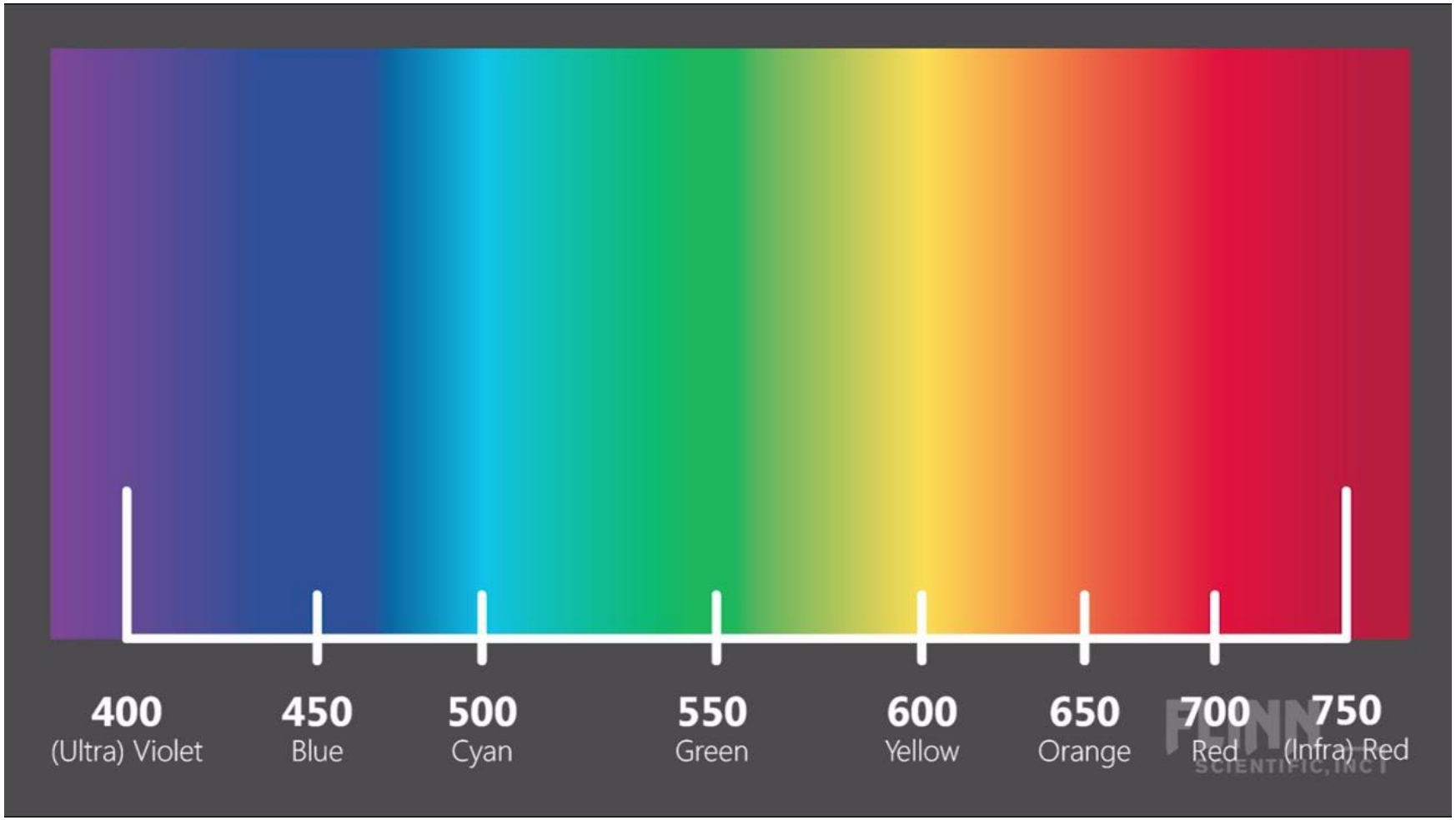
MODELLING AND RENDERING TECHNIQUES

SPECTRUM TO COLOR

Spectral colors of visible light



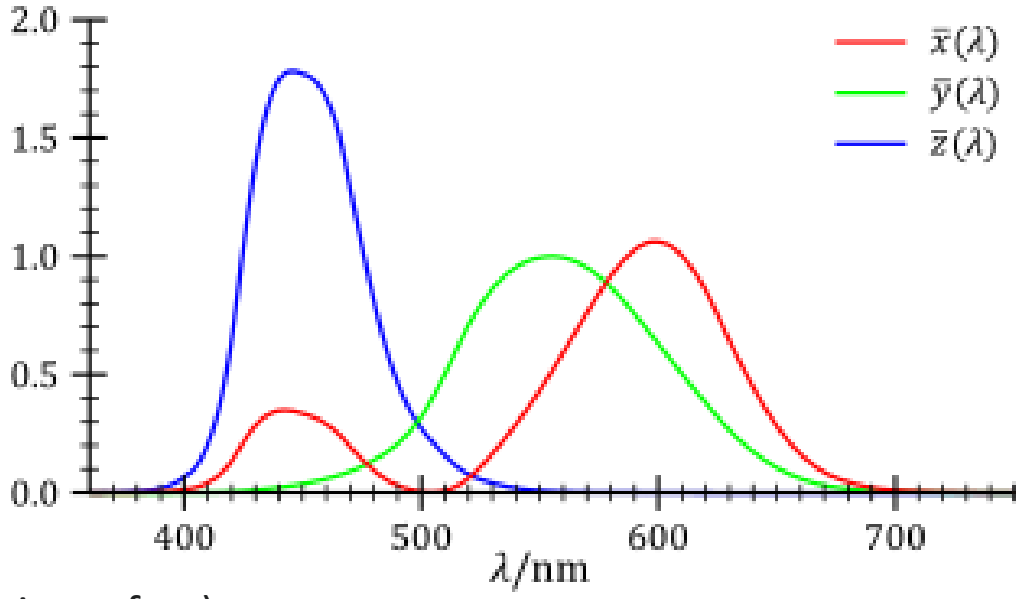
CIE color space

- Quantitative links between distributions of wavelengths in the electromagnetic visible spectrum, and physiologically perceived colors in human color vision.

- Color matching function
  - numerical description of the chromatic response of the *observer*

$$g(\lambda, \alpha, \mu, \delta_1, \delta_2) = \alpha \exp\left(\frac{(\lambda - \backslash\mathrm{mu})^2}{-2\delta^2}\right)$$

