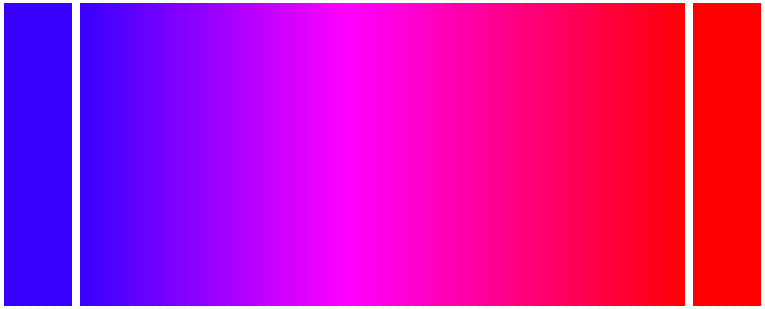
Computer Image Processing

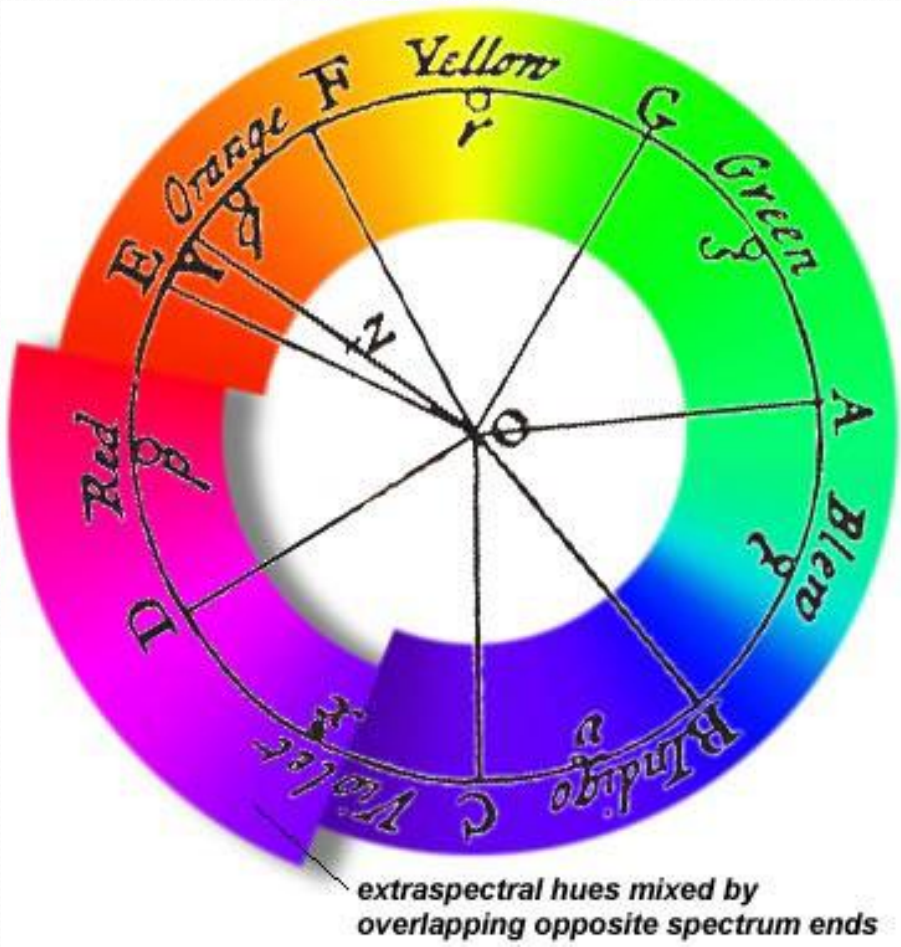
Lecture 5

Colour measurement

Colour models

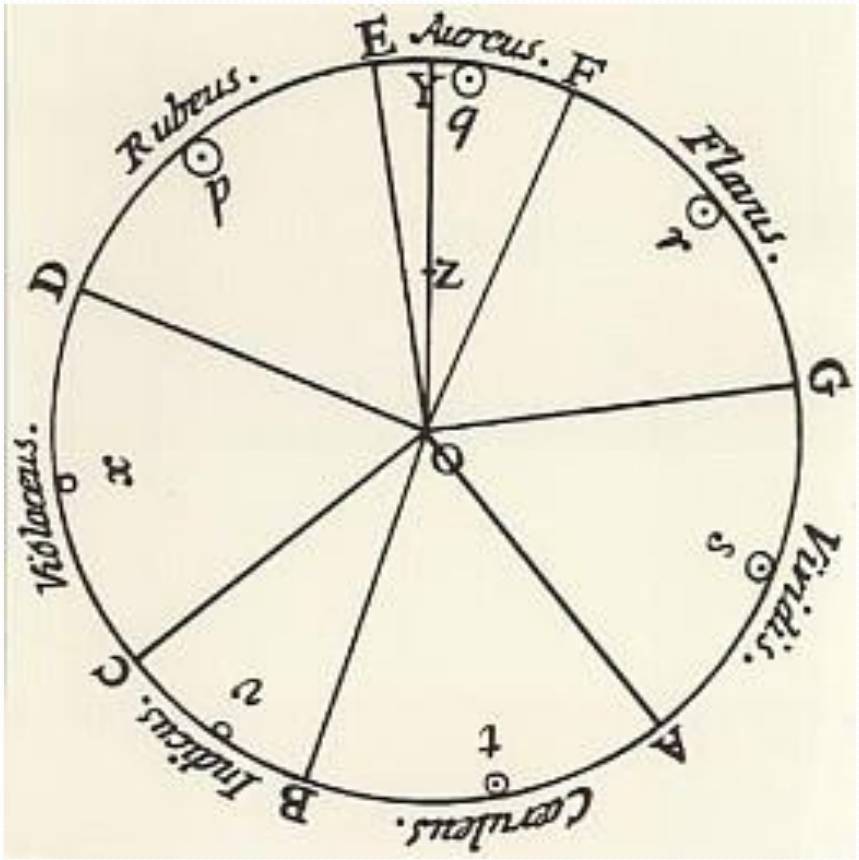
Some history

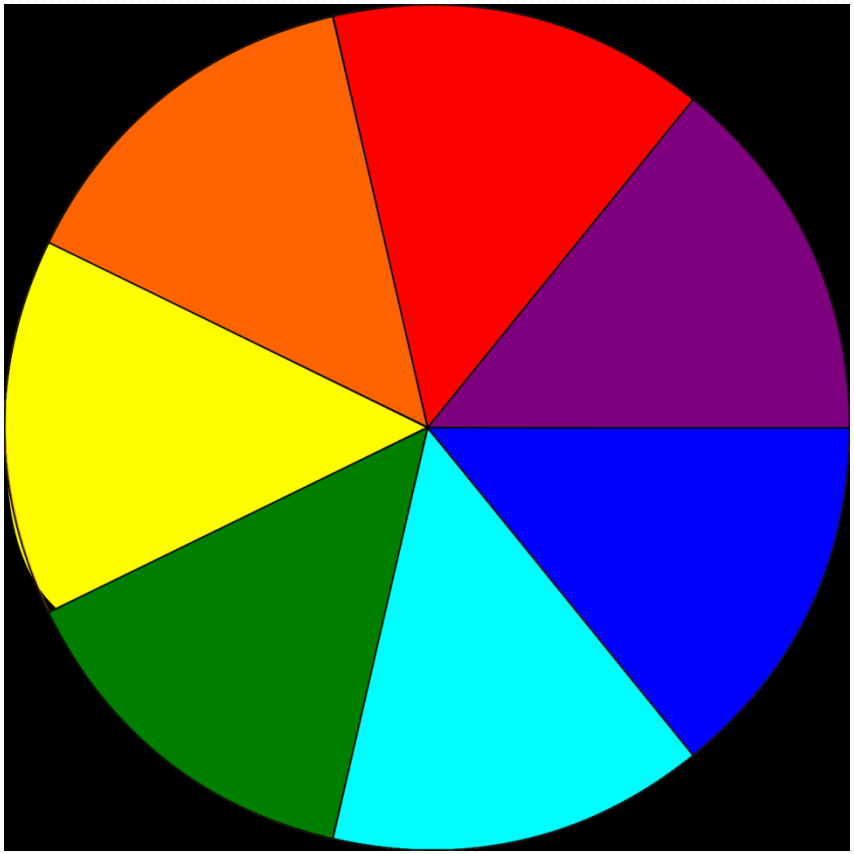




Some history

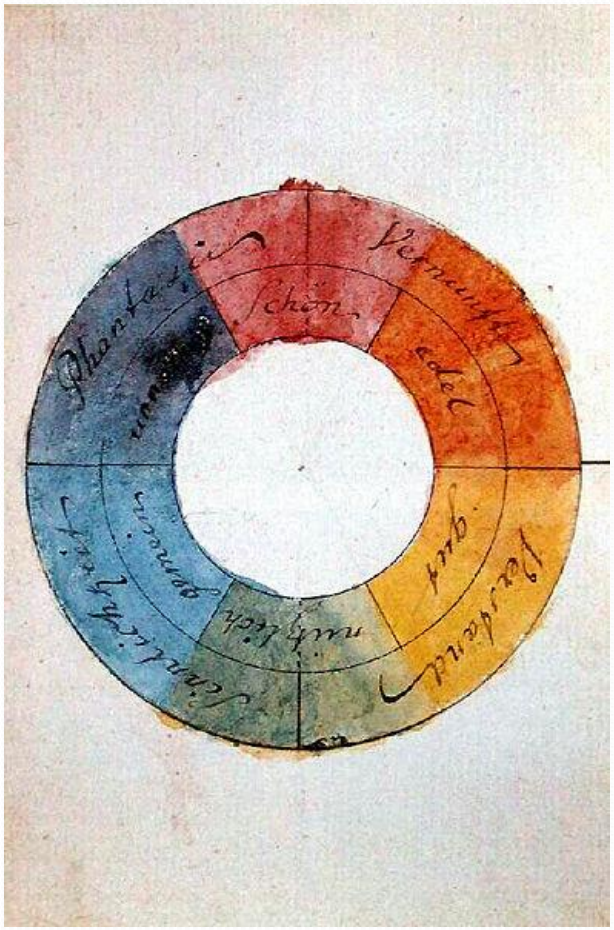
Issac Newton (1666 r.)

