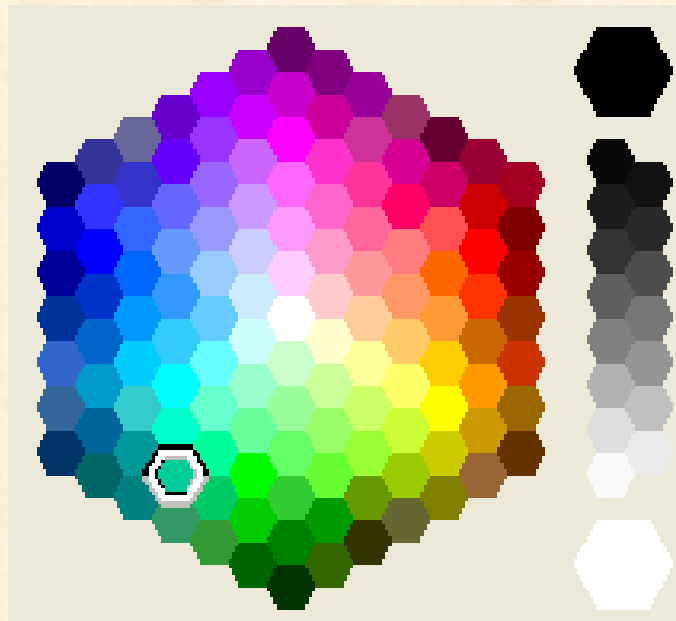
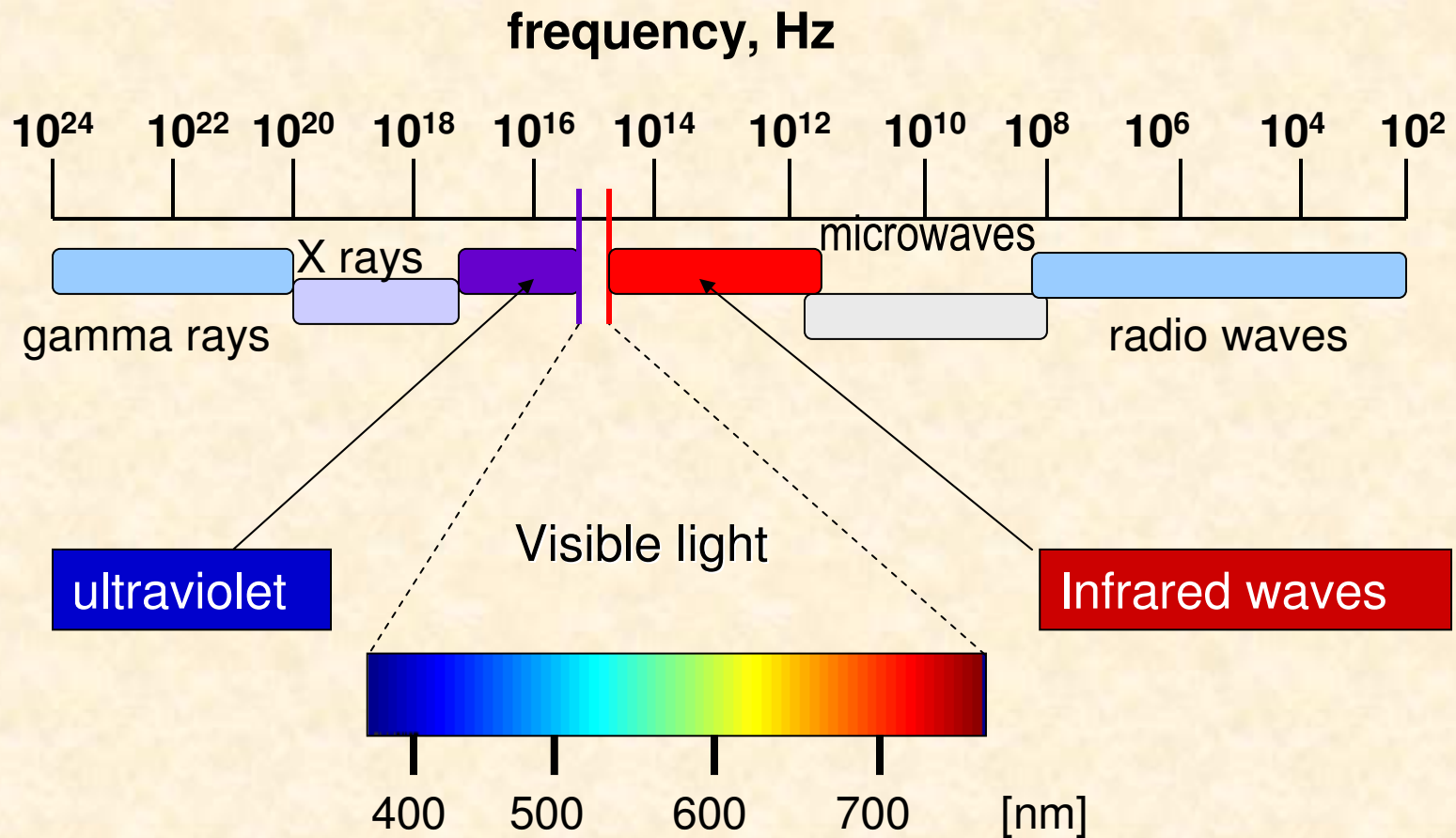


# Processing of colour images

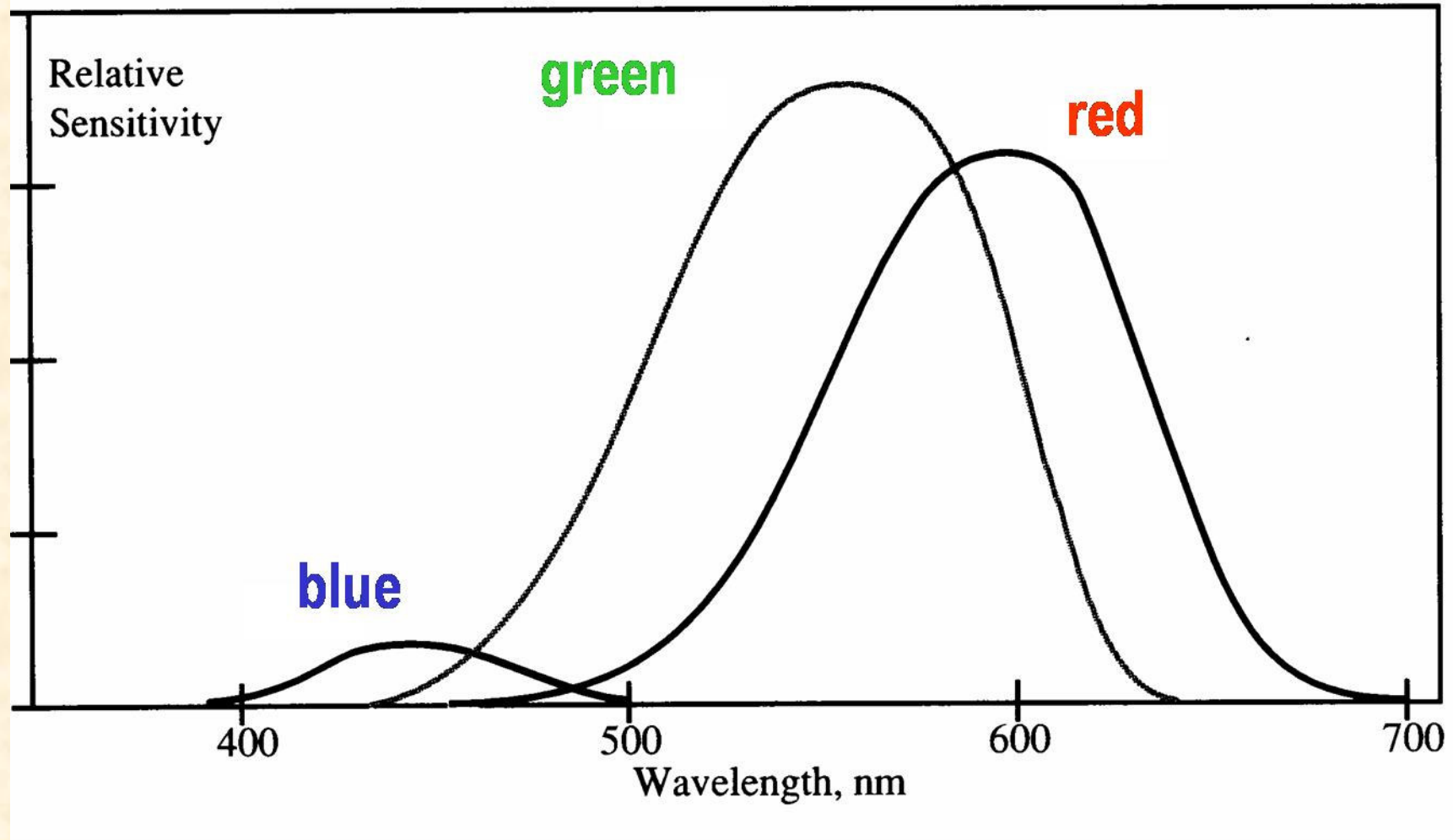
- ❑ Colour representation schemes
- ❑ Filtering of colour images



