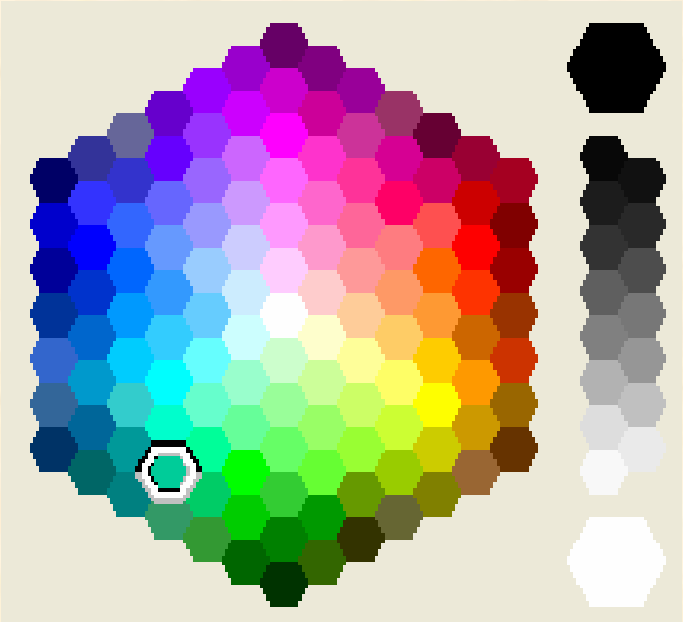
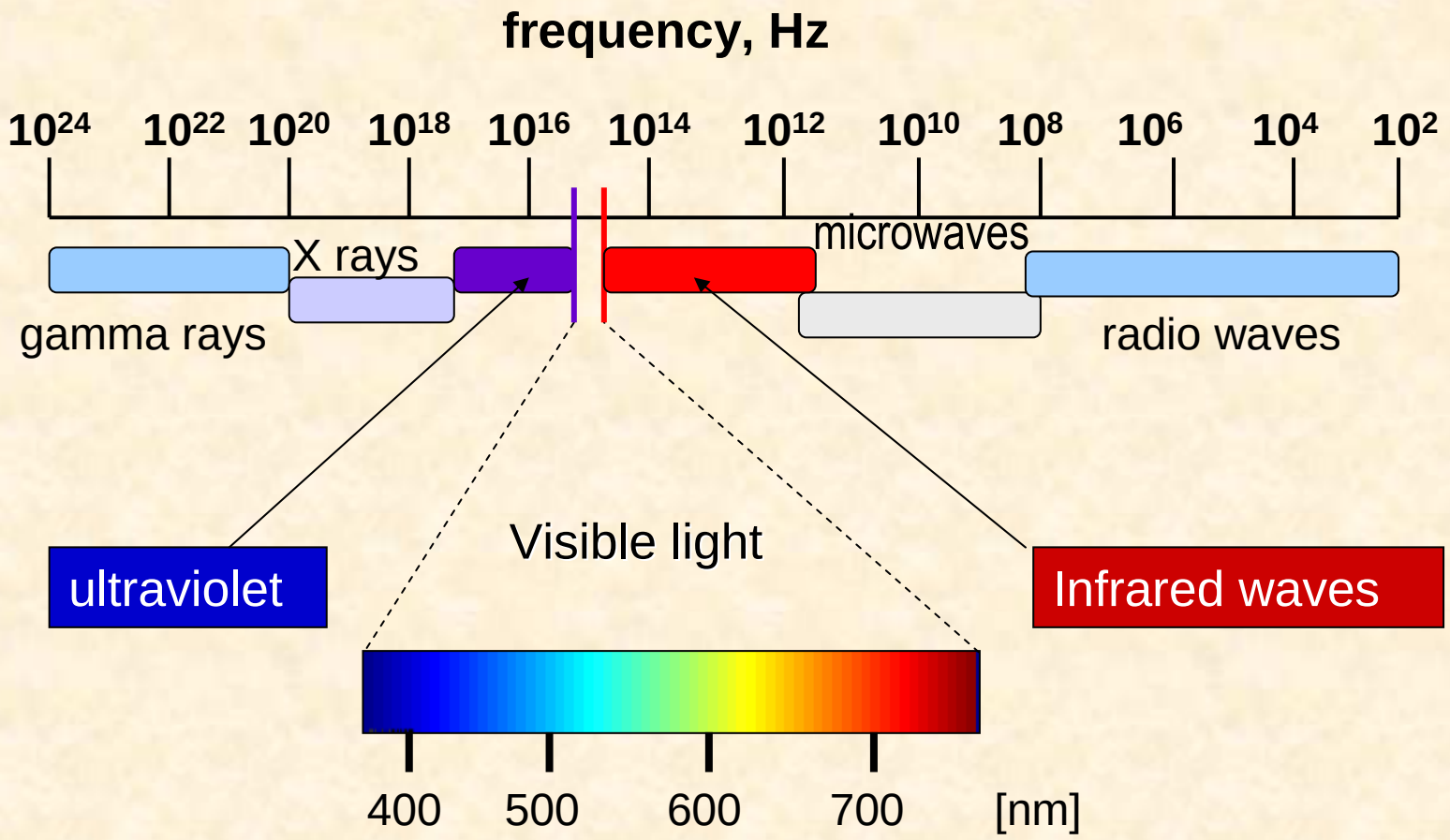
Processing of colour images