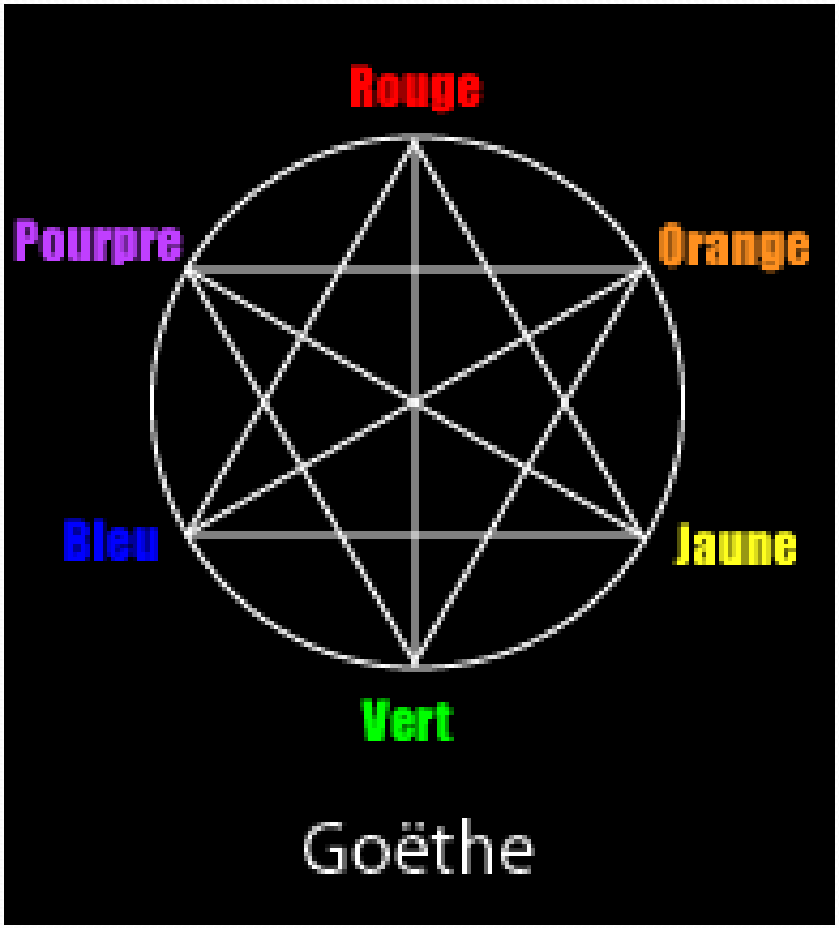




Some history

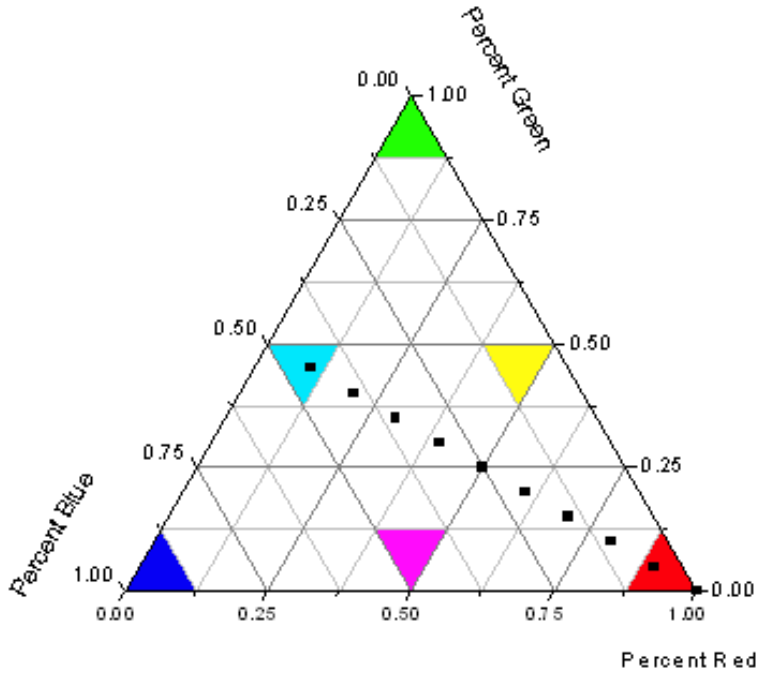
Johann Wolfgang Goethe (1810 r.)

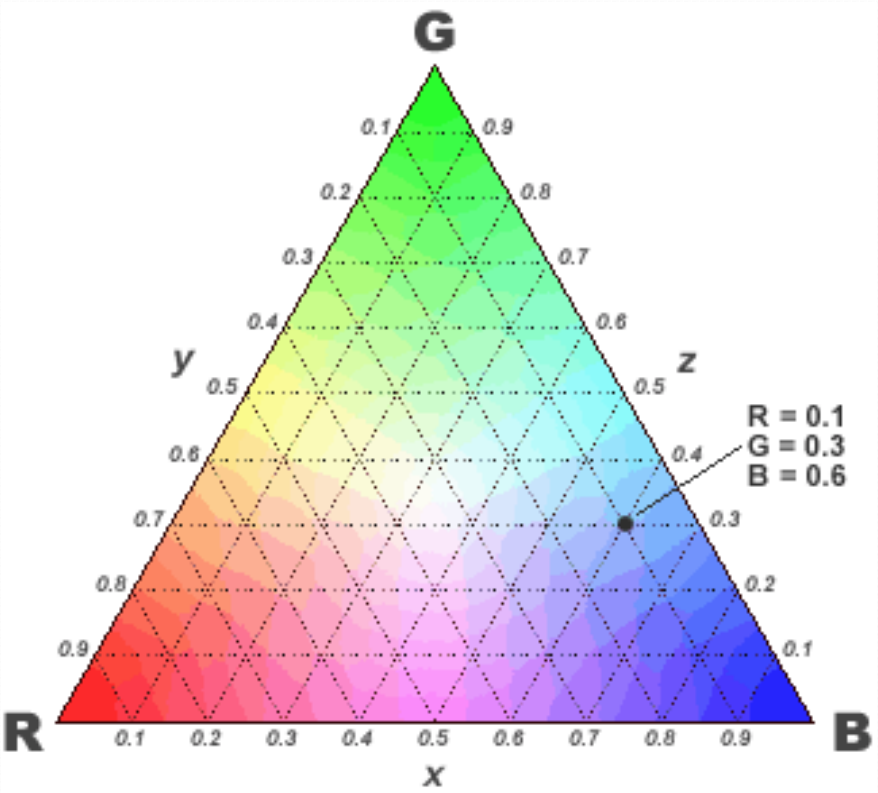




Some history

James Clerck Maxwell (1859 r.)





Subjective methods

PANTONE

Samples that are part of the PMS (Pantone Matching System).

The basic scale describes 1761 colors marked with numbers with additional descriptions such as metallicity.