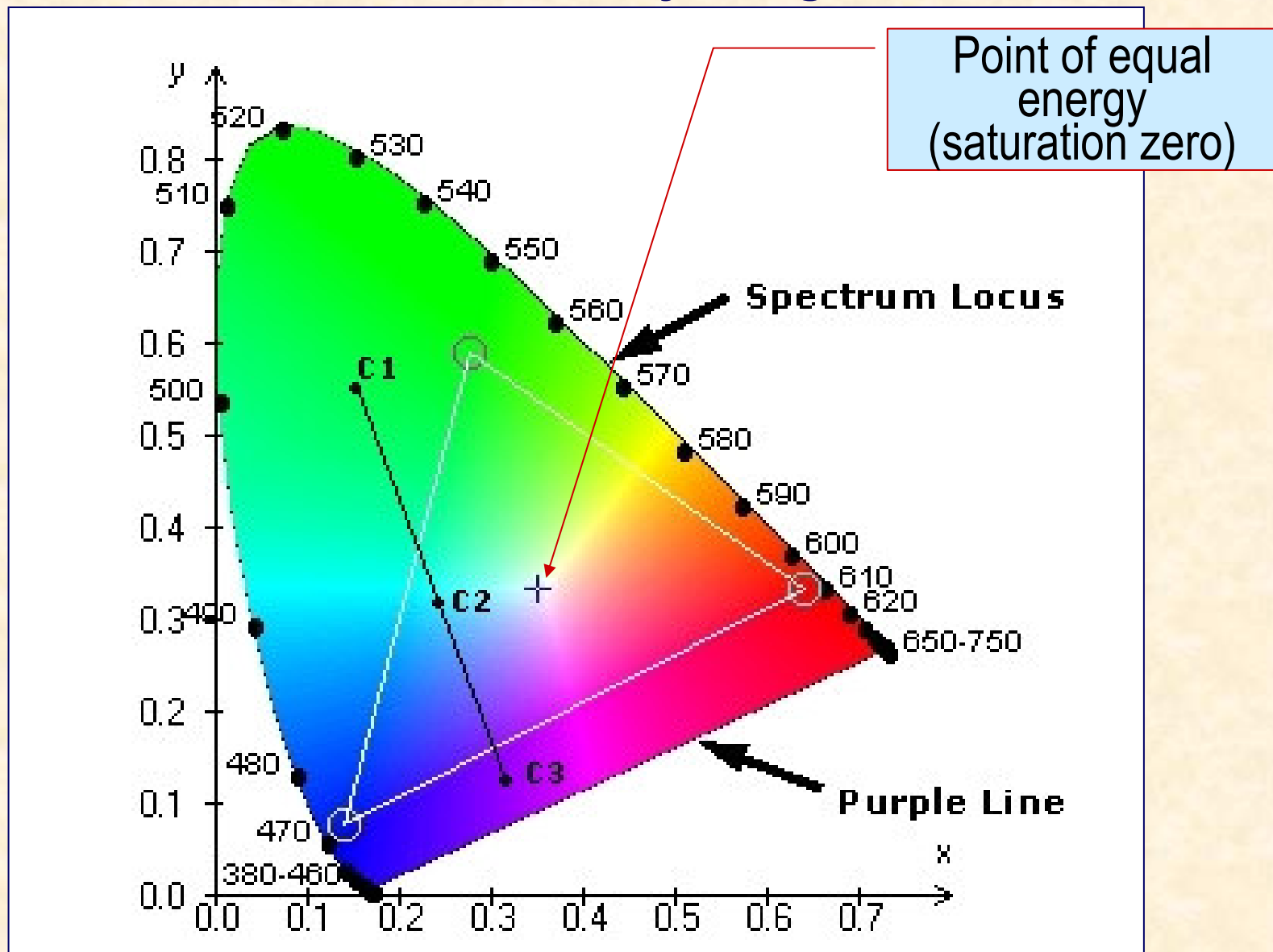
# Electromagnetic spectrum



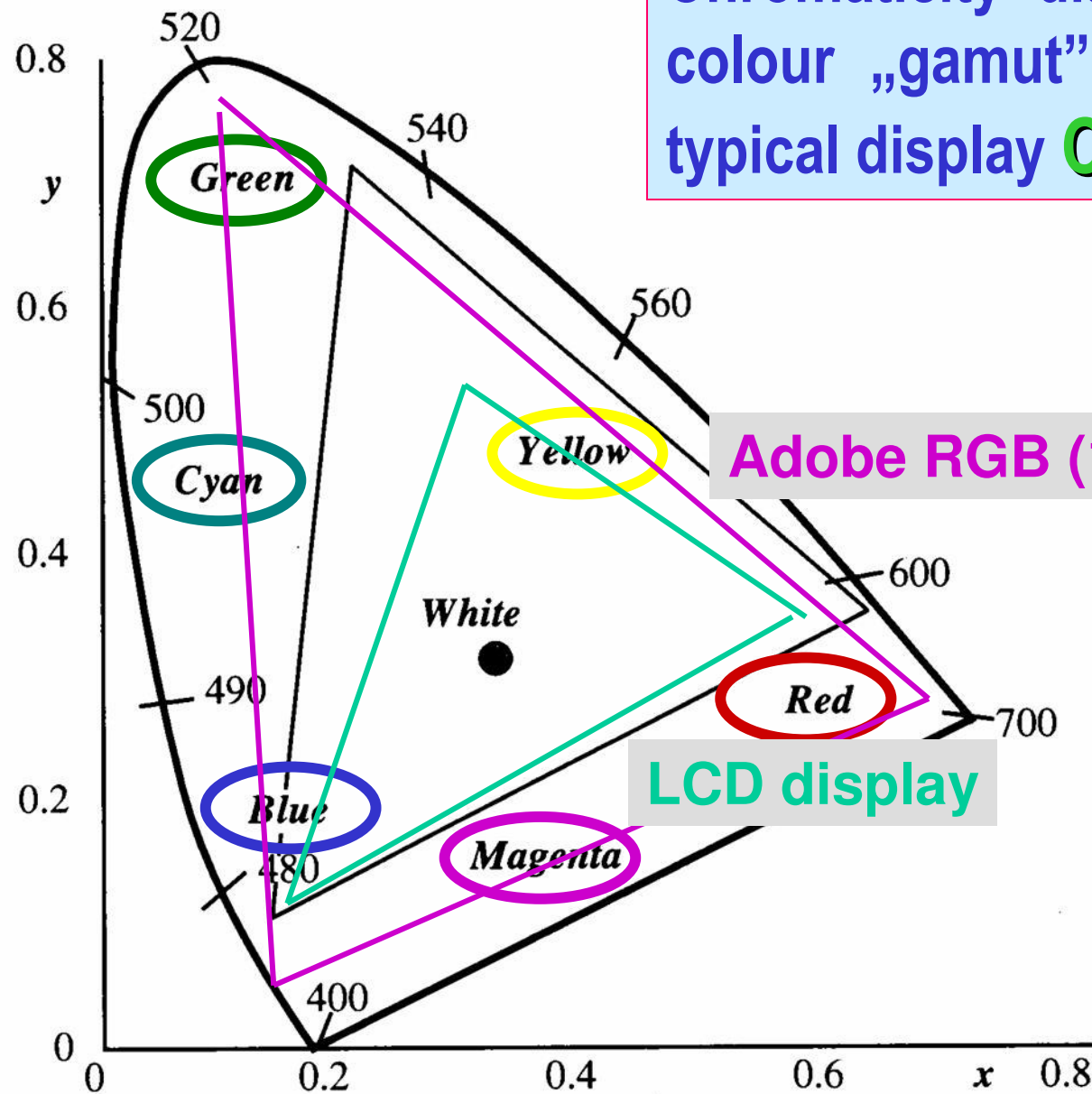
# Eye sensitivity to colour components



# Commission Internationale de l'Eclairage (CIE) Chromaticity Diagram



Chromaticity diagram and a typical colour „gamut” (the triangle) for a typical display **CRT** device