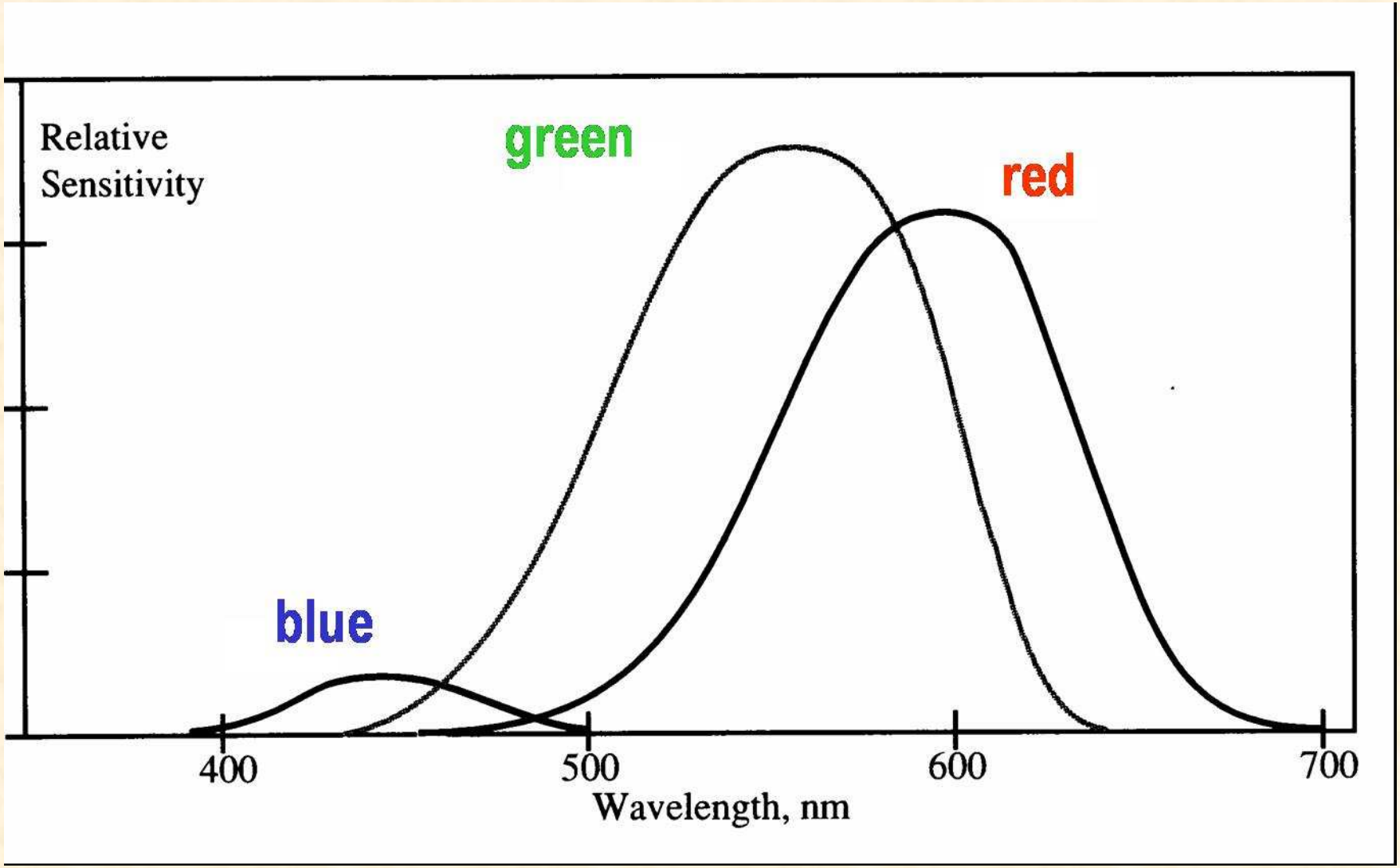
- Colour representation schemes
- Filtering of colour images