Subjective methods

PANTONE

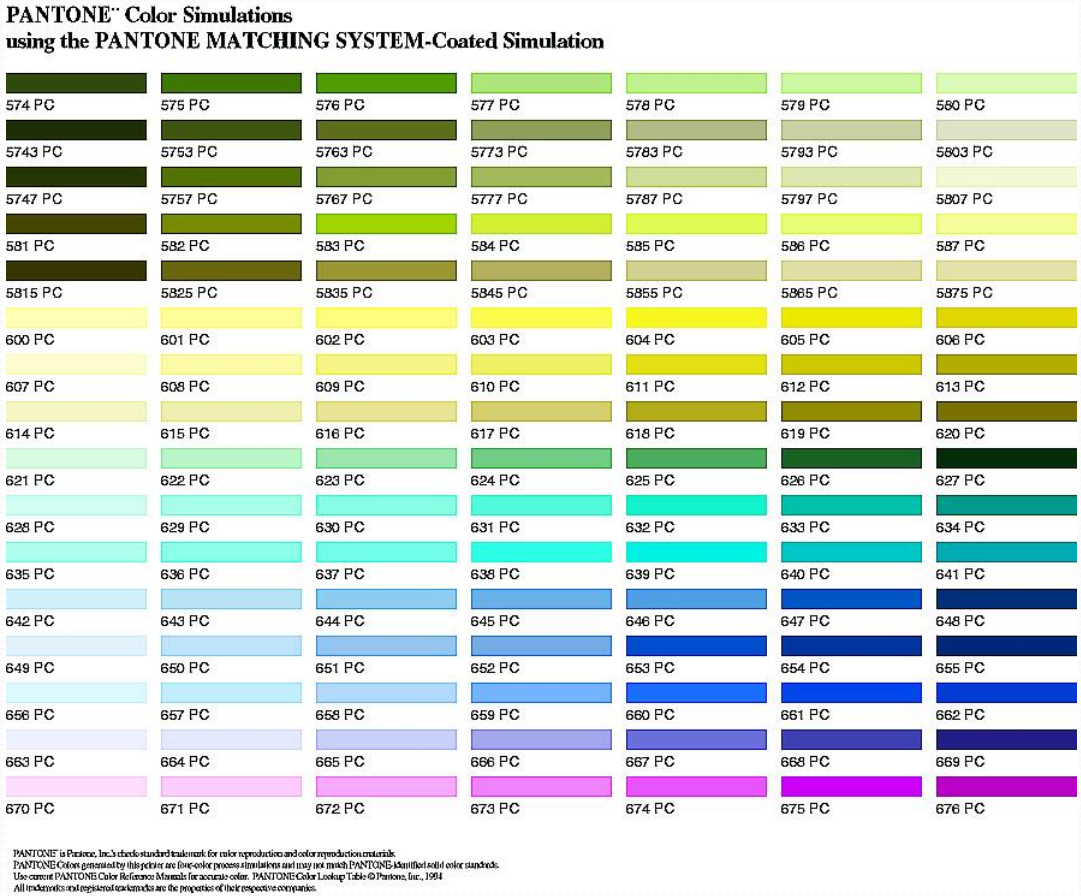
Each of the shades corresponds with ready paint or recipe to mixing paints.

They are formed by mixing 18 pigments.

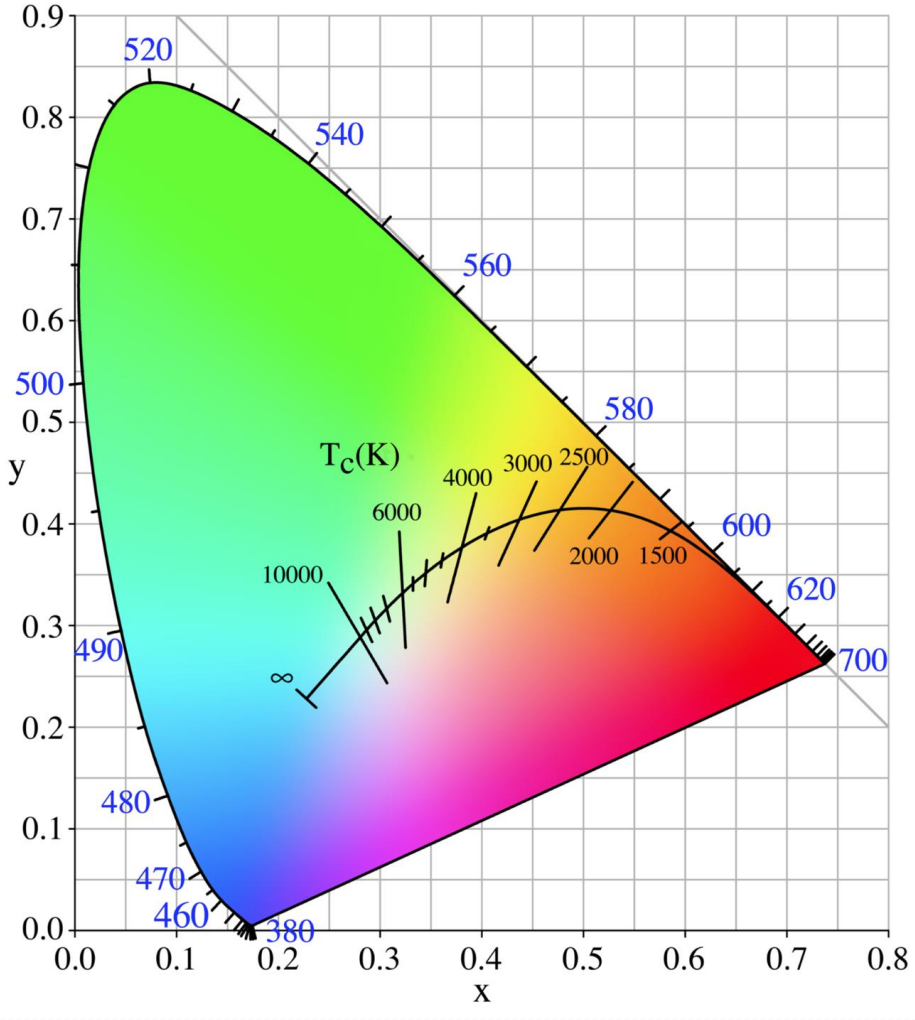
The samples include

type of substrate for which

dyes are applied.



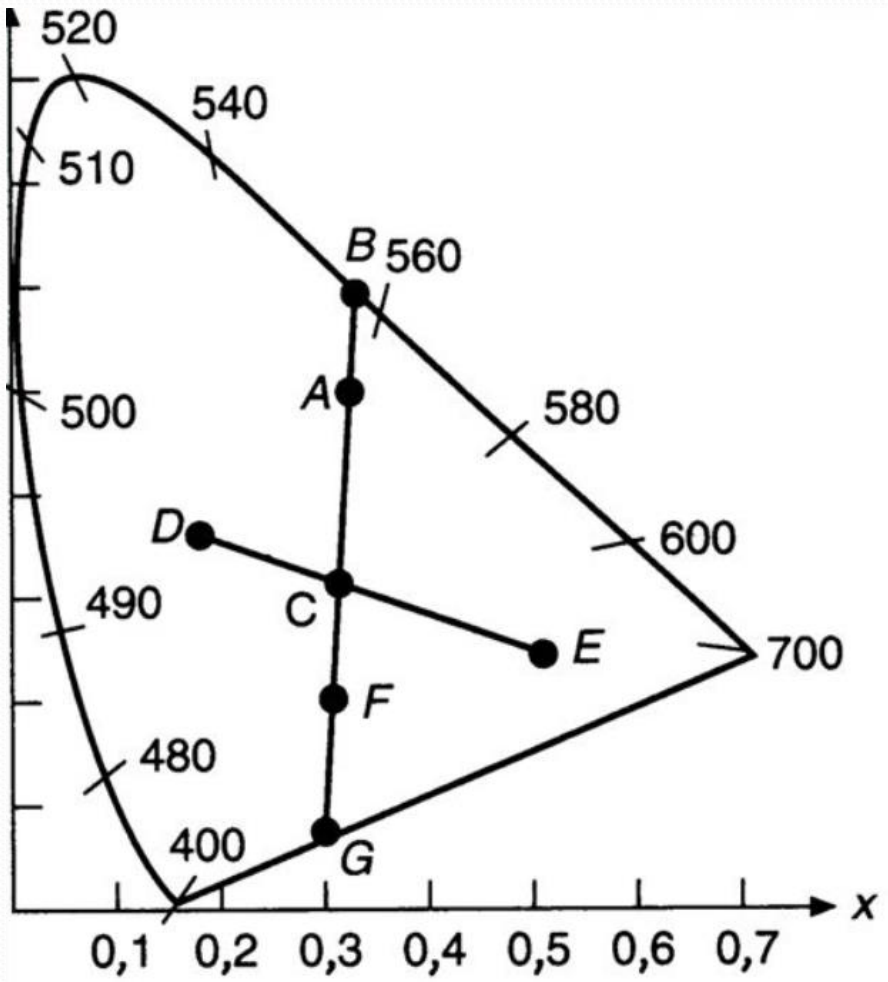
Chromaticity diagram



Chromaticity diagram

Colour dependencies in chromaticity diagram:

- C „standard” white
- the dominant wavelength for color A is pure light with a spectral color at point B
- AC to BC ratio (in percent) is the purity of the color A
- colours D and E are complementary
- F – unspectral color
- purple and magenta are determined by the complementary wavelength



Colour models

Colour models used in computer graphics:

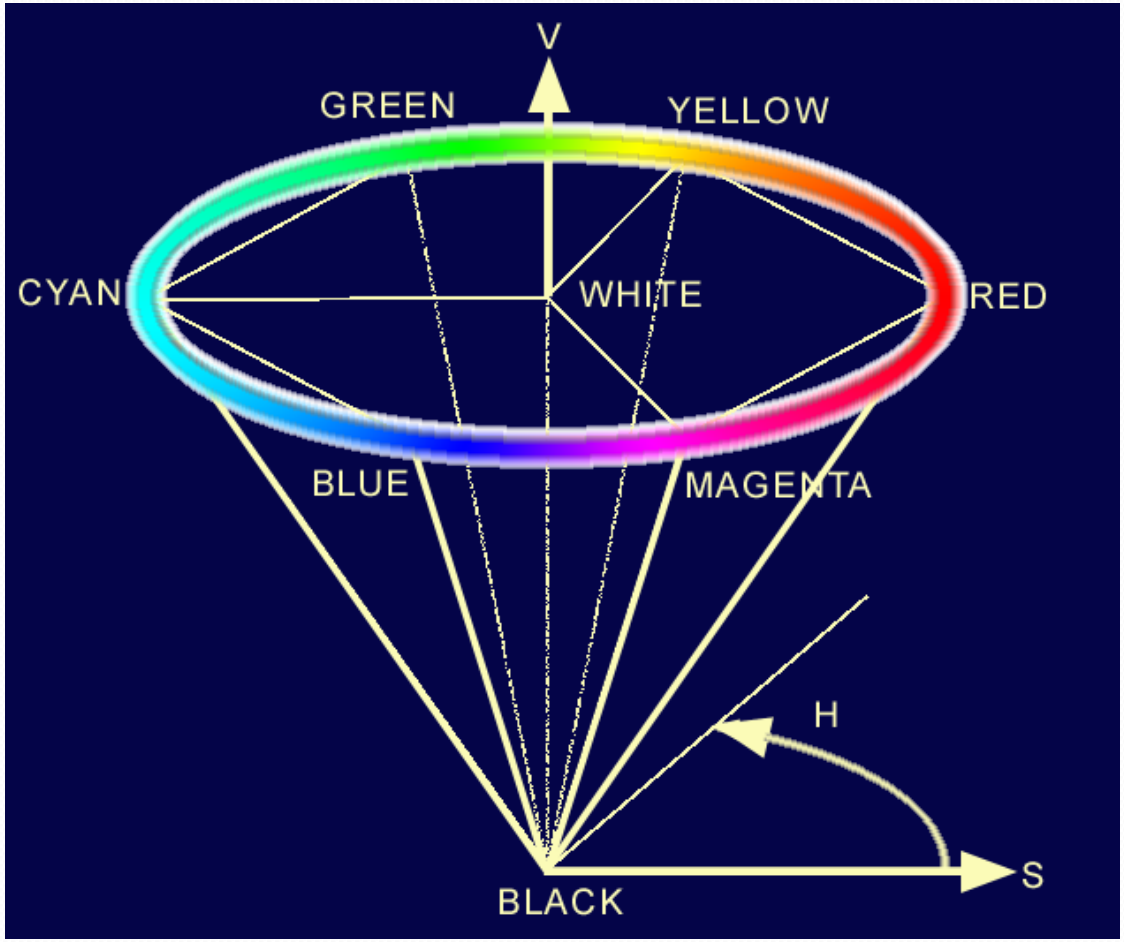
- User-oriented – HSV
- Device-oriented RGB, CMY
- Independent – CIE La*b*