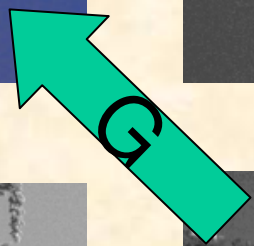


Adobe RGB (1998) space

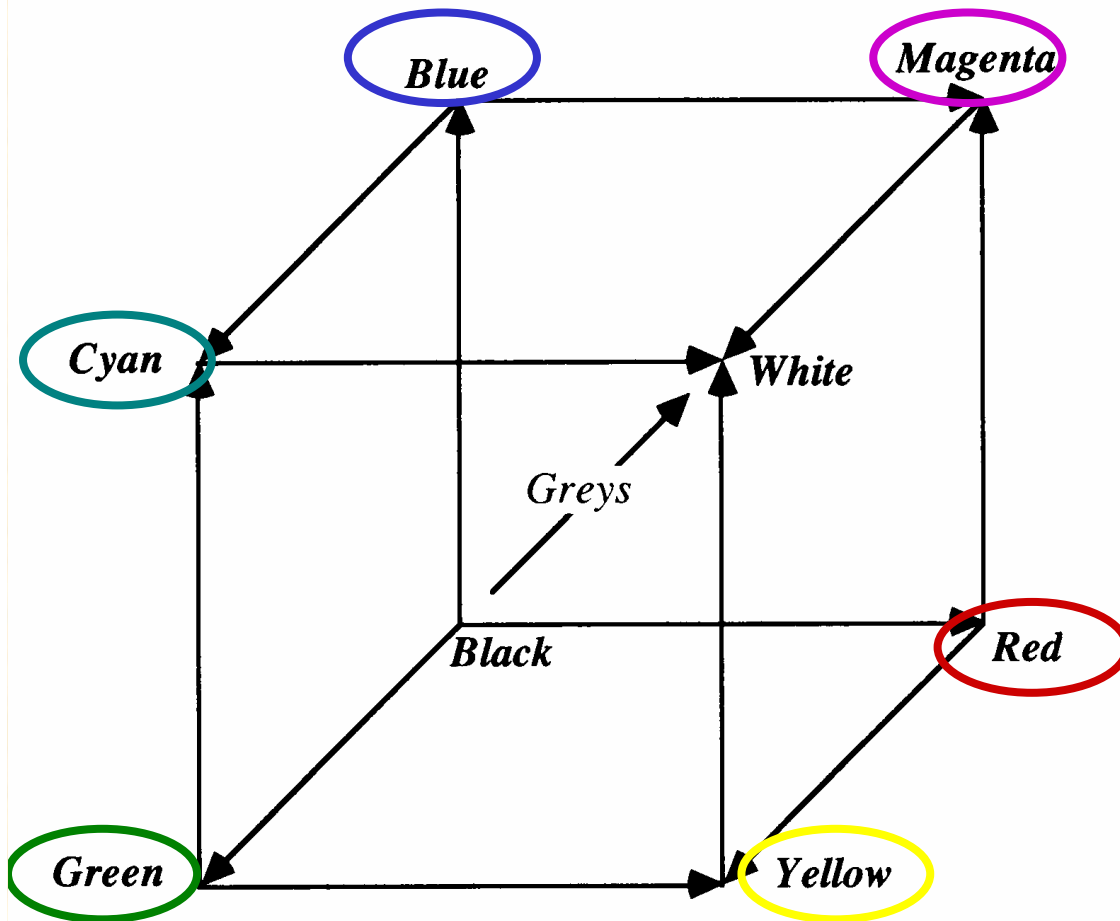
LCD display



# RGB colour images



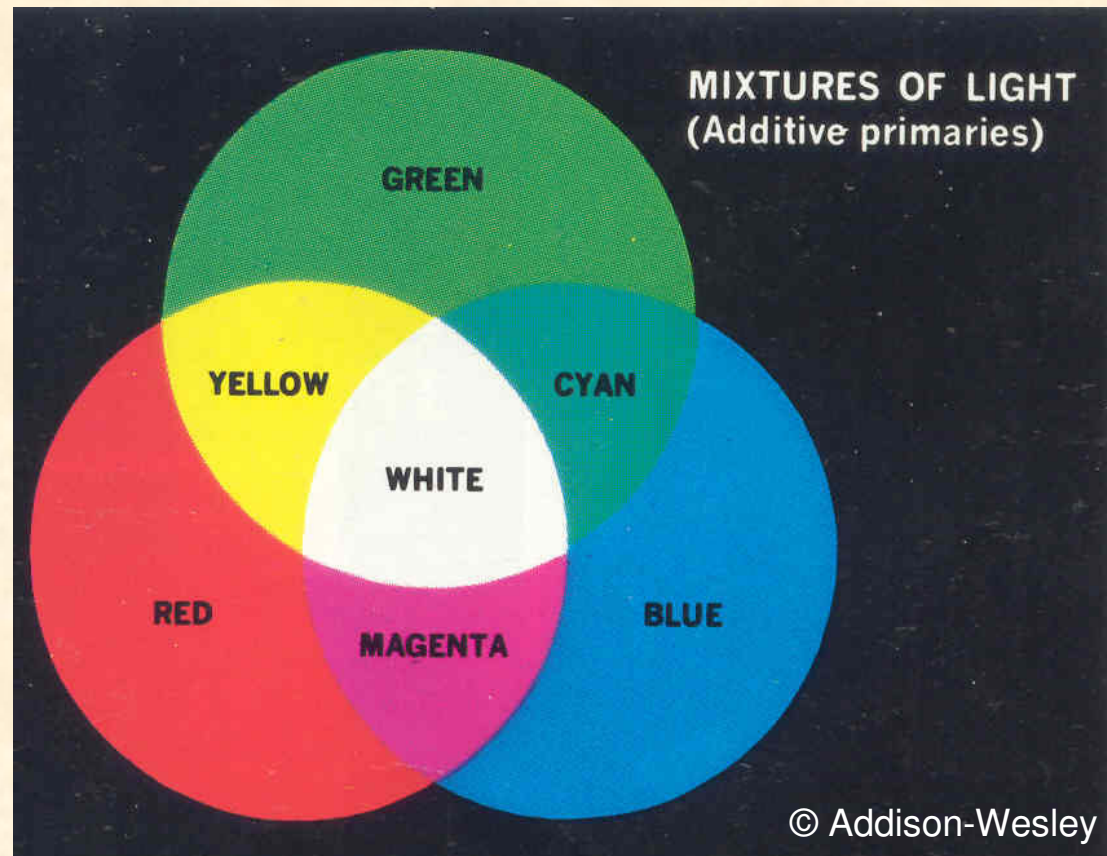
# RGB colour space



Each colour component (R,G,B) is registered and digitized in a separate video channel

# RGB additive primaries

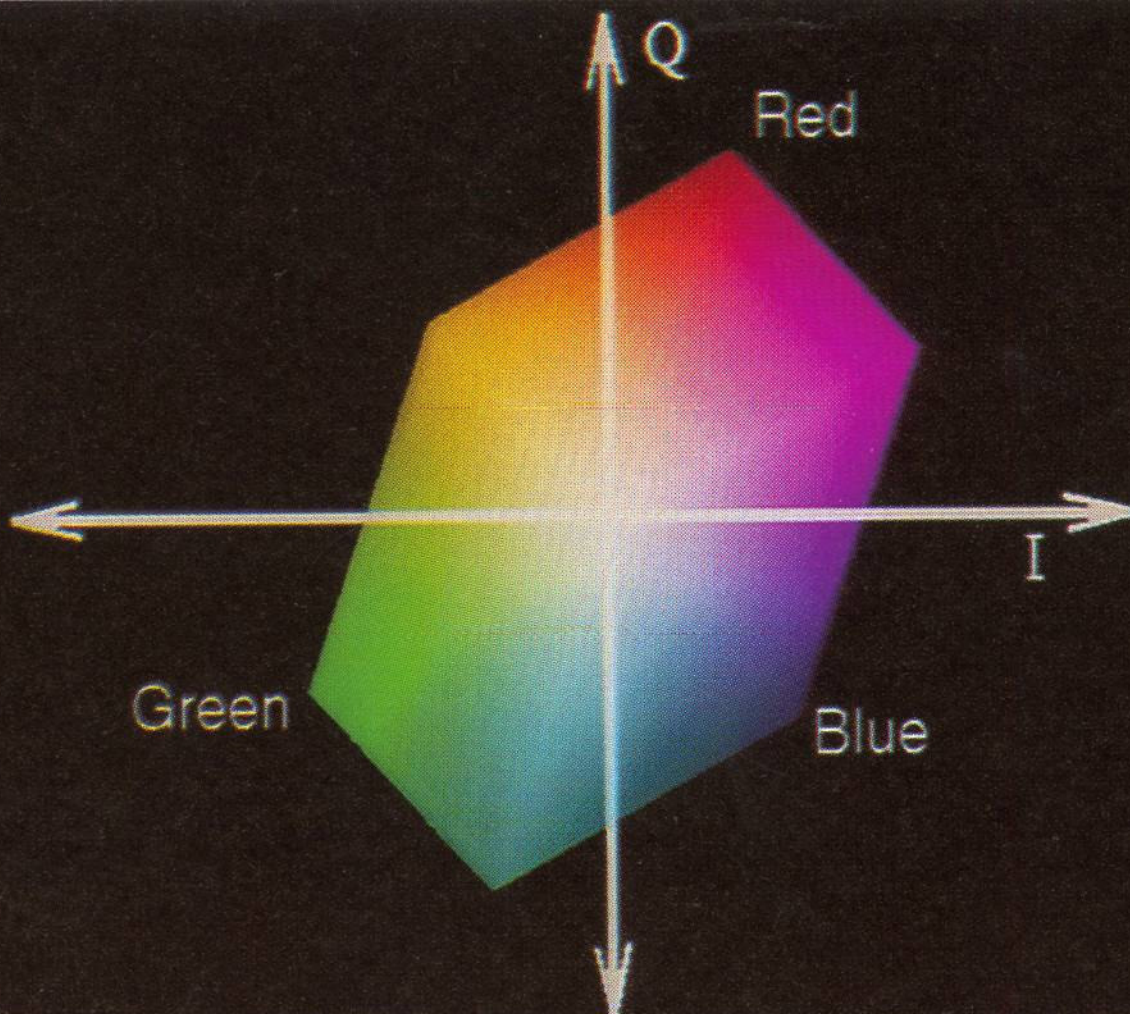
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# YIQ (YUV) colour space

Y is a luminance component and is a linear combination of (R,G,B)  
(I,Q) components define a colour.



Y – luminance,  
I – inphase,  
Q – quadrature

NTSC system

# Equivalence of colour spaces

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There exist a one-to-one mapping between RGB and YIQ systems.

$$Y = 0.299R + 0.587G + 0.114B$$

$$R = Y + 0.956I + 0.621Q$$

$$I = 0.596R - 0.274G - 0.322B$$

$$G = Y - 0.272I + 0.647Q$$

$$Q = 0.211R - 0.523G + 0.312B$$

$$B = Y - 1.106I + 1.703Q$$

For a human eye perception a better approach it is to code separately luminance and chrominance components (SVHS, 8mm)