Electromagnetic spectrum

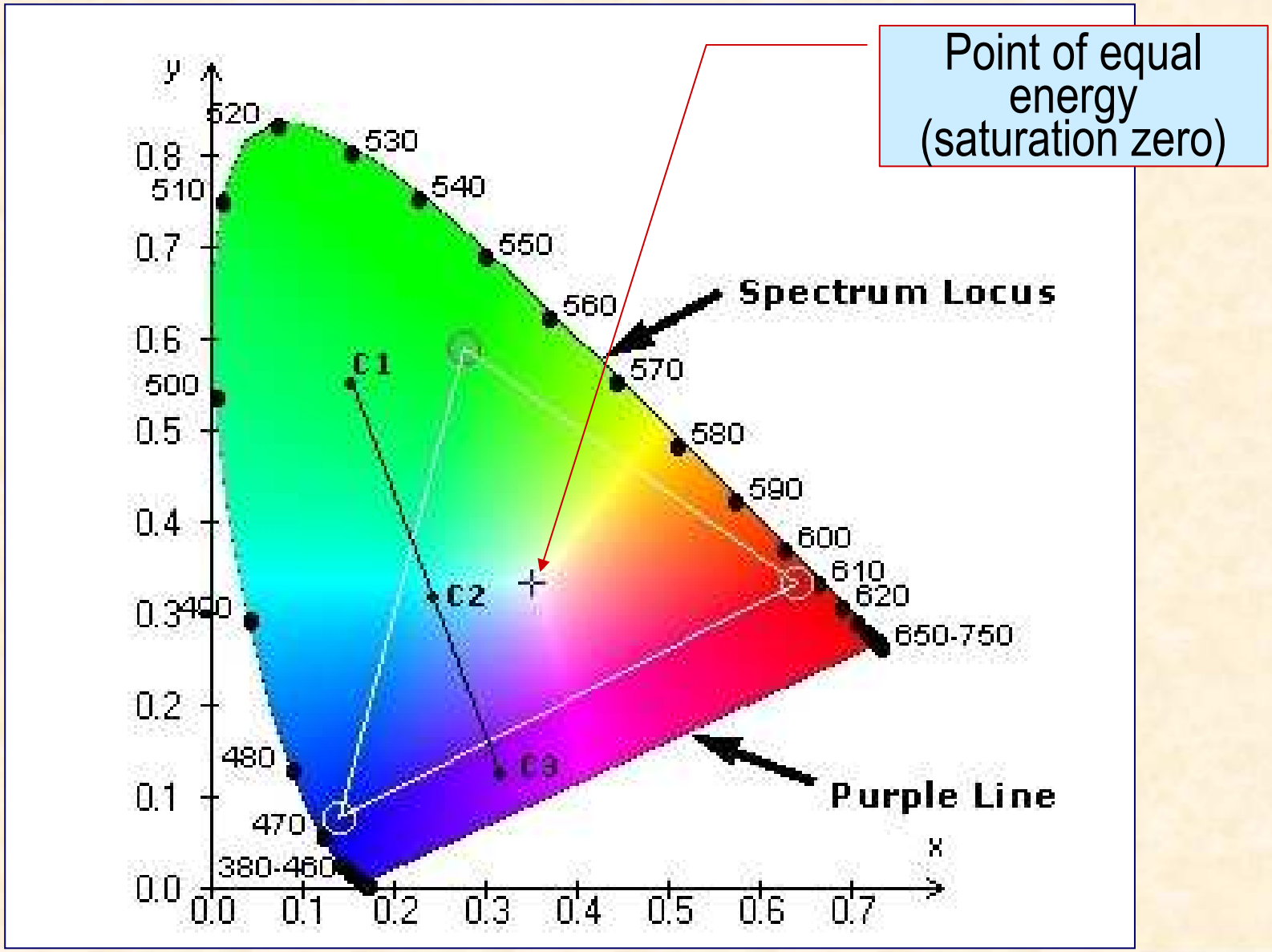


Eye sensitivity to colour components

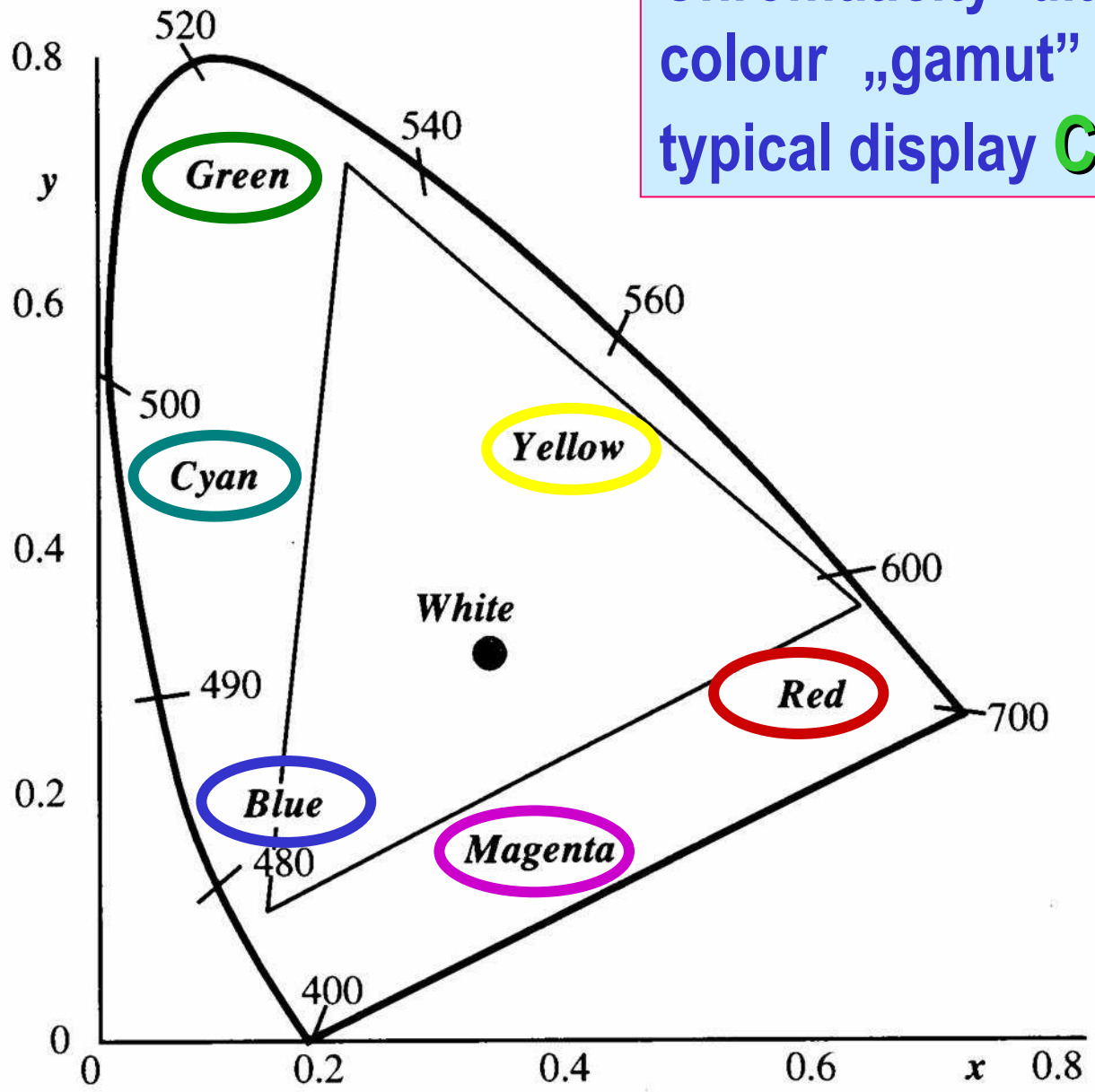


Commission Internationale de l'Eclairage (CIE)