Colour models - HSV

H – Hue

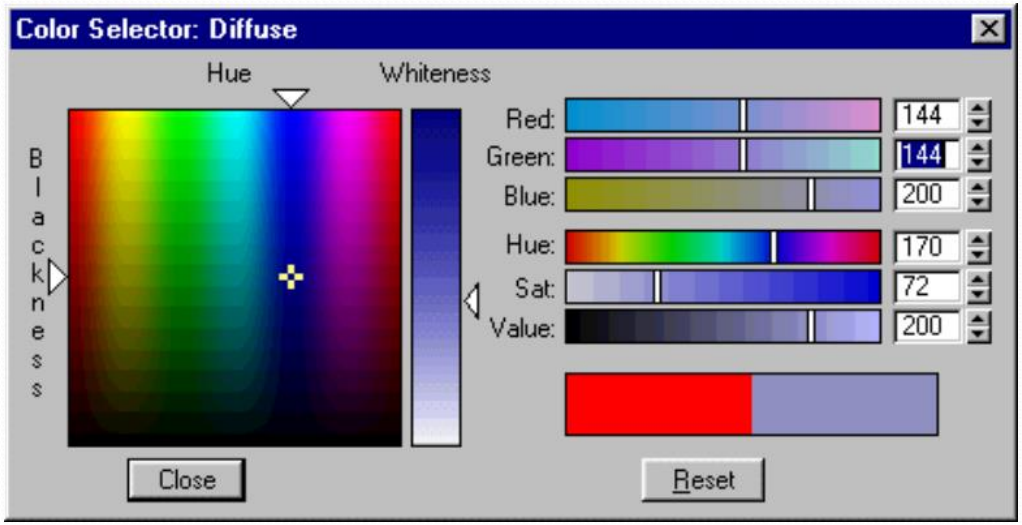
S – Saturation

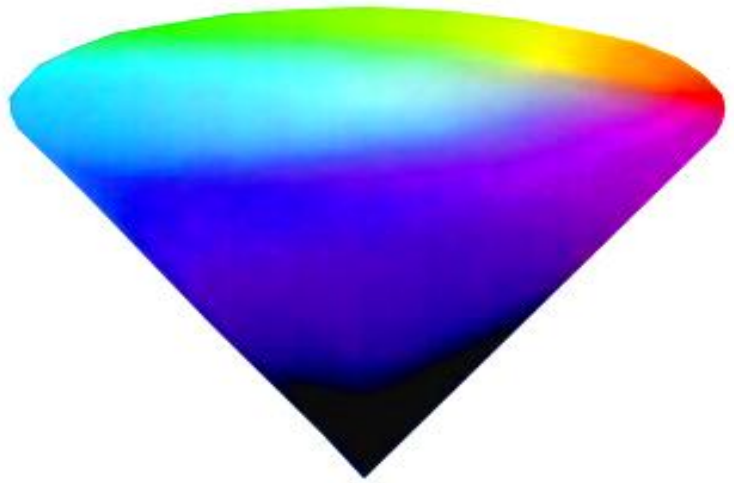
V - Value



Colour models - HSV

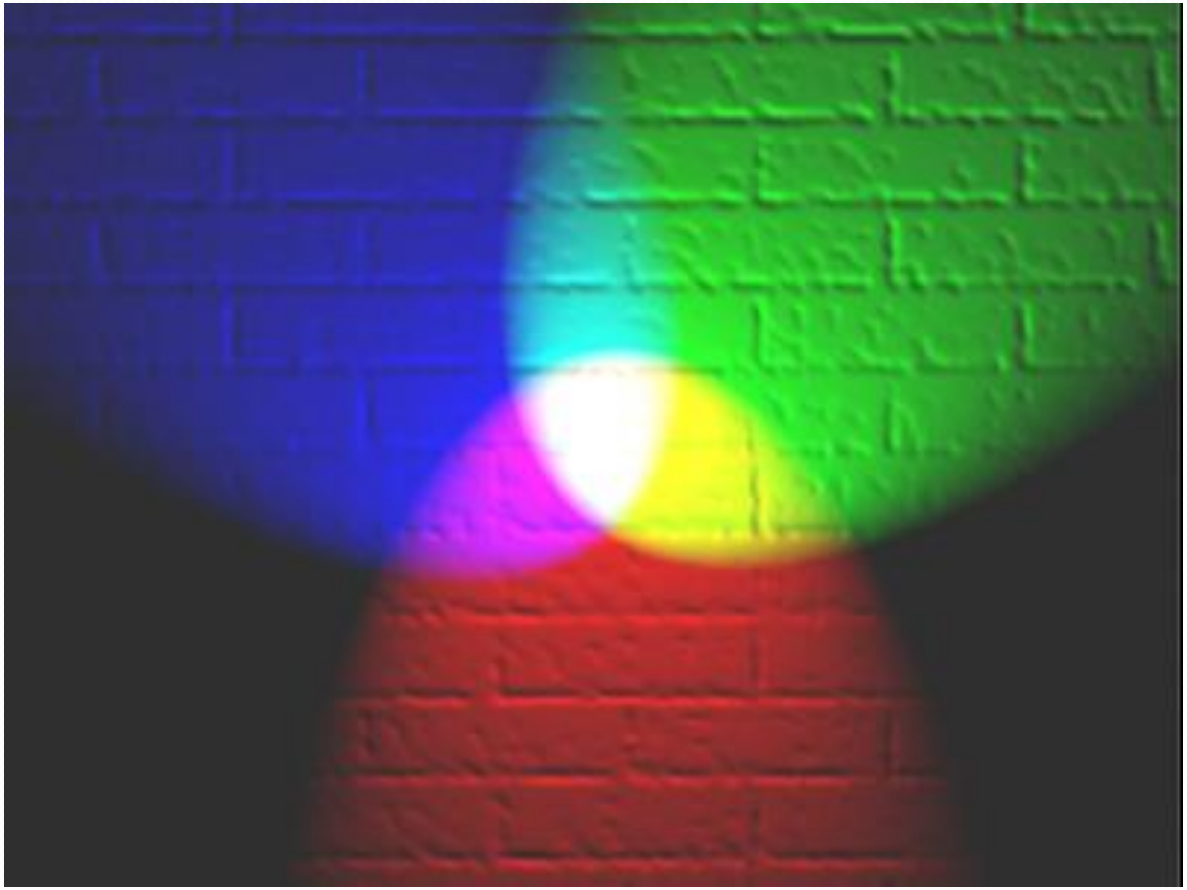
HSV model





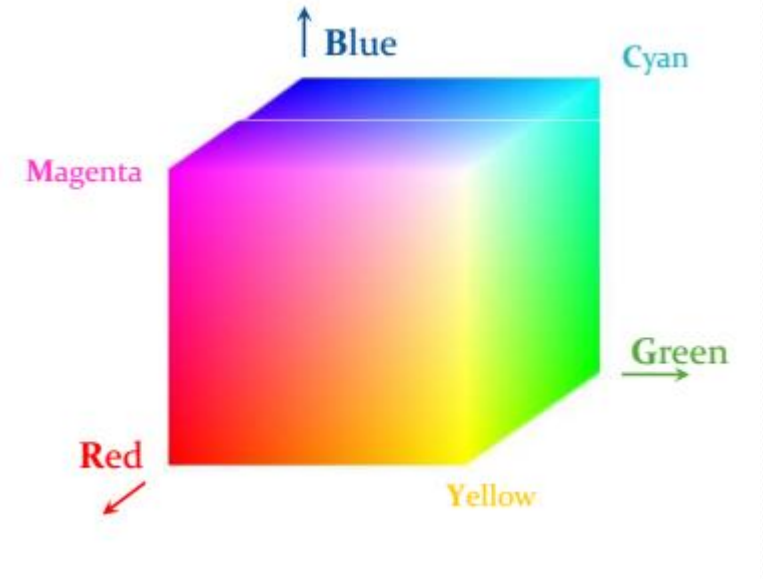
Colour models

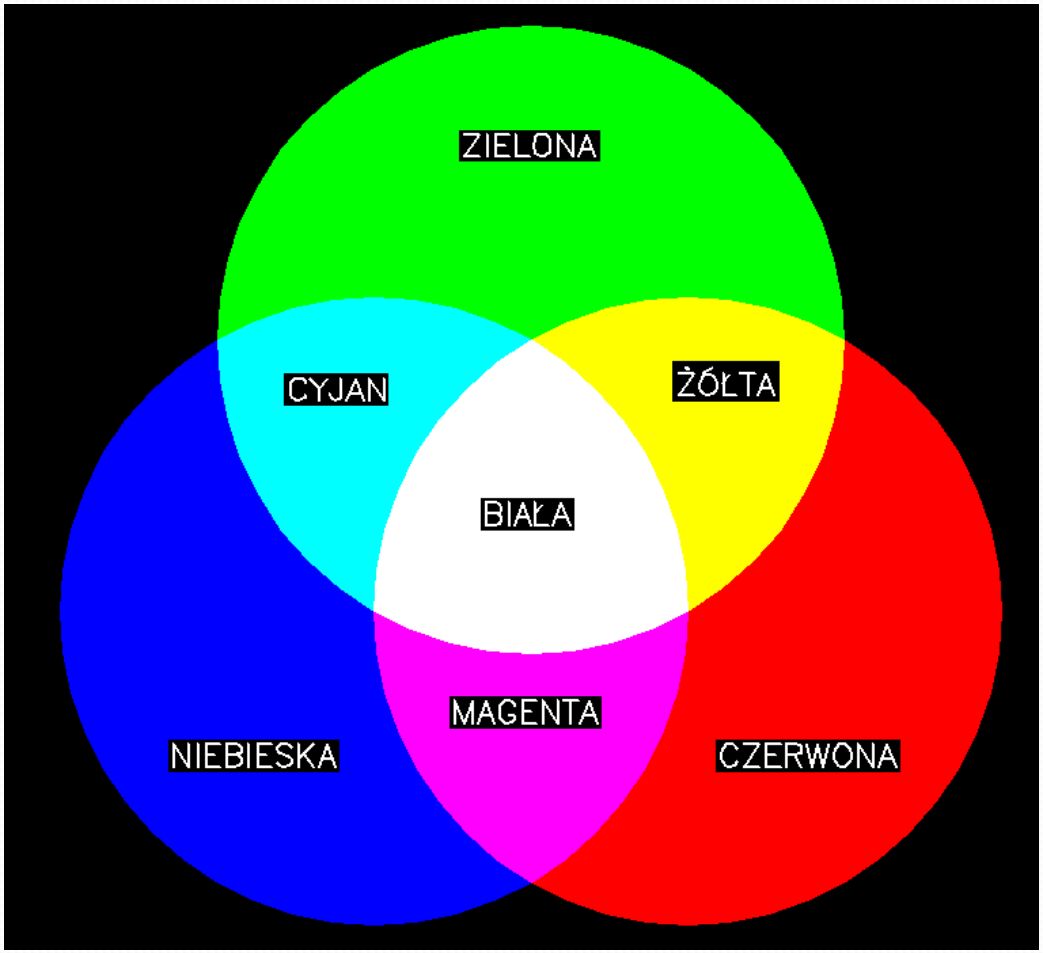
Additive model (oriented on display equipment)



Colour models

Additive model





Colour models

Additive model (RGB)

R = 1,0,0

G = 0,1,0

B = 0,0,1

C = 0,1,1

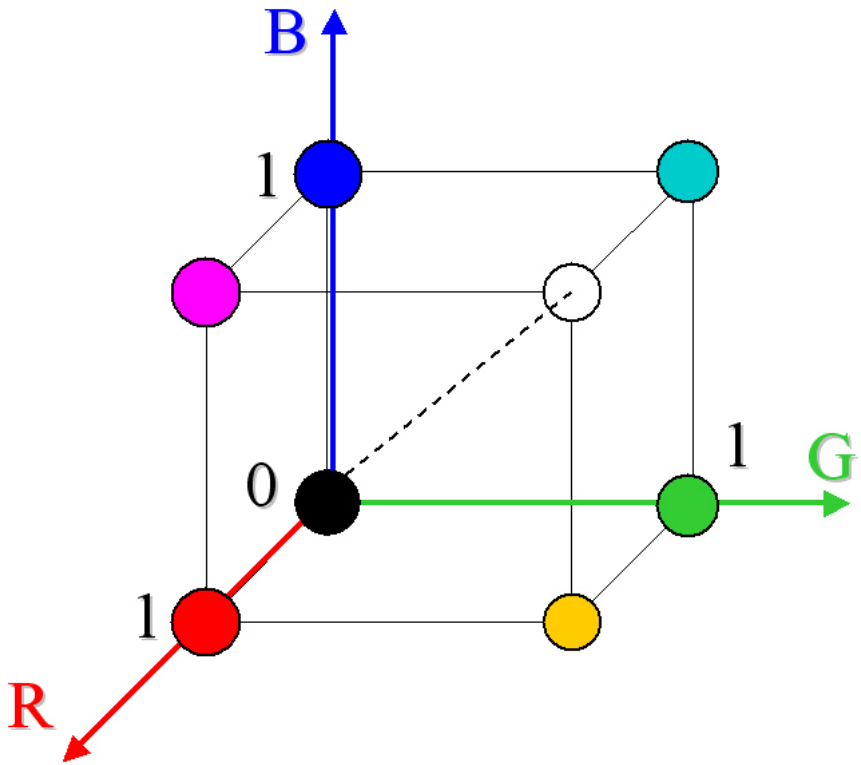
M = 1,0,1

Y = 1,1,0

black = 0,0,0

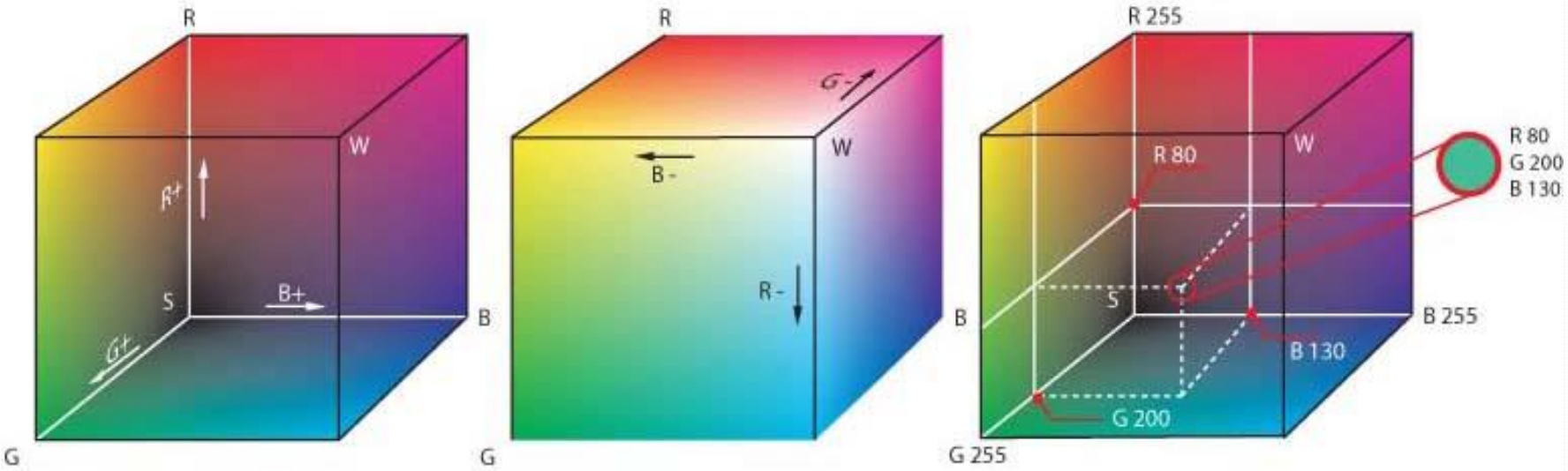
white = 1,1,1

gray = 0.5,0.5,0.5



Colour models

Additive model (RGB)