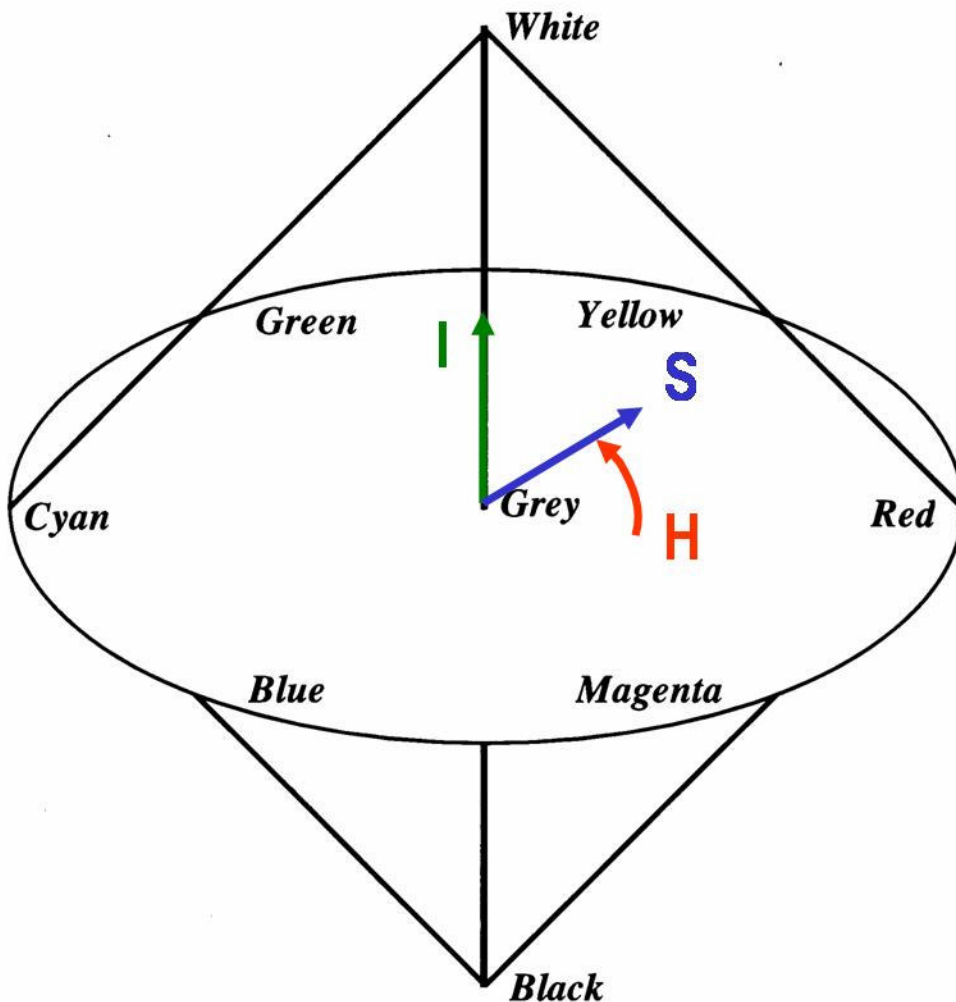




# HSI colour system

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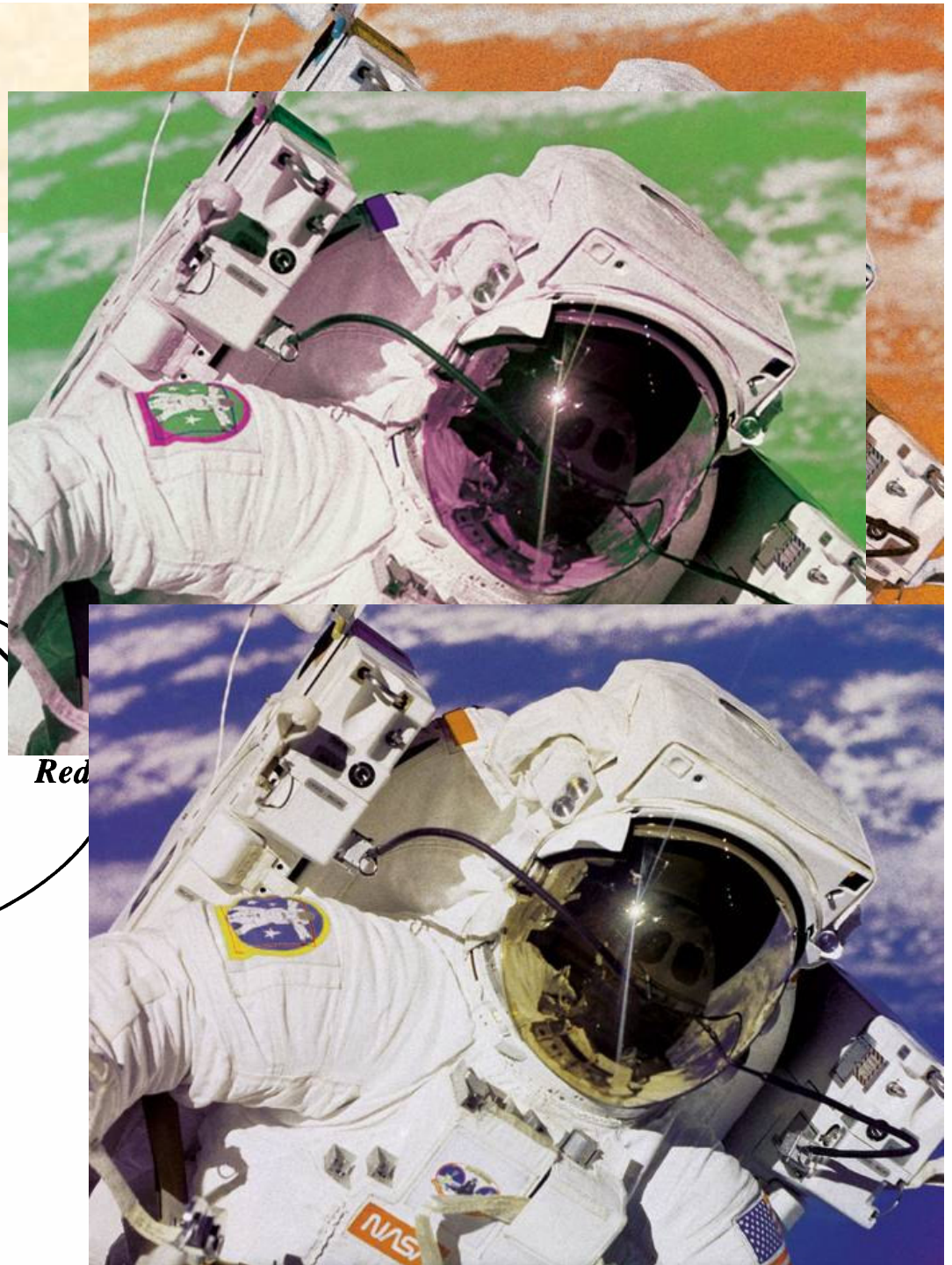
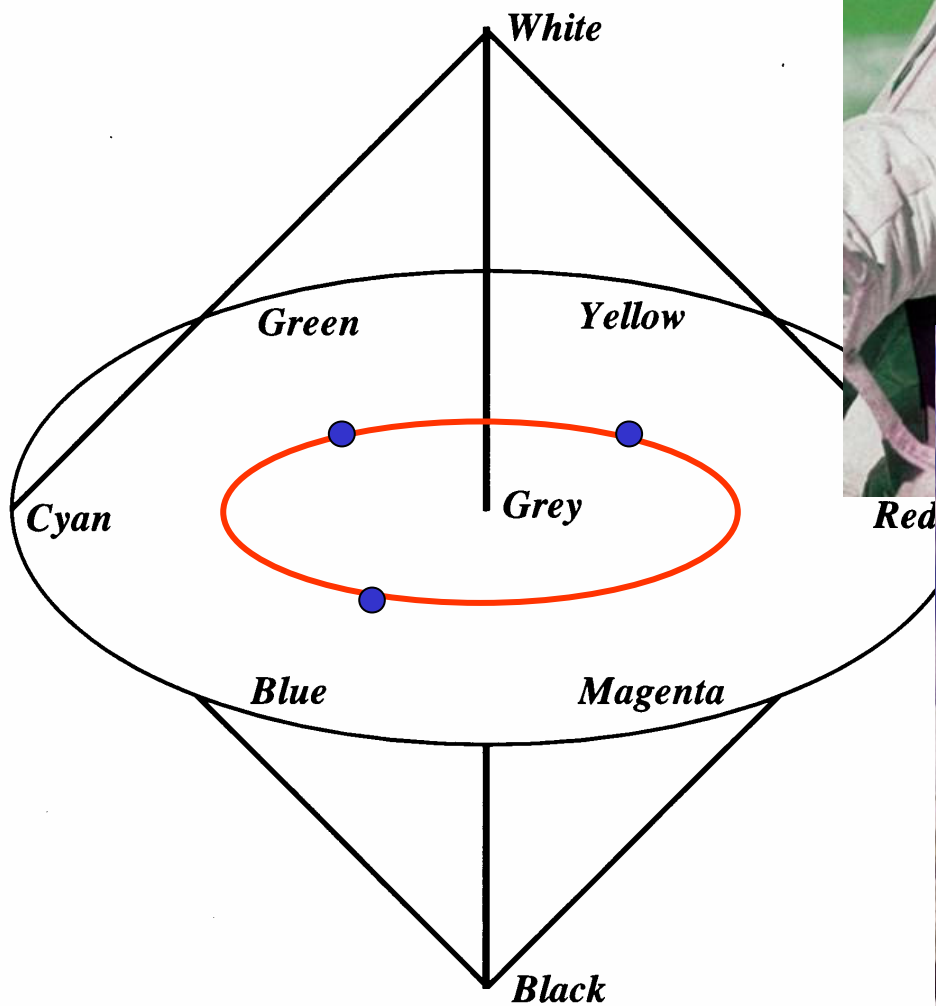
H - hue, S - saturation, I - intensity



- Well suited for a human visual perception system
- Difficult for hardware implementation

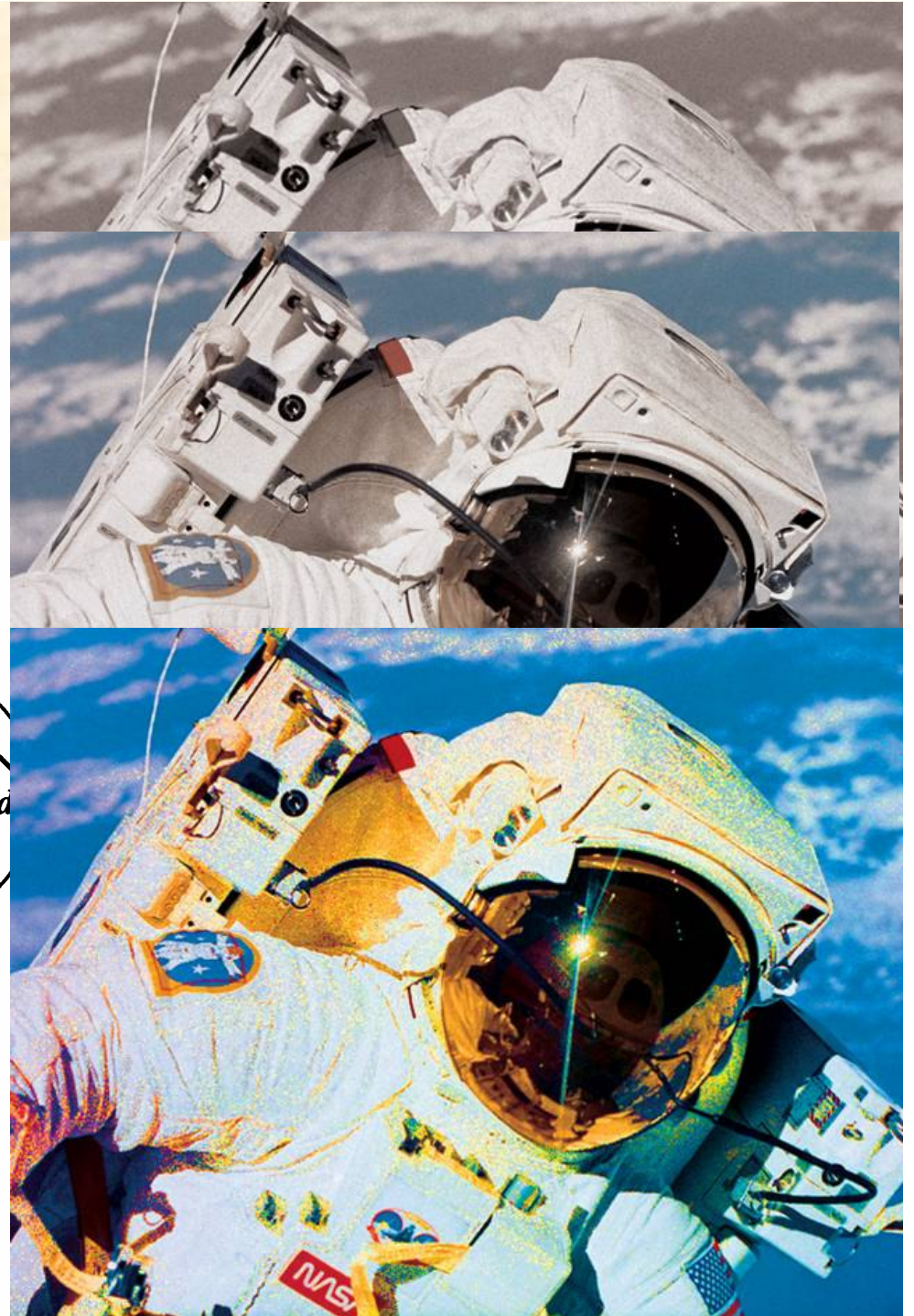
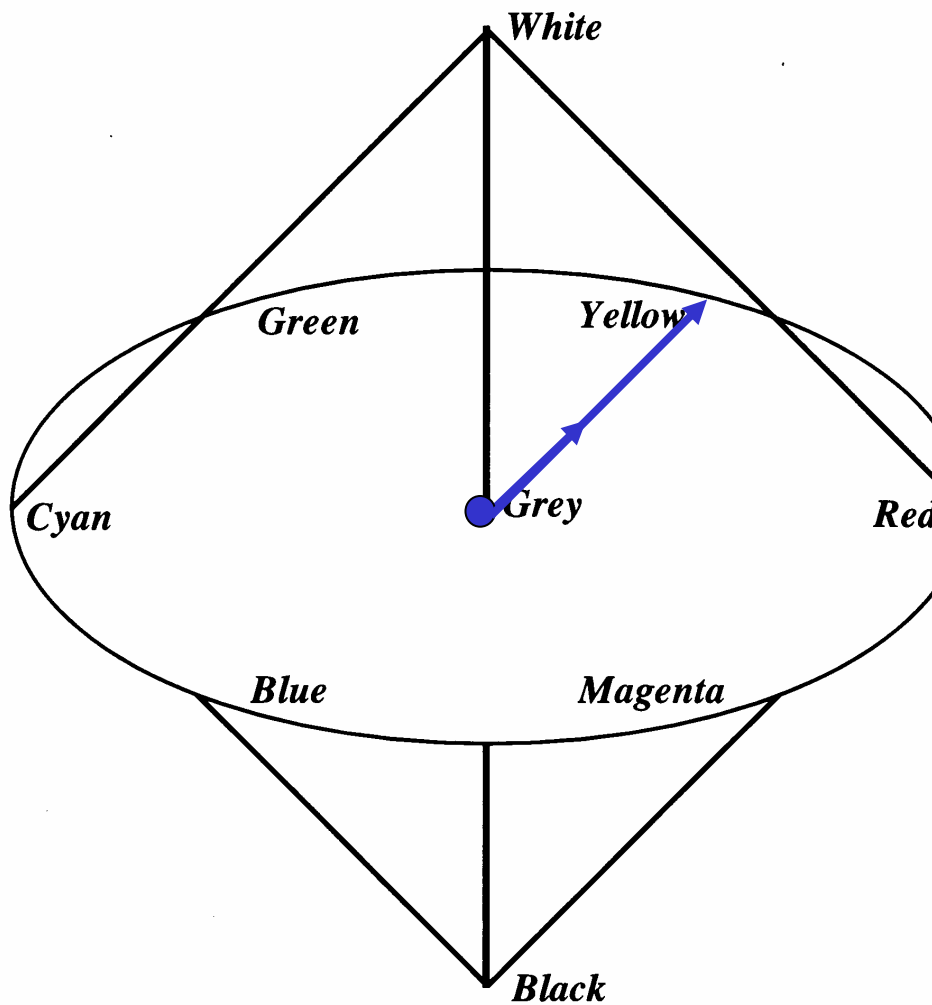