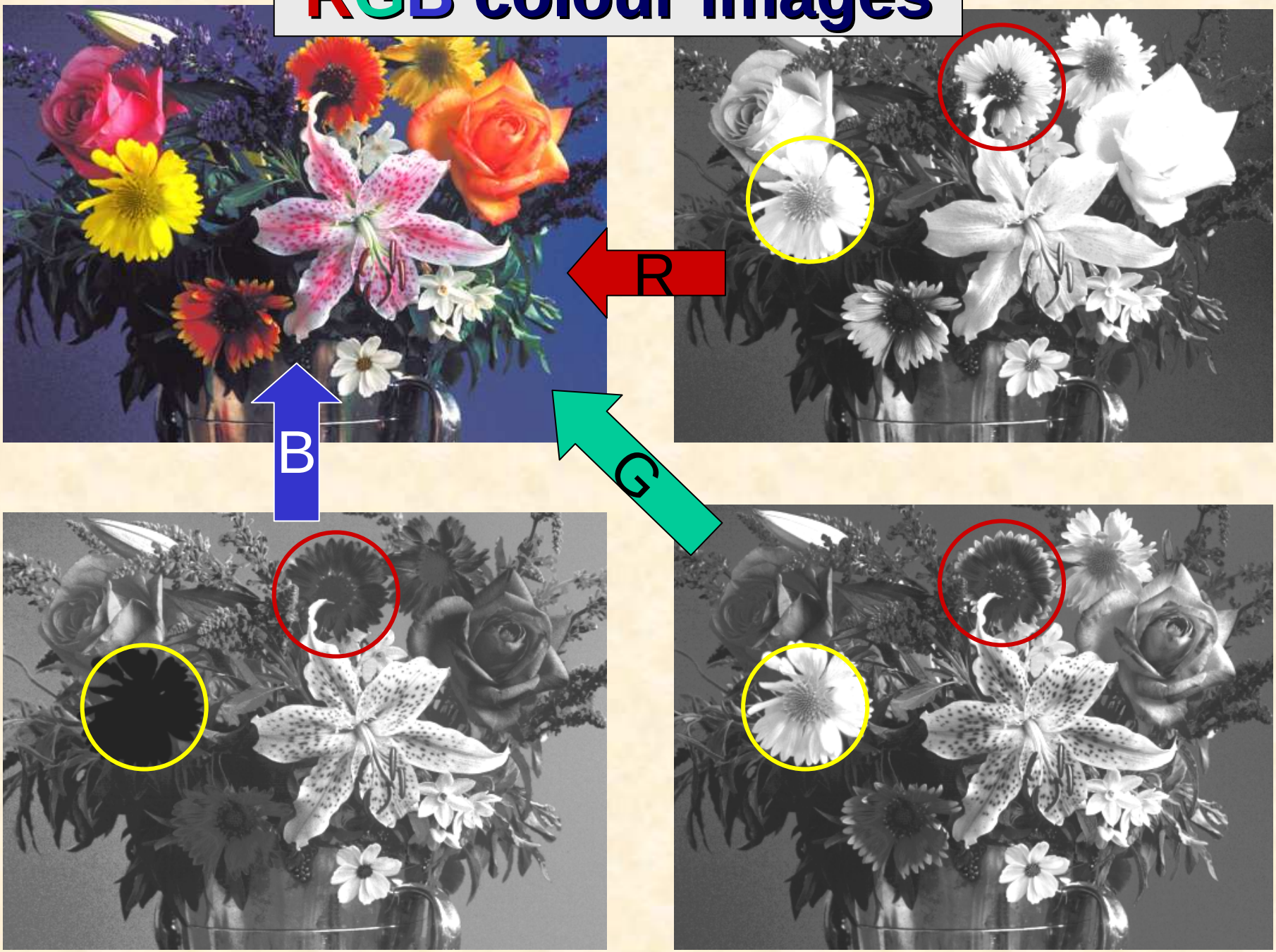
Chromaticity Diagram



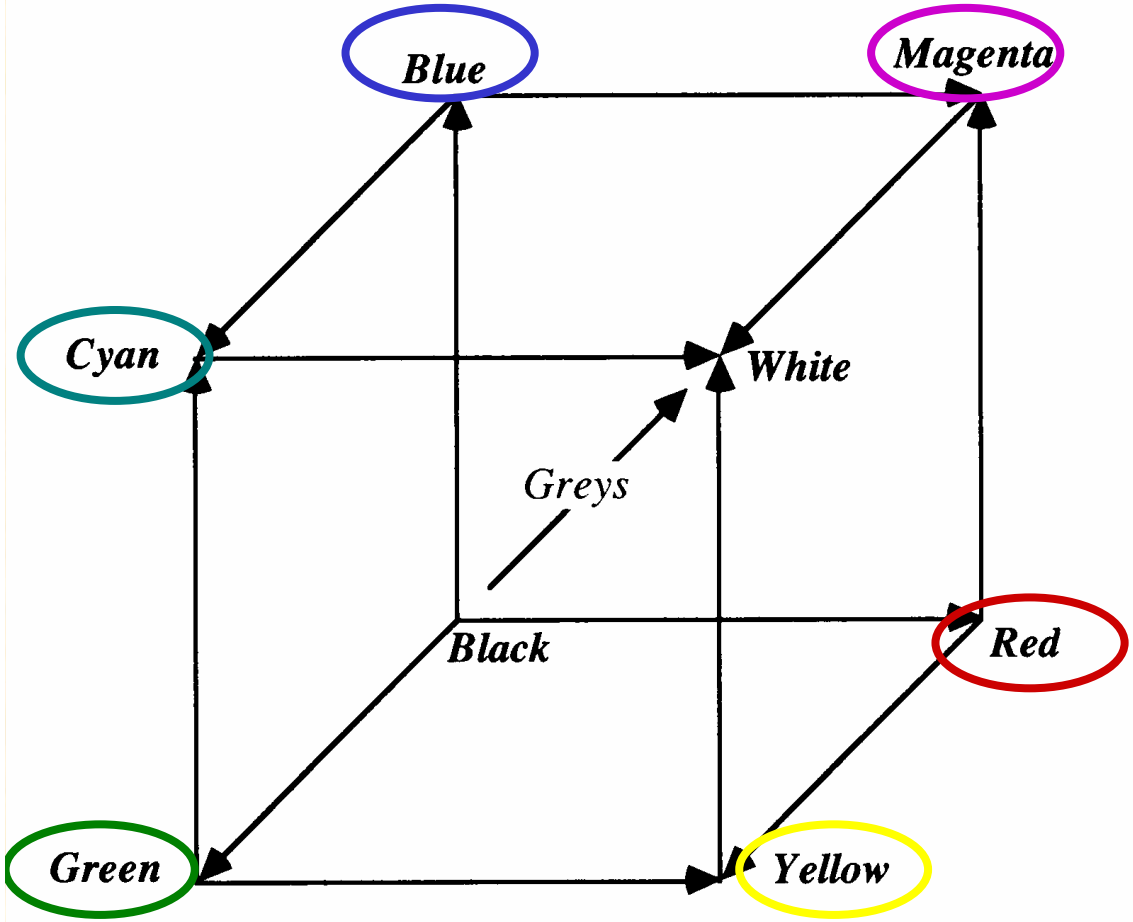
Chromaticity diagram and a typical colour „gamut" (the triangle) for a typical display CRT device