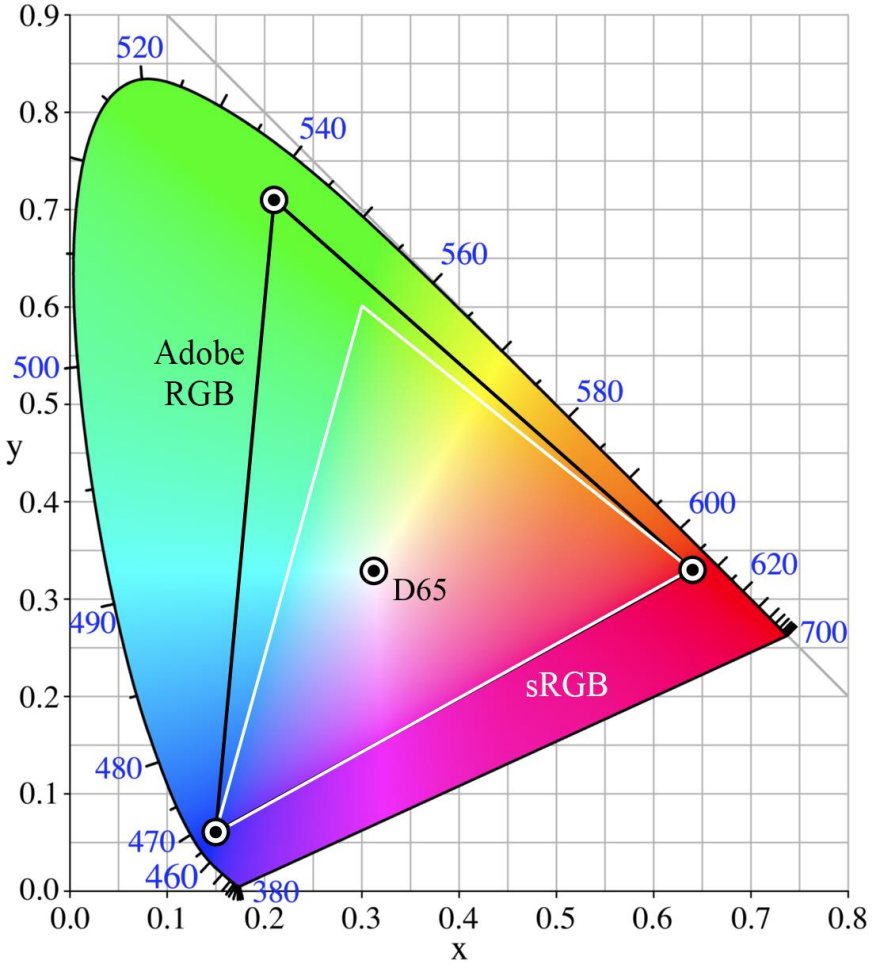


Colour models

1911 - photography made with the use of colour filters and three exposures

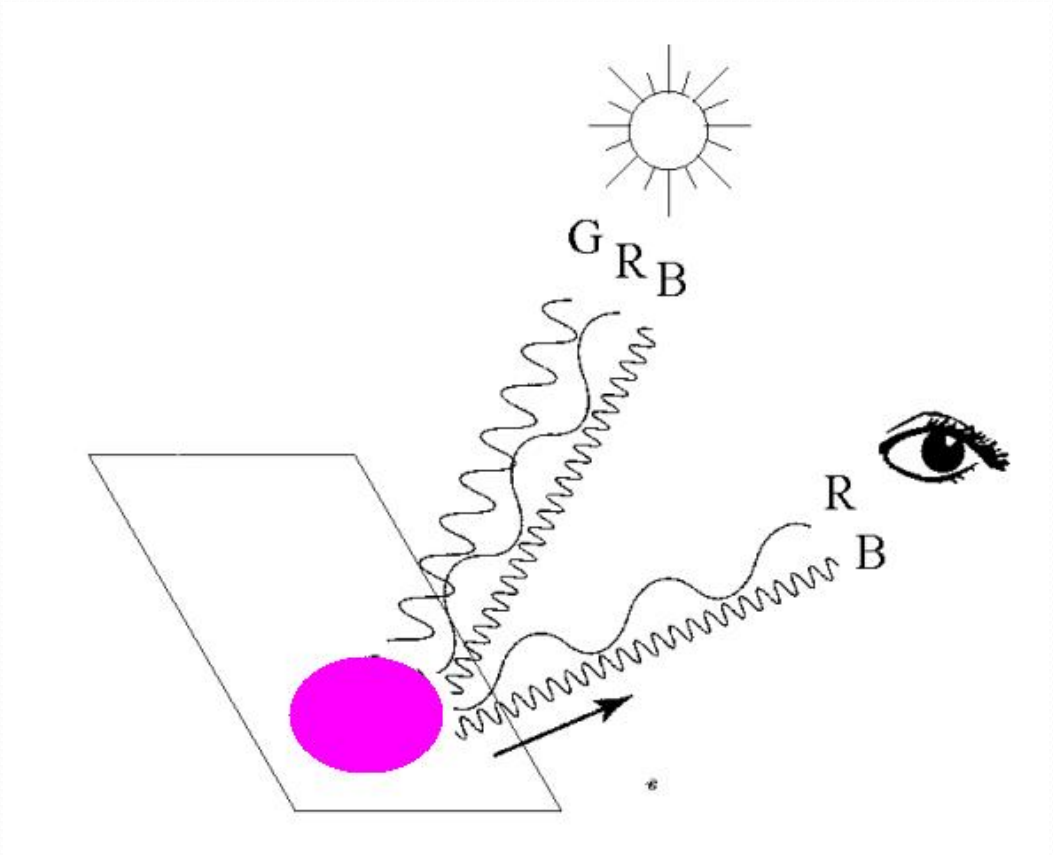
Gamut

In color reproduction, including computer graphics and photography, the **gamut** is a certain complete subset of colors. The most common usage refers to the subset of colors which can be accurately represented in a given circumstance, such as within a given color space or by a certain output device.



Colour models

Subtractive model (oriented on printing equipment)



Colour models

Subtractive model (CMY)

