830) nm**
Radiant Power	ϕ_e in W (Watt)	Luminous Flux	ϕ_v in lm (Lumen)			
		$\Phi = Q/t$ $\Phi v = Km \int_{380\,nm}^{780\,nm} \Phi v \cdot V(\lambda) \cdot d\lambda$ 1W = 683 lm at 555 nm 1lm = 1.46 mW at 555 nm 1 K_m = 683 lm/W		Fluorescent Lamp	(2.8 - 12) W	(750 - 3200) lm
				White LED at 400 mA	710 mW	2150 lm
				White LED at 20 mA	4 mW	12 lm
Radiant Intensity	I_e in W/sr	Luminous Intensity	I_v in lm/sr = cd			
		Characterization of directional dependence of emitted radiation / luminous flux $I = \Phi/\Omega = E \cdot r^2$ $A = \Omega \cdot r^2$		Light Bulb	360 mW/sr	110 cd
				Head Light, Xenon	up to 5550 W/sr	up to 10^6 cd
				LED (10 mA)	510 nm 0.003 - 0.56 mW/sr 590 nm 0.003 - 0.59 mW/sr	1-300 mcd
				White LED (20 mA)	0.02 W/sr	5.6 cd
Radiance	L_e in W/(m²sr)	Luminance	L_v in lm/(m²sr) = cd/m²			
		Independent of measurement distance. Photometry: Brightness, seen by the human eye, of a certain location (area) on a emitting surface. L = I/A		Surface of the Sun	5 x 10^6 W/(m²sr)	1.5 x 10^9 cd/m²
				Glow Wire	117 x 10^3 W/(m²sr)	35 x 10^6 cd/m²
				Fluorescent Lamp	11 - 56 W/(m²sr)	0.3 - 1.5 x 10^4 cd/m²
				Night Sky	about 10^{-12} W/(m²sr)	about 10^{-11} cd/m²
Irradiance	E_e in W/m²	Illuminance	E_v in lm/m² = lx (lux)			
		Radiation / Luminous flux impinging upon a certain location of an irradiated surface $E = \Phi/A = I/r^2$		Sunshine at Noon	max. 330 W/m²	max. 100.000 lx
				LED Lamp	1.9 W/m²	500 lx
				Clear Night with Full Moon	0.67 x 10^{-3} W/m²	0.2 lx

CRI	Rating
>90	Best
80-90	Very Good
70-80	Good
60-70	OK
40-60	Poor

Examples	CRI
High-pressure sodium	24
Halophosphate fluorescent	>50
Standard white LED	>80
Tri-phosphor fluorescent	<90
High-CRI white LED	>90
Incandescent / Halogen	~100

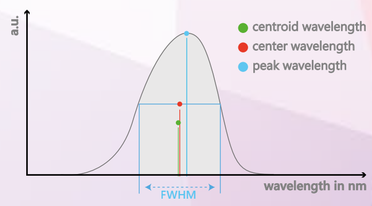
Spectral Line

Peak Wavelength, λp
It is defined as the wavelength at which the spectral distribution or line reaches its largest value.

Centroid Wavelength, λc
This wavelength defines the position of the spectral center of mass.

Centre Wavelength, λs
The center wavelength is defined as the center of the FWHM.

Full Width at Half Maximum (FWHM)
This quantity gives information about the width of a radiator at half the height of its maximum.



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