RGB colour images

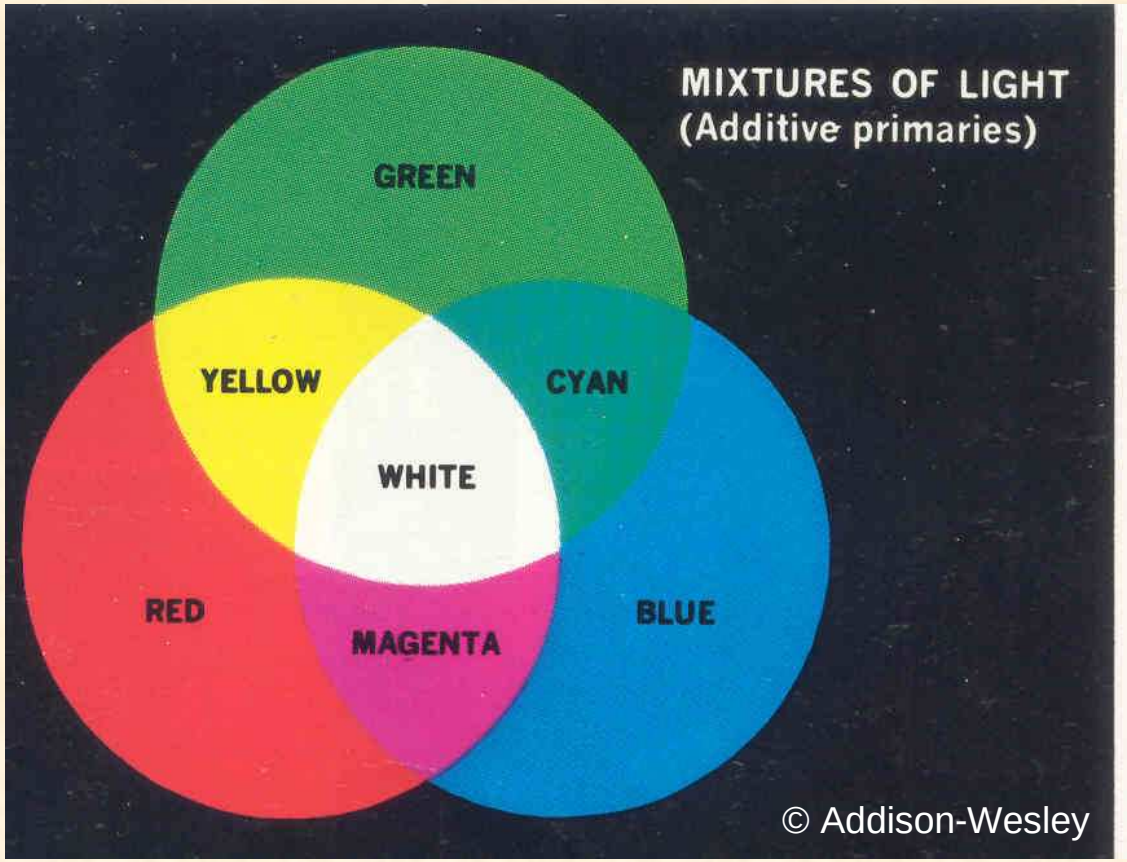


RGB colour space



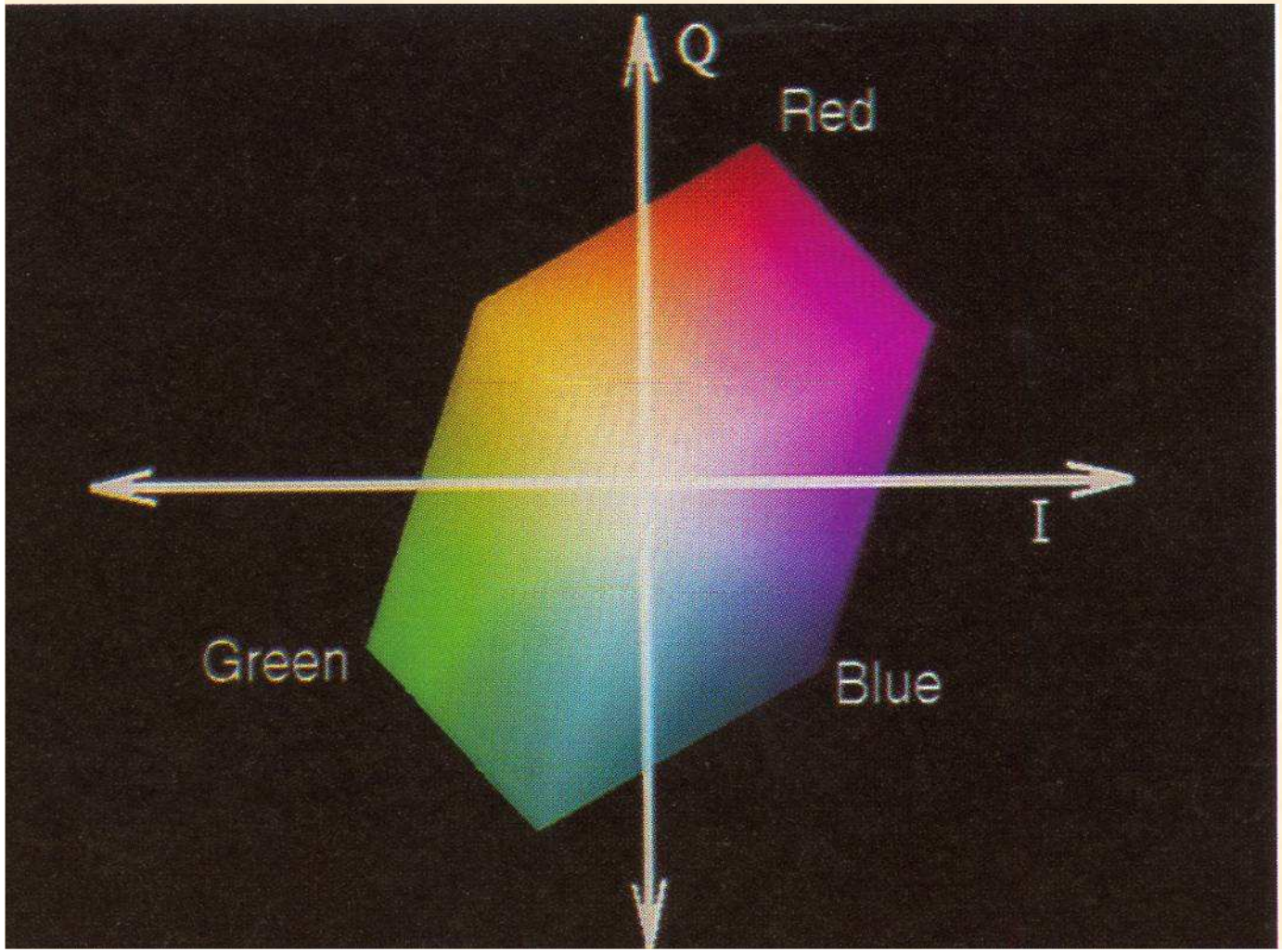
Each colour compoment (R,G,B) is registered and digitized in a separate video channel

RGB additive primaries



YIQ (YUV) colour space

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



Y – luminance,

I – inphase,

Q – quadrature

NTSC system

Equivalence of colour spaces

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 is is to code separately luminance and chrominance components (SVHS, 8mm)