C = 1,0,0

M = 0,1,0

Y = 0,0,1

R = 0,1,1

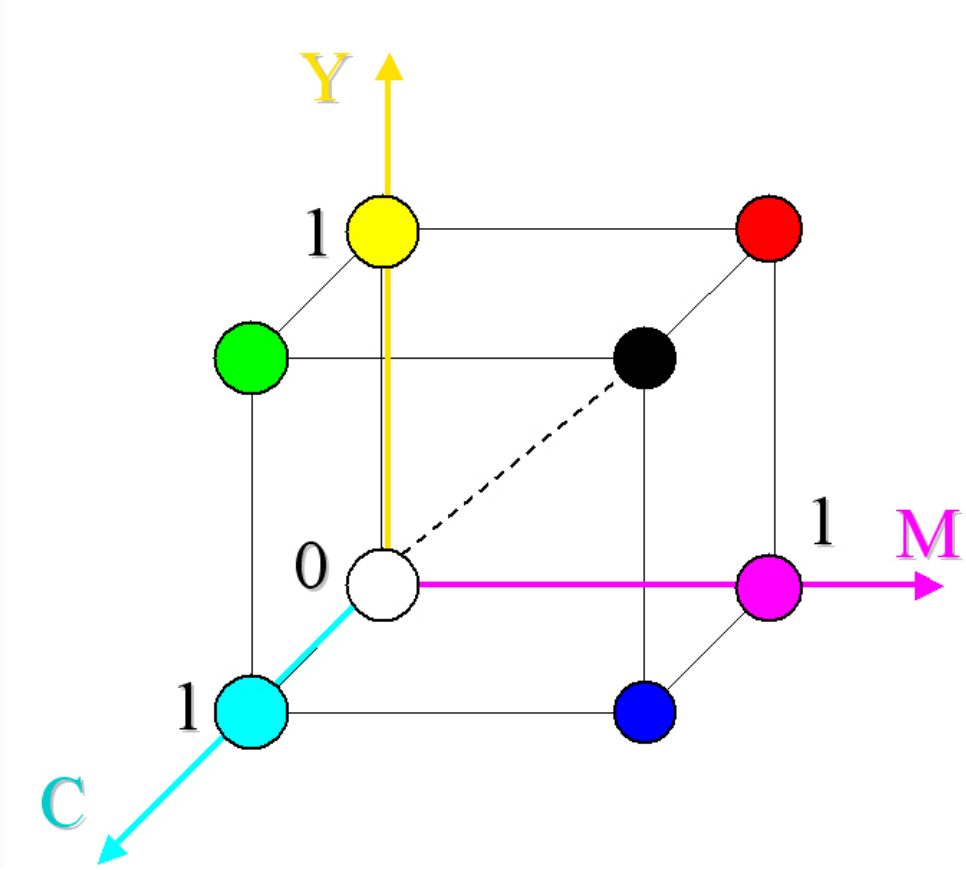
G = 1,0,1

B = 1,1,0

black = 1,1,1

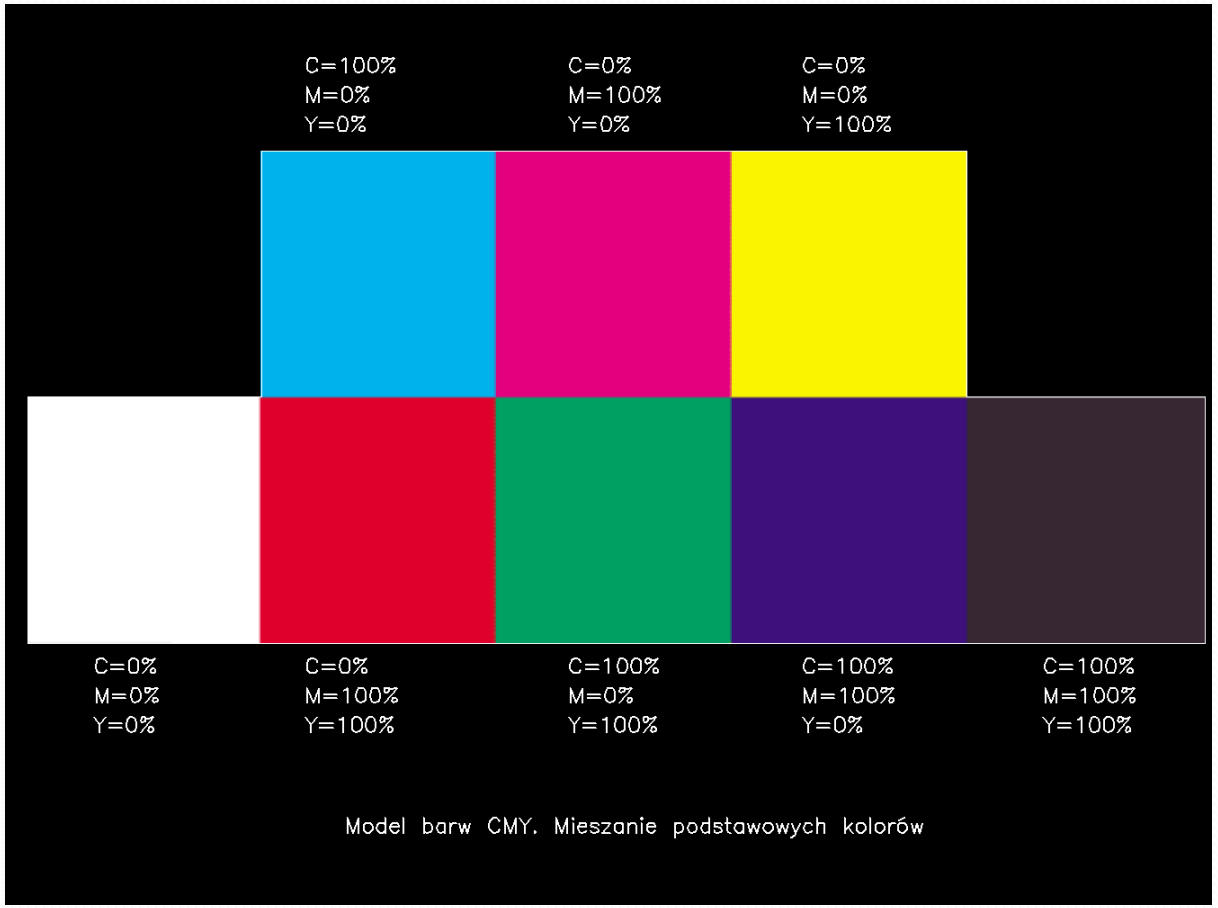
white = 0,0,0

gray = 0.5,0.5,0.5



Colour models

CMY colour space



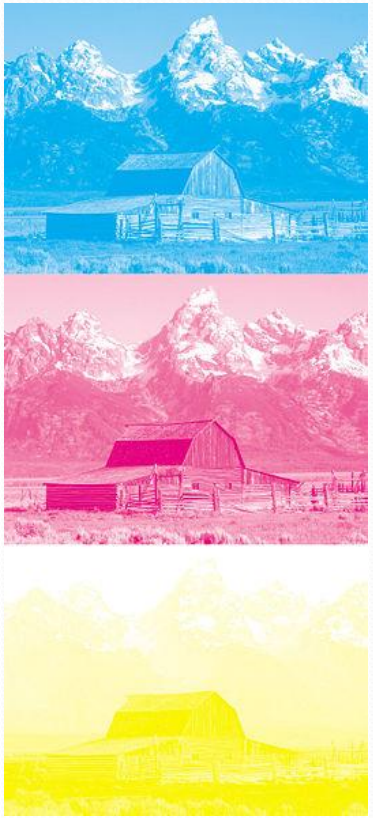
Colour models

CMYK model

In the CMY model, gray is obtained by mixing equal amounts of three basic colors (C=M=Y). In the CMYK model it is generated by the fourth primary color - blacK

	C	M	Y	C	M	Y	K
		0.2	0.5		0.2	0.5	
	0.4	0.4	0.4				0.4
	0.4	0.6	0.9		0.2	0.5	0.4

Colour models



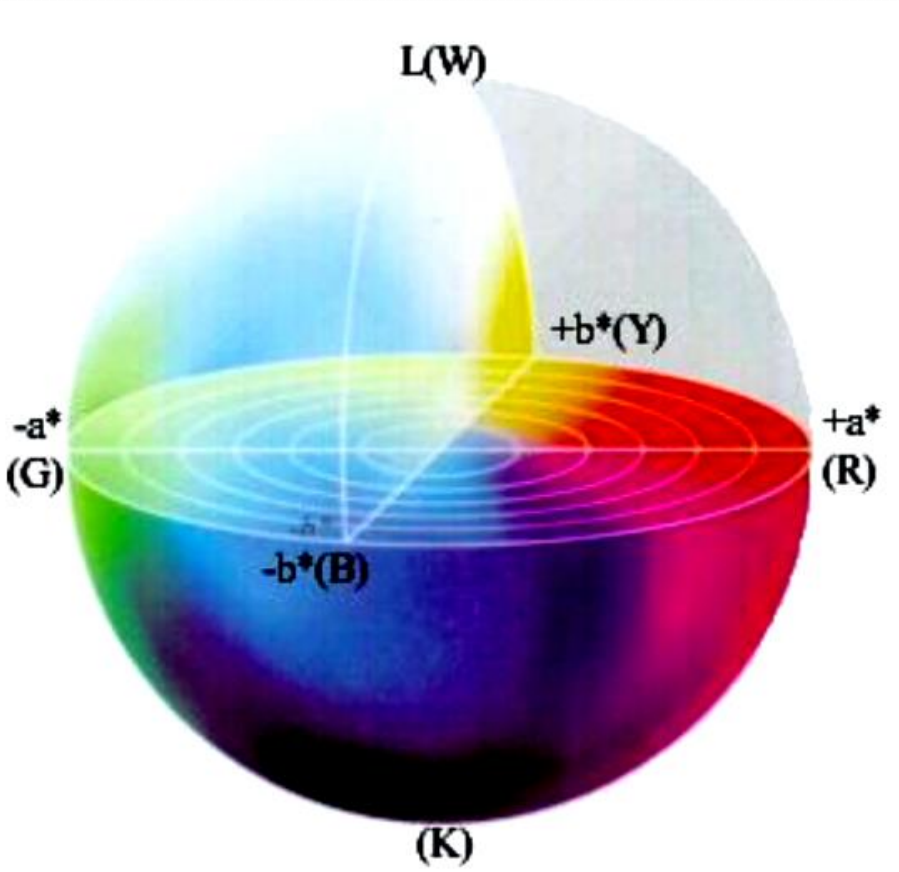
Colour models

CIE La*b*

It contains the widest mathematically defined colour space, which was created as a result of the transformation of a CIE cone.