# Hue

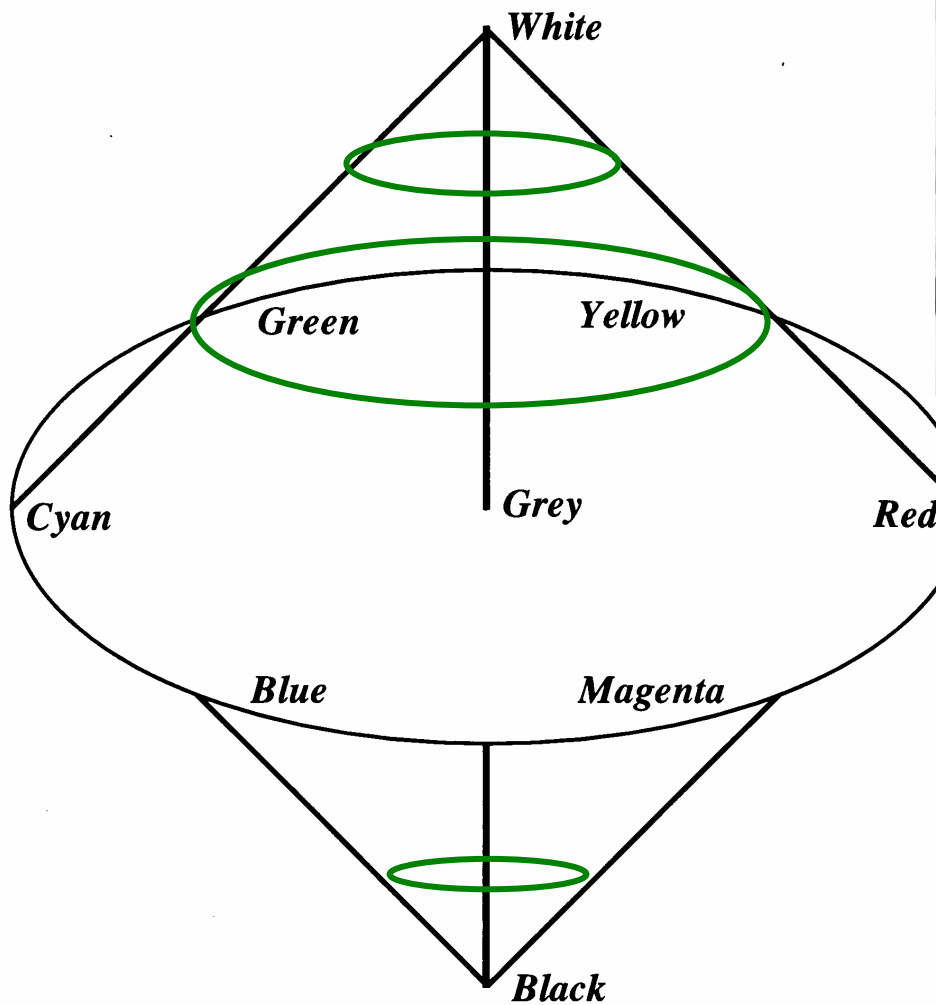




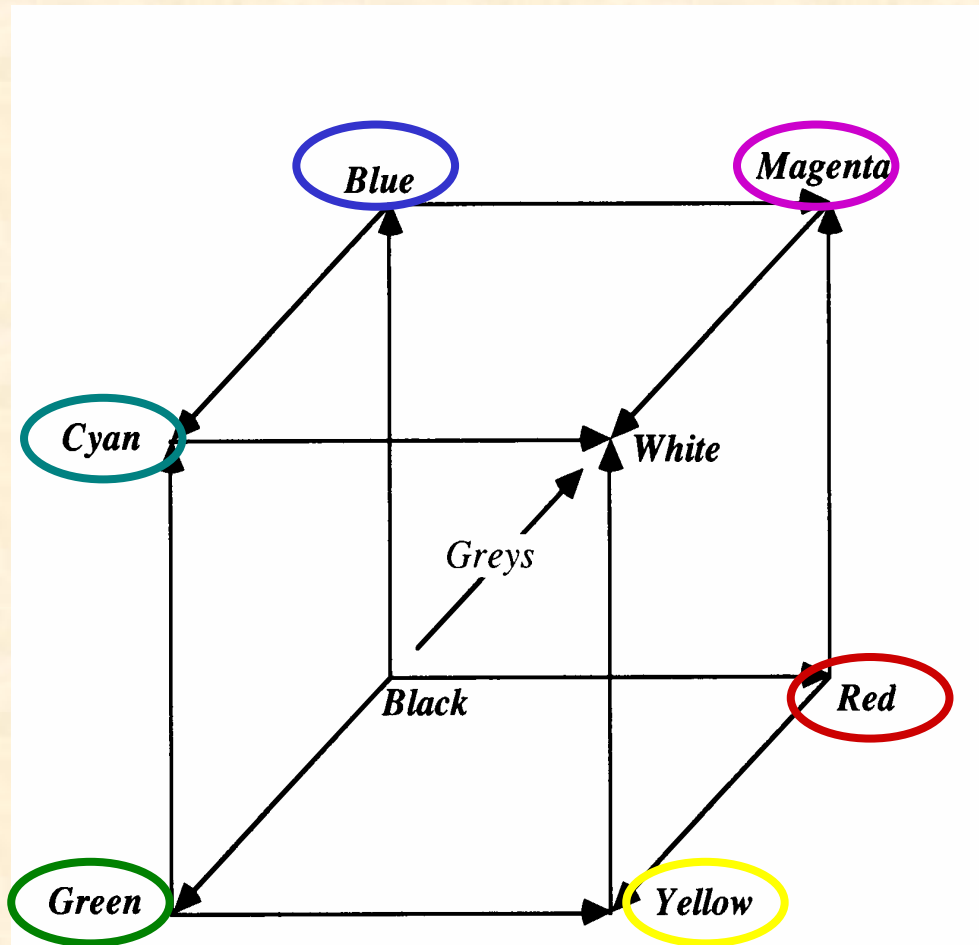
# Saturation



# Intensity



# CMY colour system



A black component is added (CMY+K), in order to obtain a better image contrast

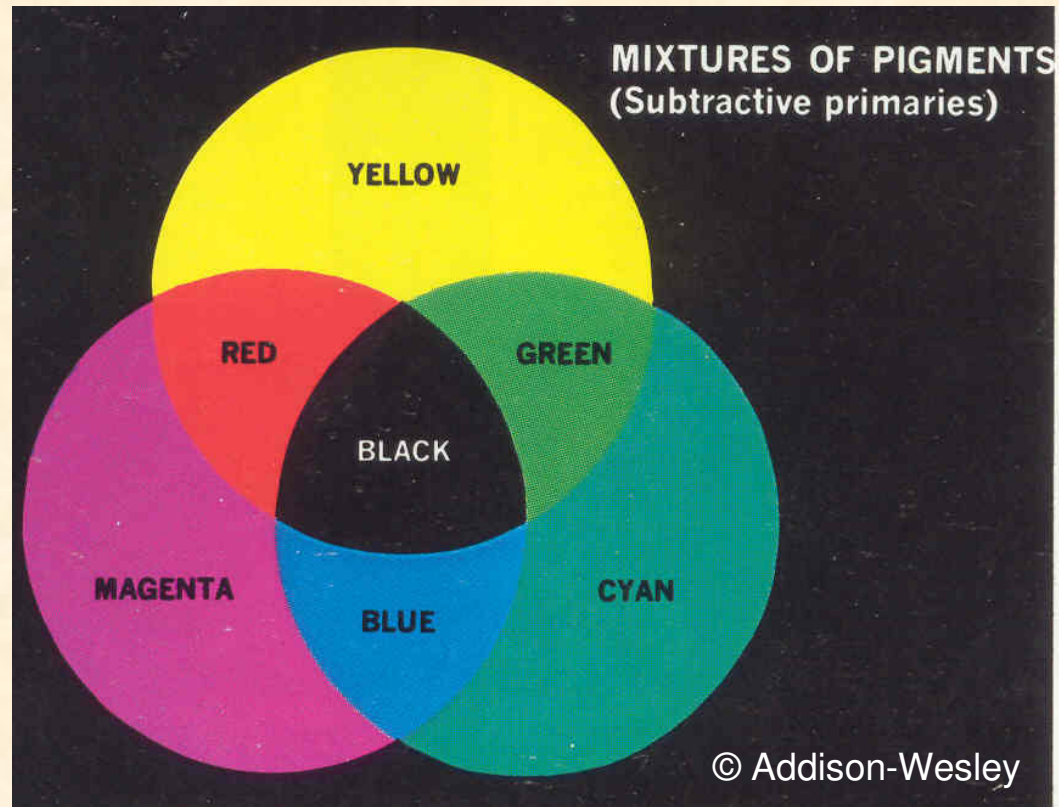
$$\begin{bmatrix} C \\ M \\ Y \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} - \begin{bmatrix} R \\ G \\ B \end{bmatrix}$$