where $\delta = \delta_1 \; if \;\; \lambda < \mu \; else \; \delta_2$



  - Precomputed values (https://scipython.com/static/media/blog/colours/cie-cmf.txt)

XYZ values from real data

$$X = \int_{\lambda} S(\lambda)\overline{x}(\lambda) \qquad x = \frac{X}{X+Y+Z}$$

$$Y = \int_{\lambda} S(\lambda)\overline{y}(\lambda) \qquad y = \frac{Y}{X+Y+Z}$$

$$Z = \int_{\lambda} S(\lambda)\overline{z}(\lambda) \qquad z = \frac{Z}{X+Y+Z} = 1 - x - y$$

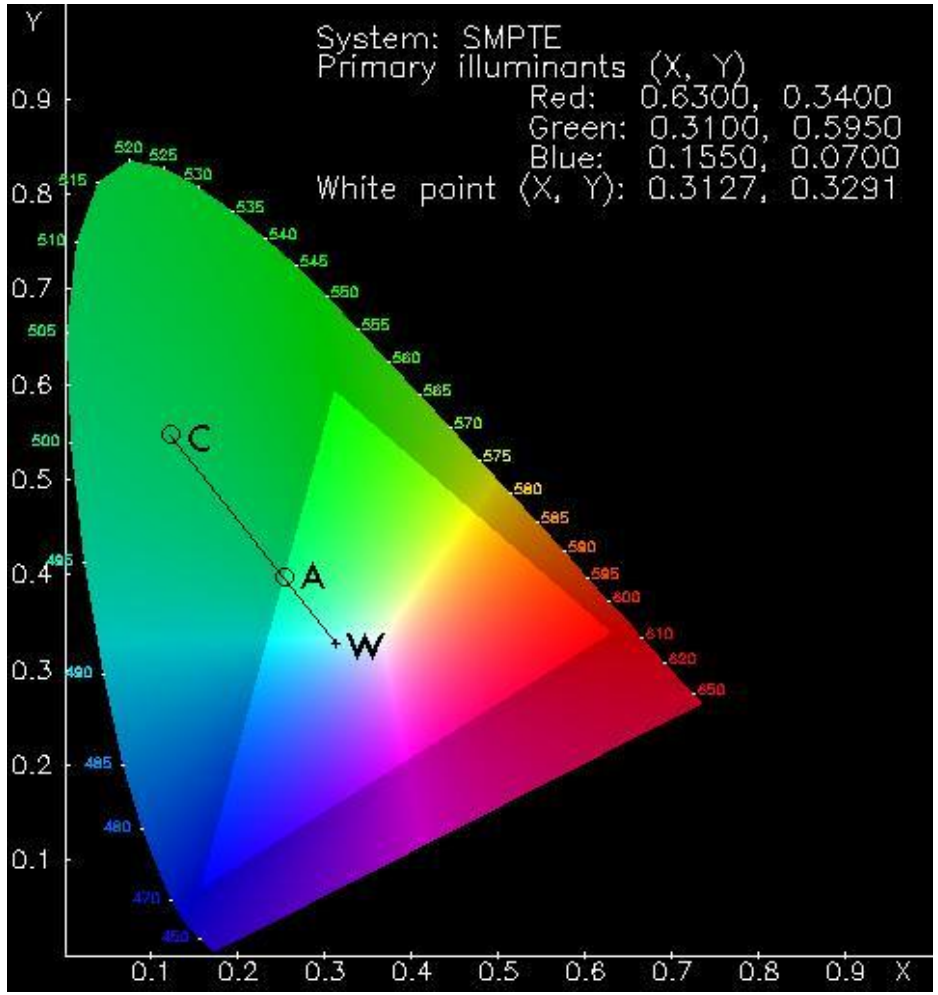
- y - luminance of a color
- x, z - chromaticity