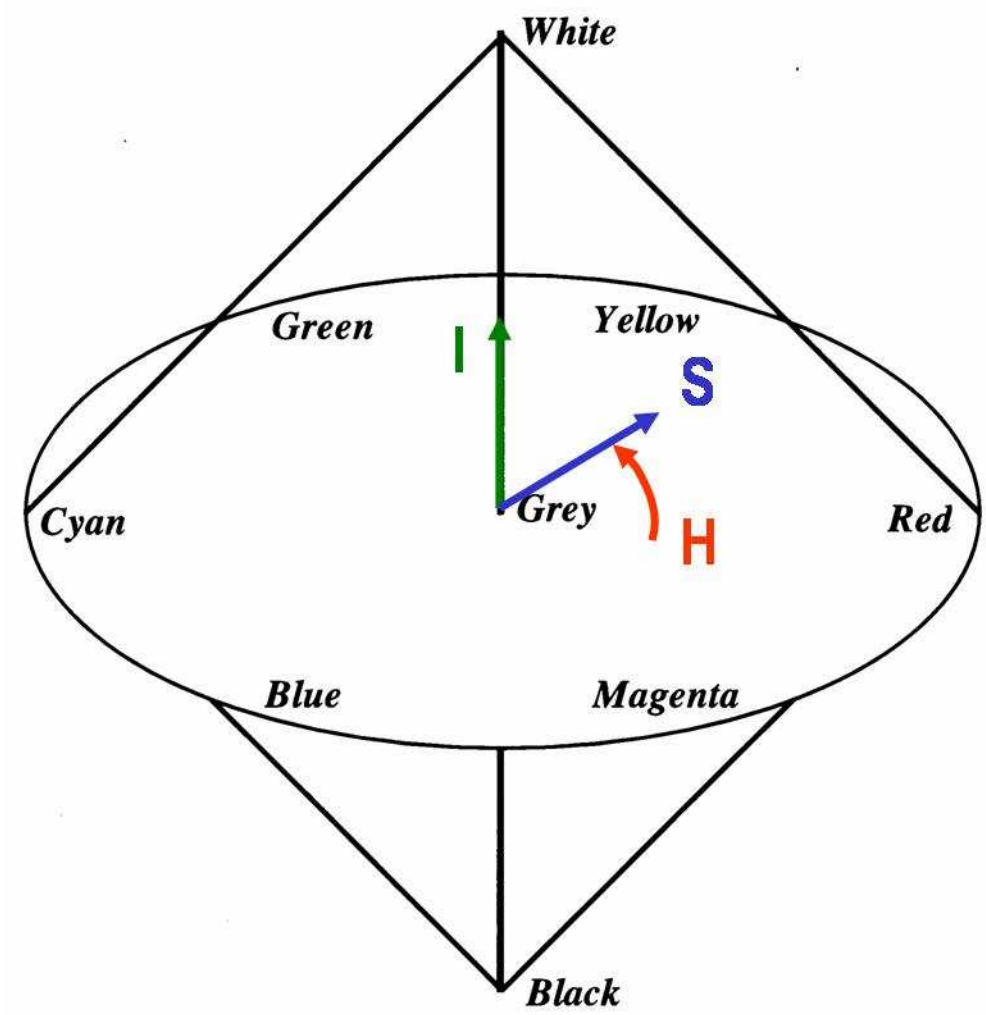

Y


I


Q

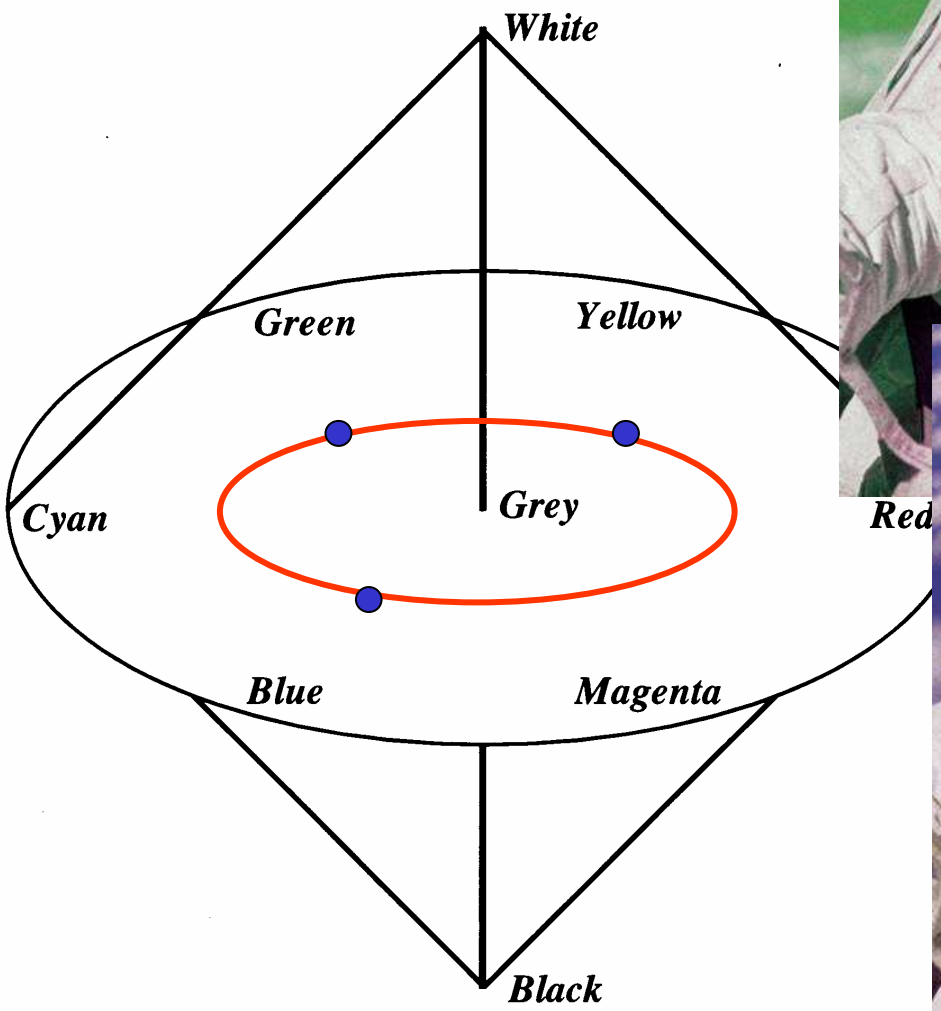
HSI colour system