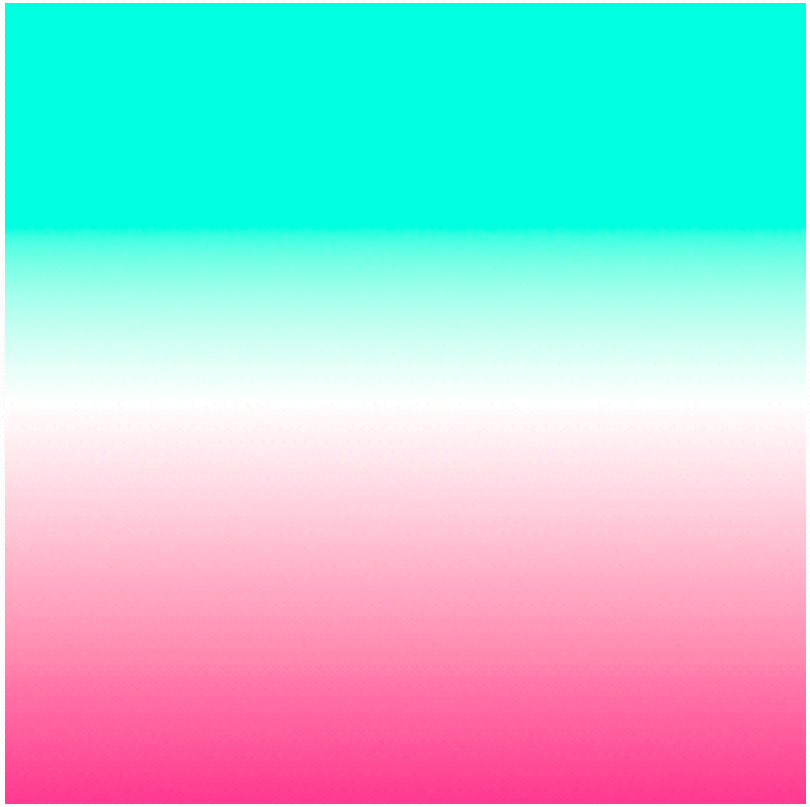
The most important computer graphics model, used for calculations on colours by CMS (Color Management Systems).

The colours are described mathematically by three components : *L* - brightness (luminance) and two channels - *a* and *b*.

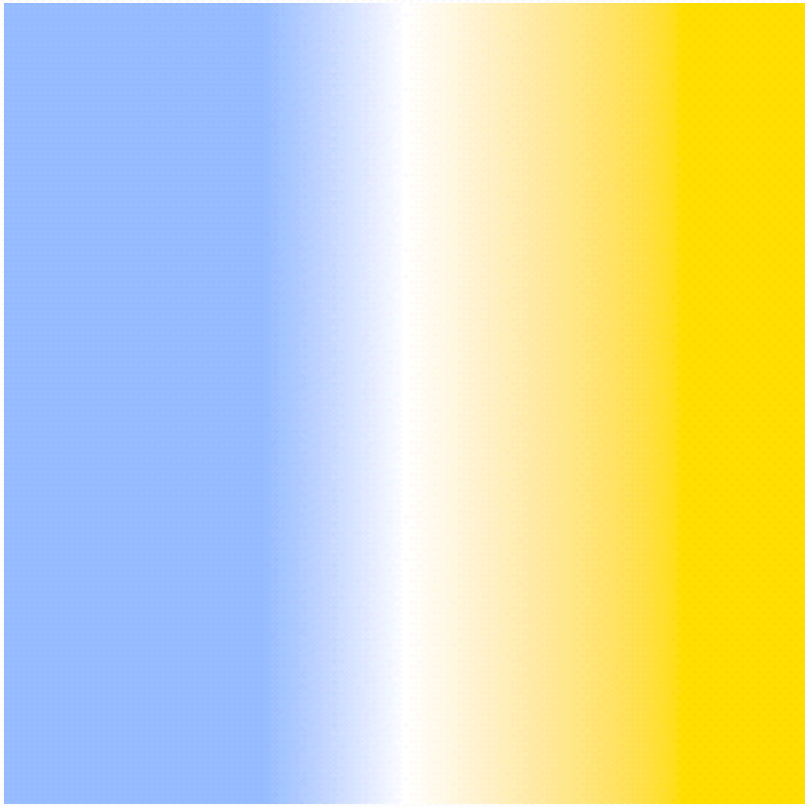


Colour models

CIE La*b*



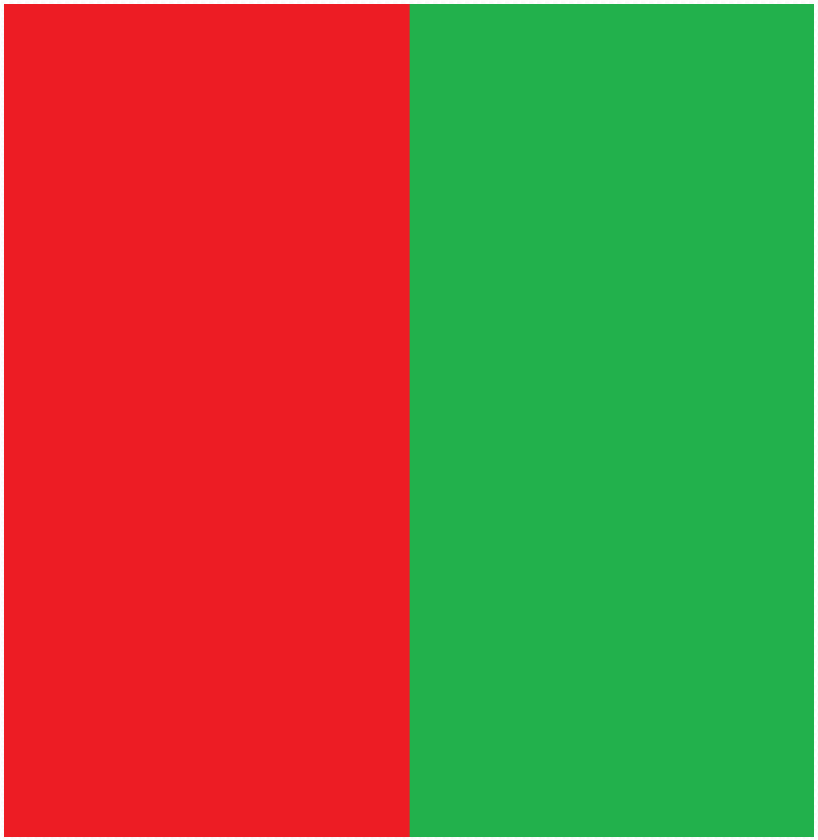
channel a

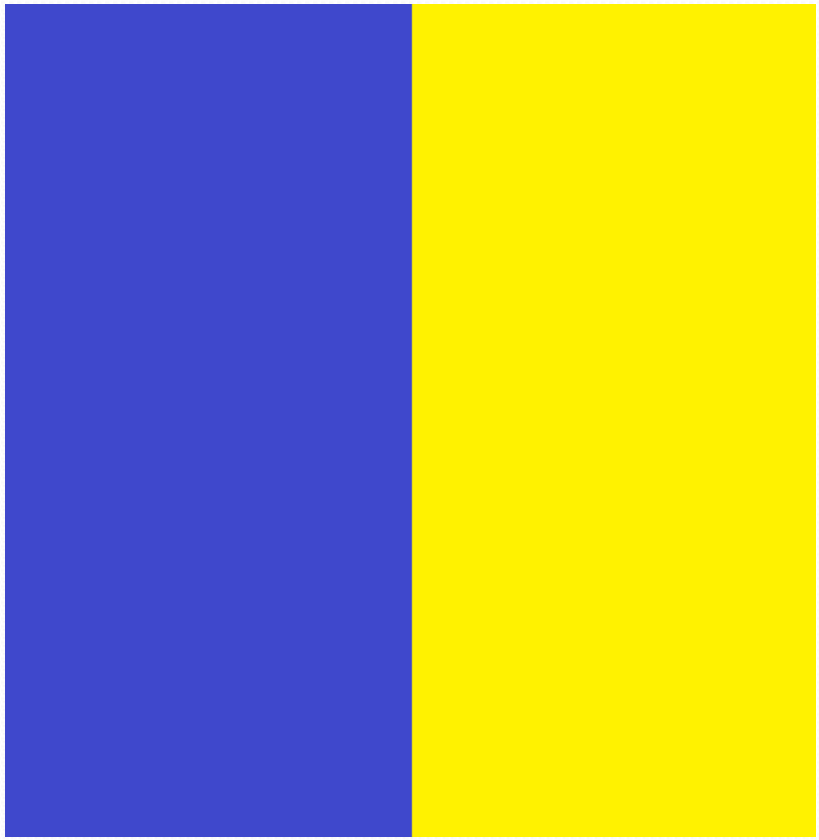


channel b

Colour models

„Impossible" colours





Colour models