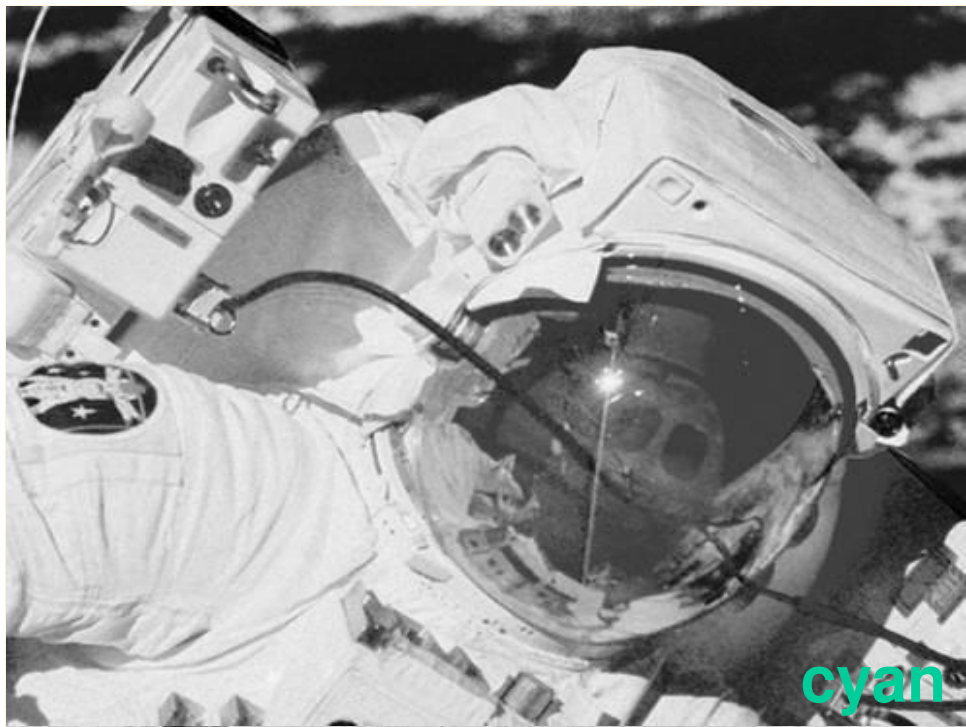
CMY colour components are subtractive colours (as opposed to RGB components that are additive colour components)



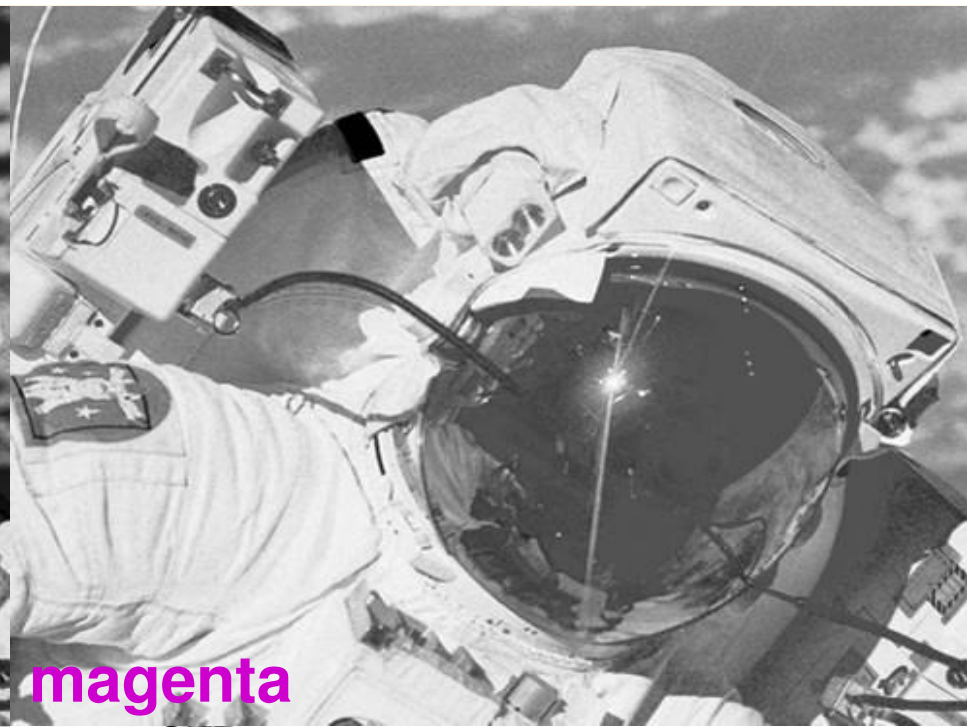
# CMY subtractive primaries

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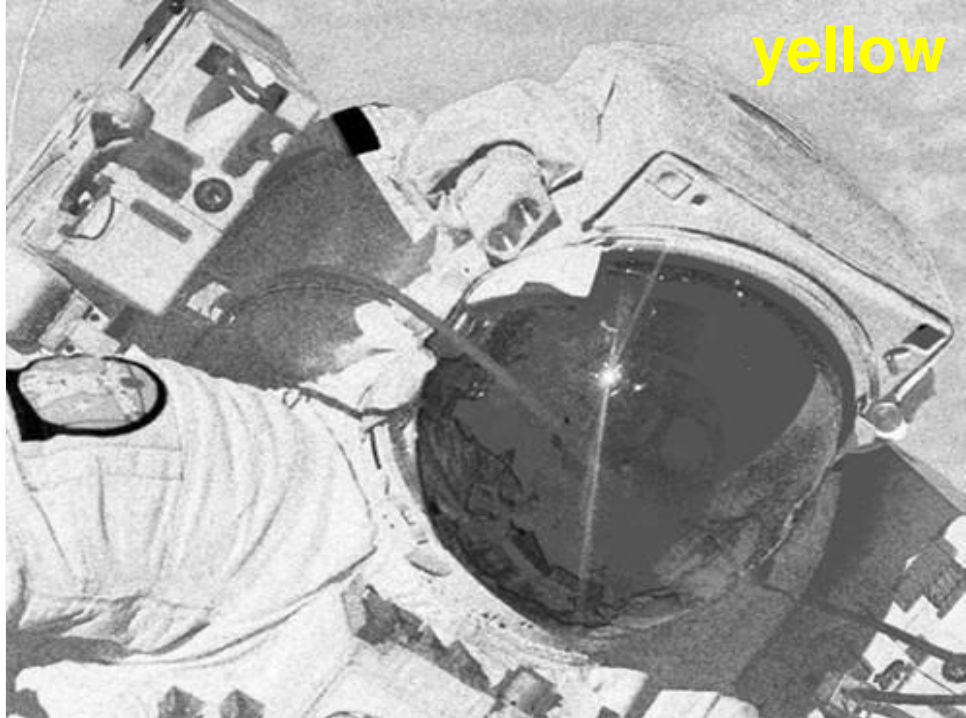