xyz to RGB values

$$\begin{pmatrix} x_r & x_g & x_b \\ y_r & y_g & y_b \\ z_r & z_g & z_b \end{pmatrix} \begin{pmatrix} r \\ g \\ b \end{pmatrix} = \begin{pmatrix} x \\ y \\ z \end{pmatrix}$$

- RGB values can be adjusted with the luminosity
- Resulting RGB values can be negative – point outside of RGB "gamut"
  - Subtract from RGB until all values are ≥ 0

	Red		Green		Blue		White point	
System	x_r	y_r	x_g	y_g	x_b	y_b	x_w	y_w
hdtv	0.67	0.33	0.21	0.71	0.14	0.08	0.3127	0.3291
smpte	0.63	0.34	0.31	0.595	0.155	0.07	0.3127	0.3291
srgb	0.64	0.33	0.3	0.6	0.15	0.6	0.3127	0.3291

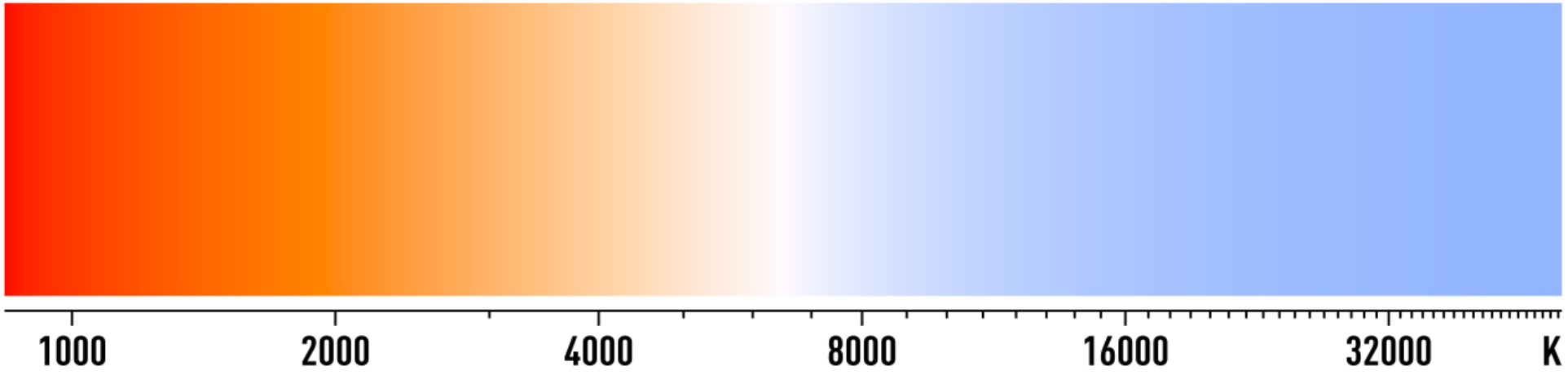


Black body

- The spectral radiance of a black body is given by the *Planck function*:

$$B(\lambda; T) = \frac{2hc^2}{\lambda^5} \frac{1}{\exp\left(\frac{hc}{\lambda k_B T}\right) - 1}$$

  - h – Planck constant
  - c – speed of light in vacuum
  - k – Boltzmann constant



Assignment

- Compute RGB Color of Black body at temperature
  - ((# in table) – 5) x 1000 K (example Roman Durikovic #5 -> 0 x 1000 = 0 K)
  - Create program in any programing language or use excel
  - Send corresponding color and RGB values
  - https://scipython.com/static/media/blog/colours/cie-cmf.txt
  - Use values from table for **HDTV**

- Deadline 7.10. 10:40
- Send to daniel.kyselica@fmph.uniba.sk