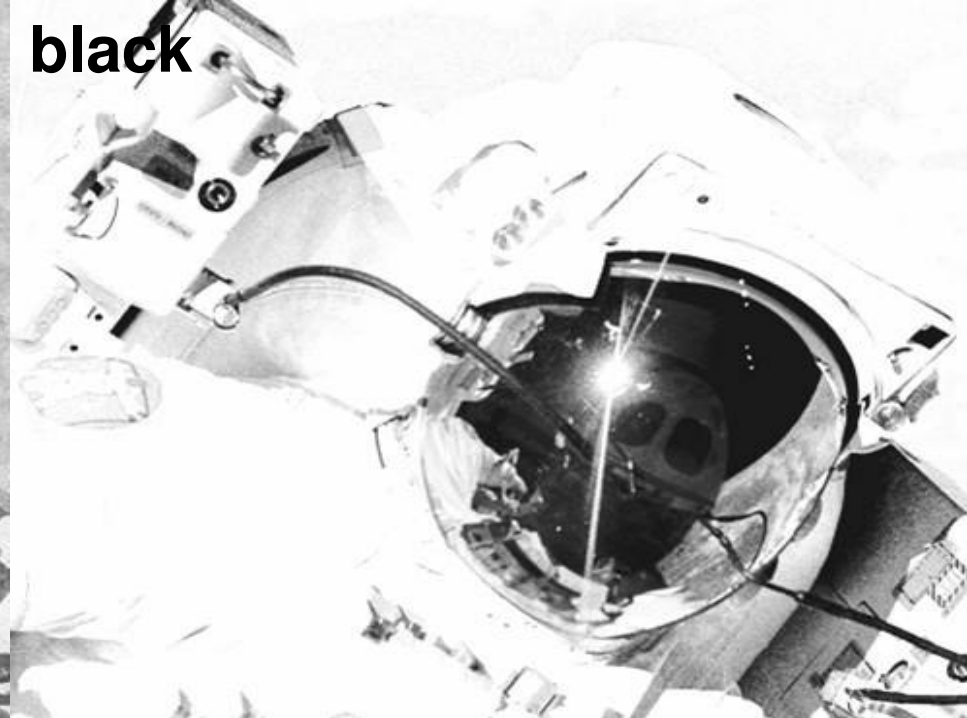
cyan



magenta



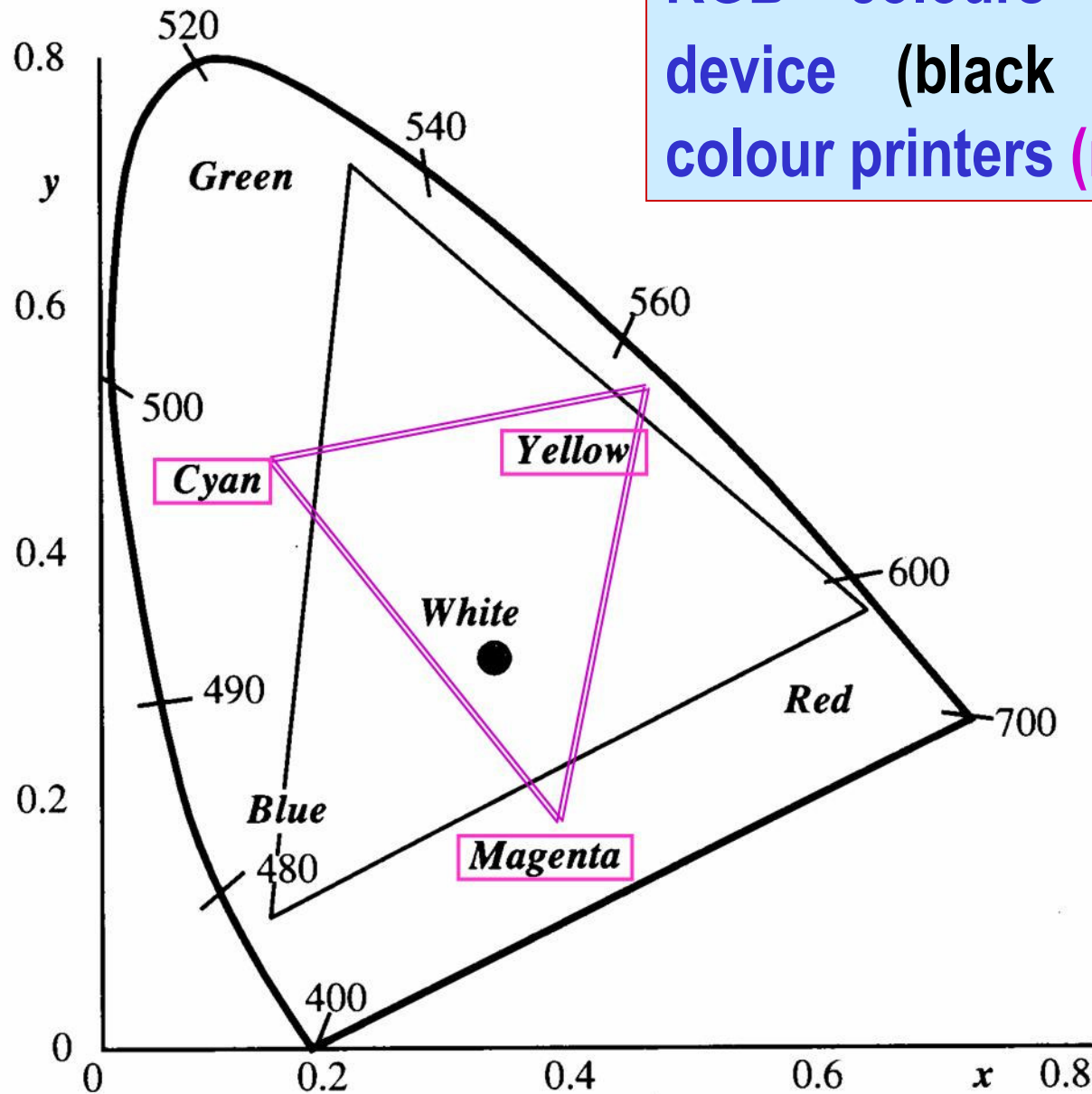
yellow



black

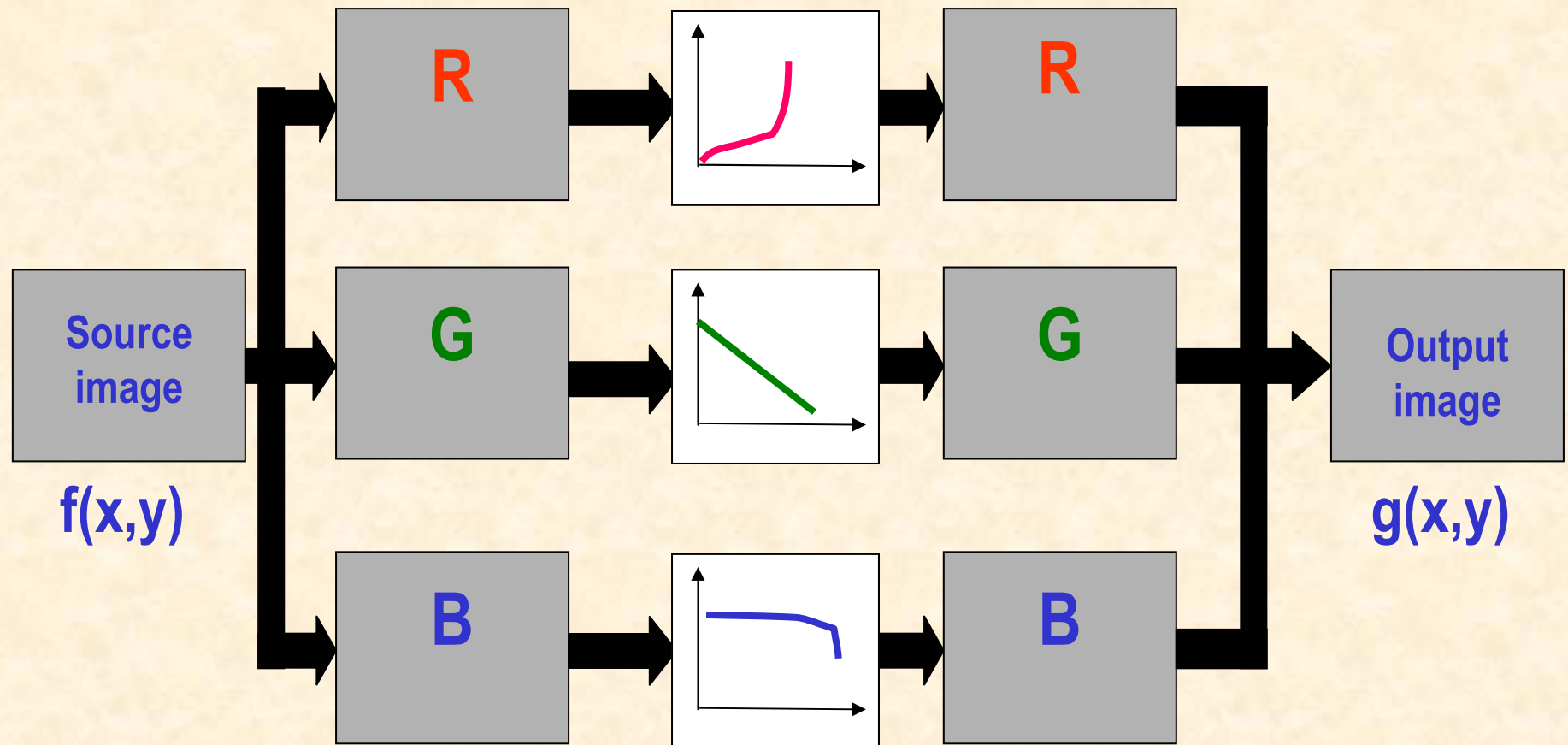


RGB colours produced by CRT device (black triangle) and CMY colour printers (magenta triangle)



# Processing of color images in spatial domain

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source image



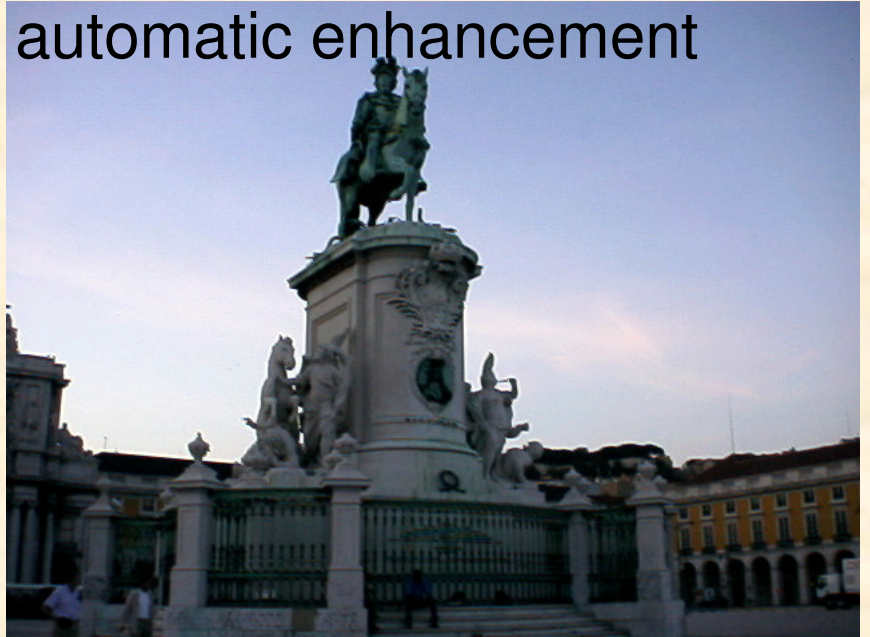
contrast/brightness correction



Blue component correction

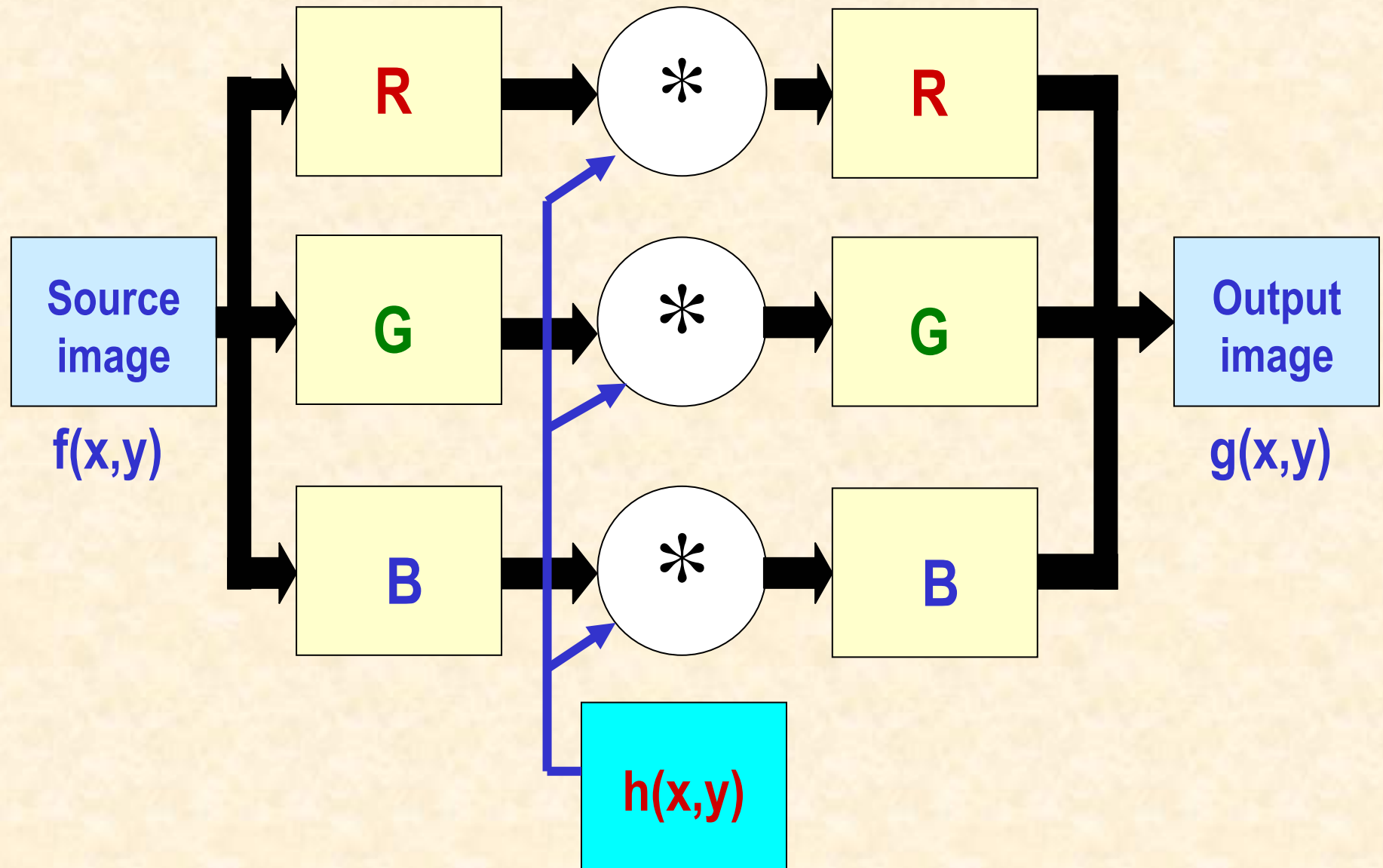


automatic enhancement



# Filtering of colour images in spatial domain

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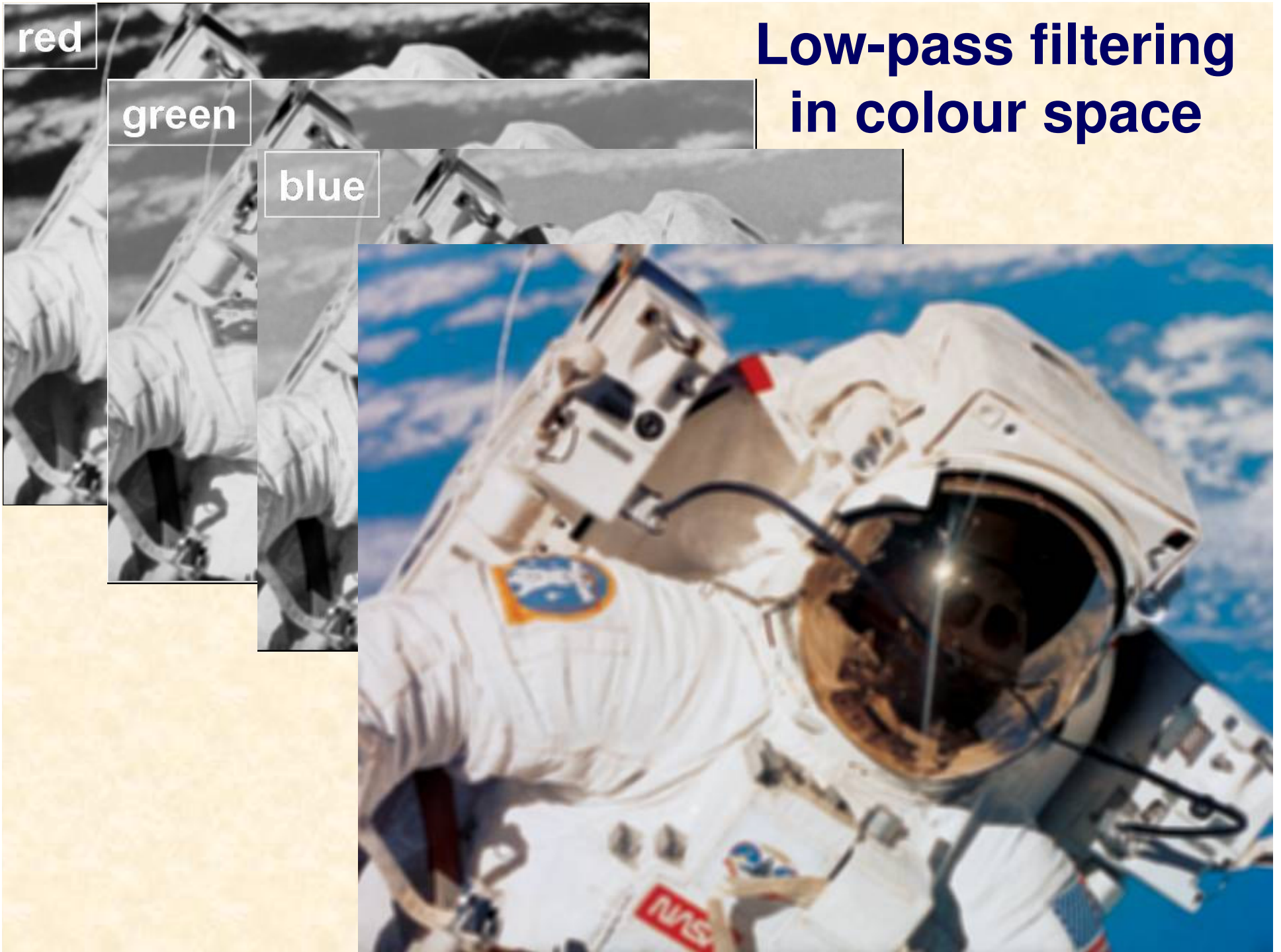


red

green

blue

# Low-pass filtering in colour space



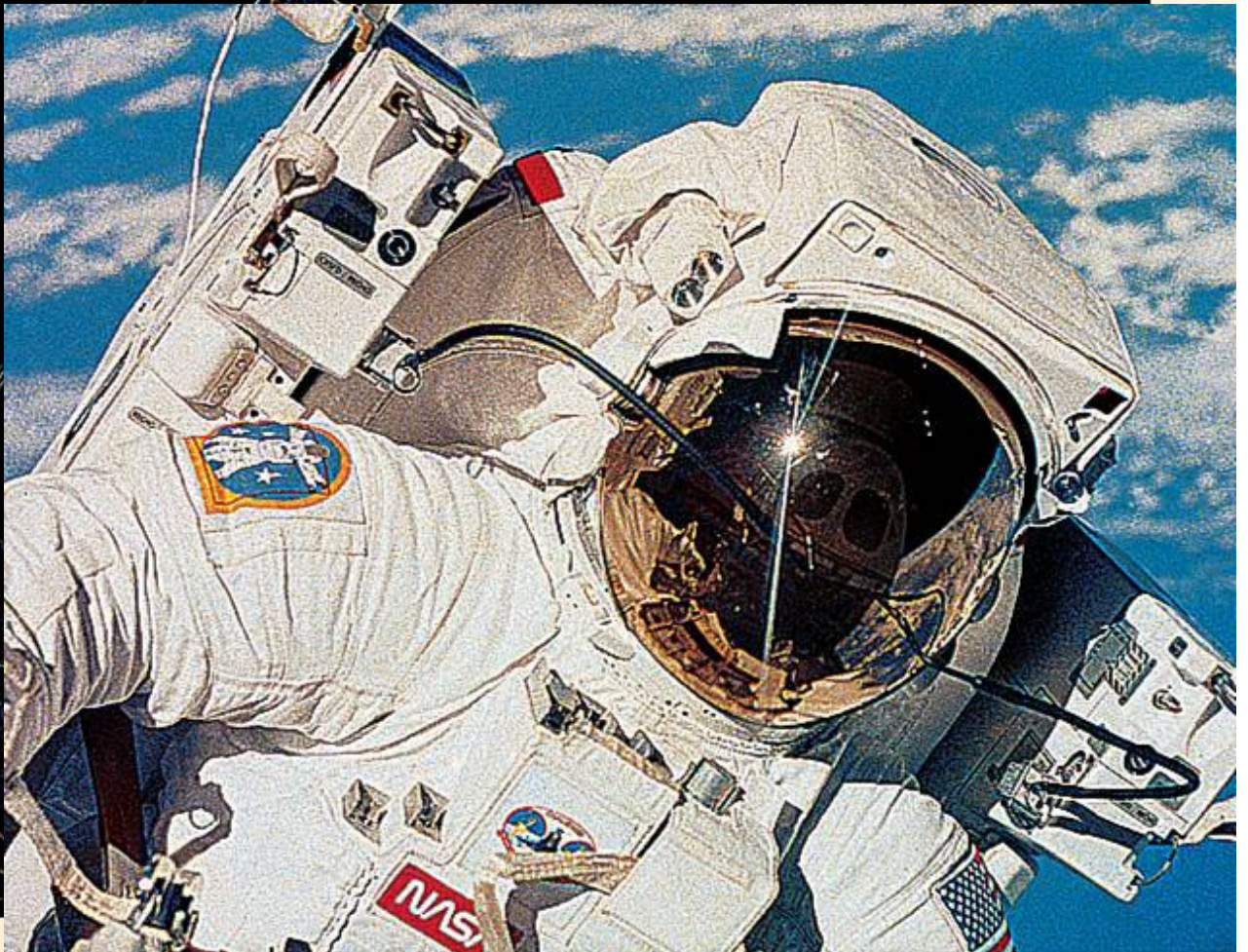


# High pass filtering in colour space

red

green

blue



# Filtering of colour images in spatial domain

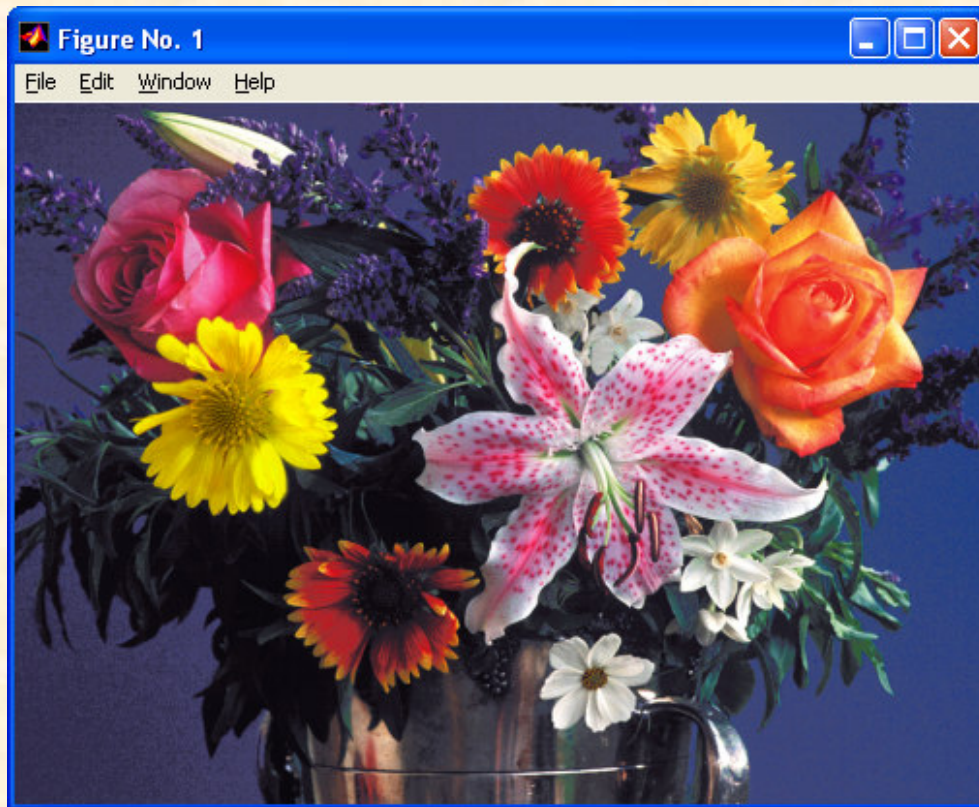
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Another possible approach:

1. Convert from RGB to YIQ
2. Filter the Y (luminance) component and keep the colours (I, Q) unchanged
3. Convert back to RGB



**High pass  
filtering of Y  
component**



```
%Matlab  
h=fspecial('unsharp');  
ys=filter2(h,y);
```