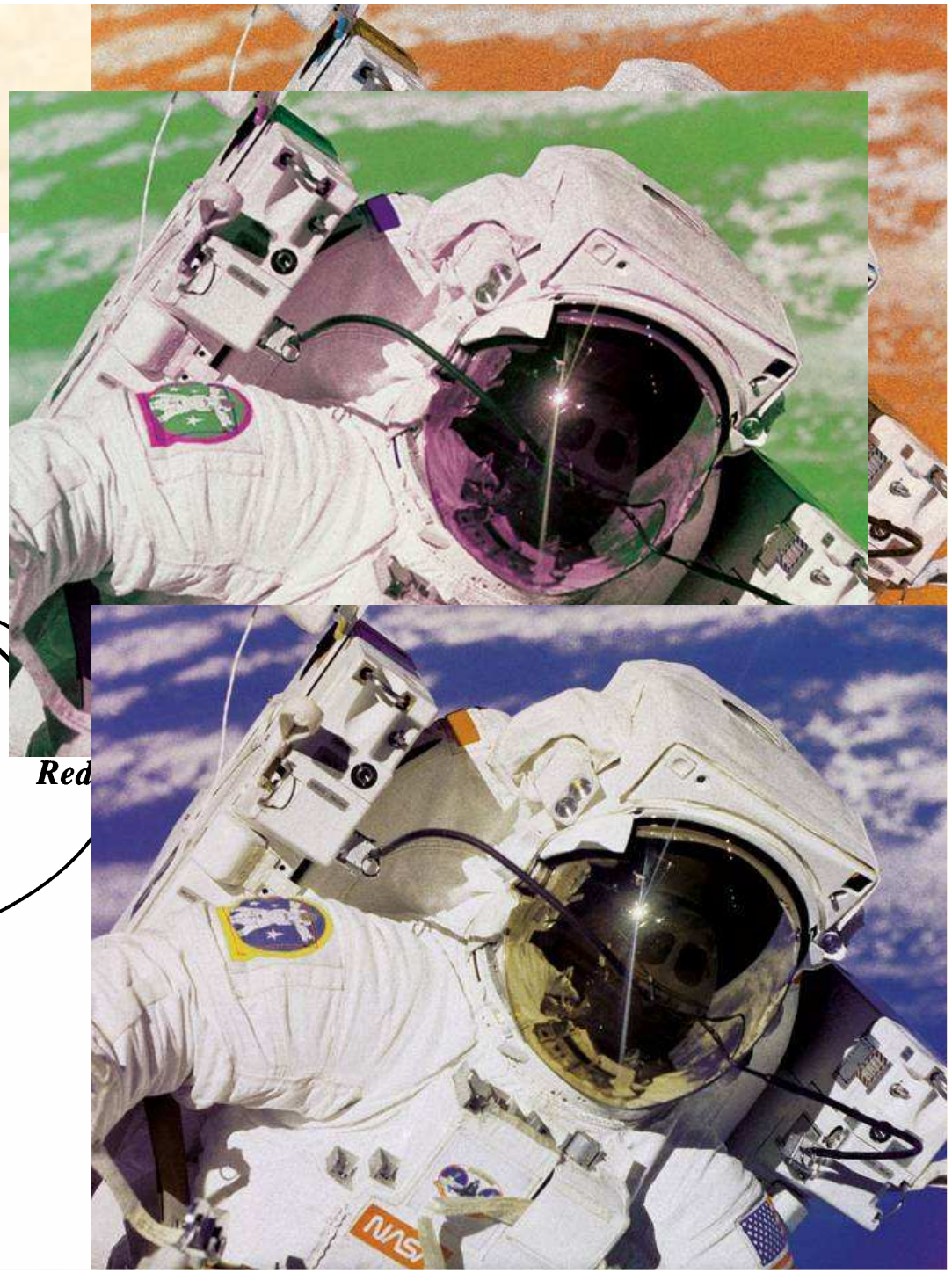
H - hue, S - saturation, I - intensity



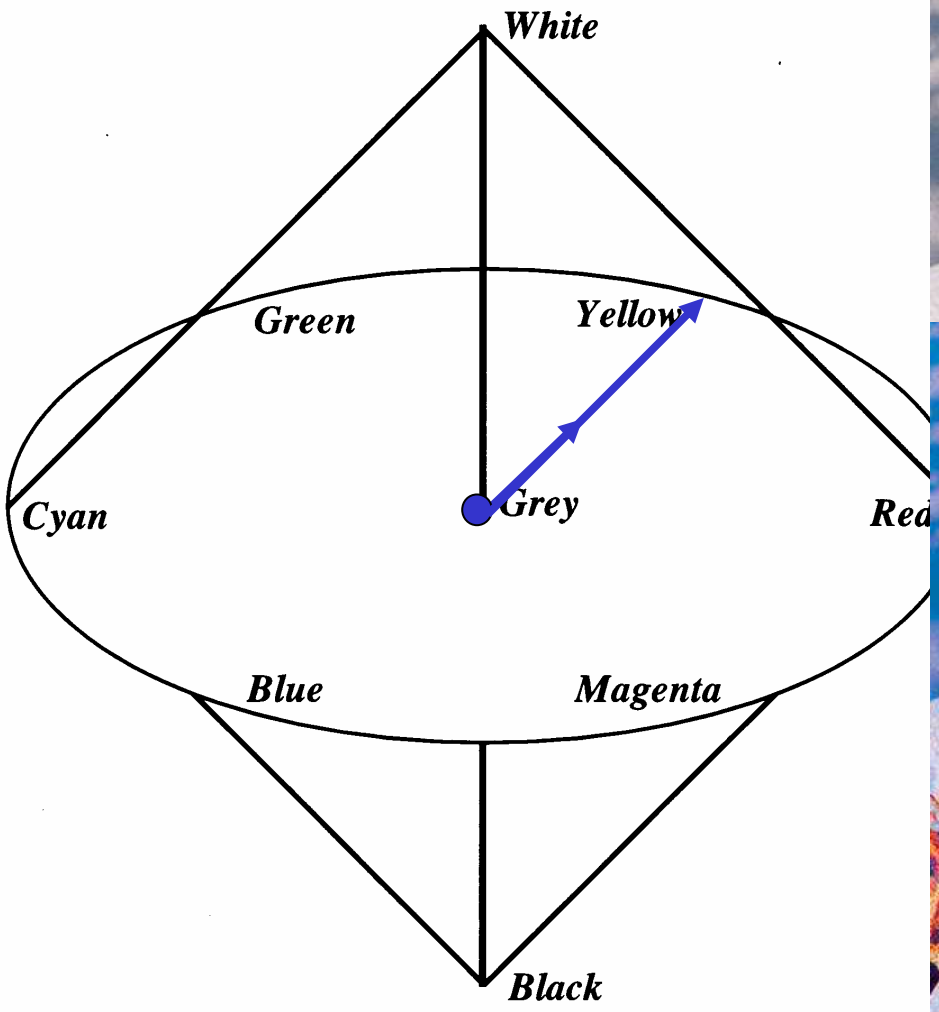
- Well suited for a human visual perception system
- Difficult for hardware implementation

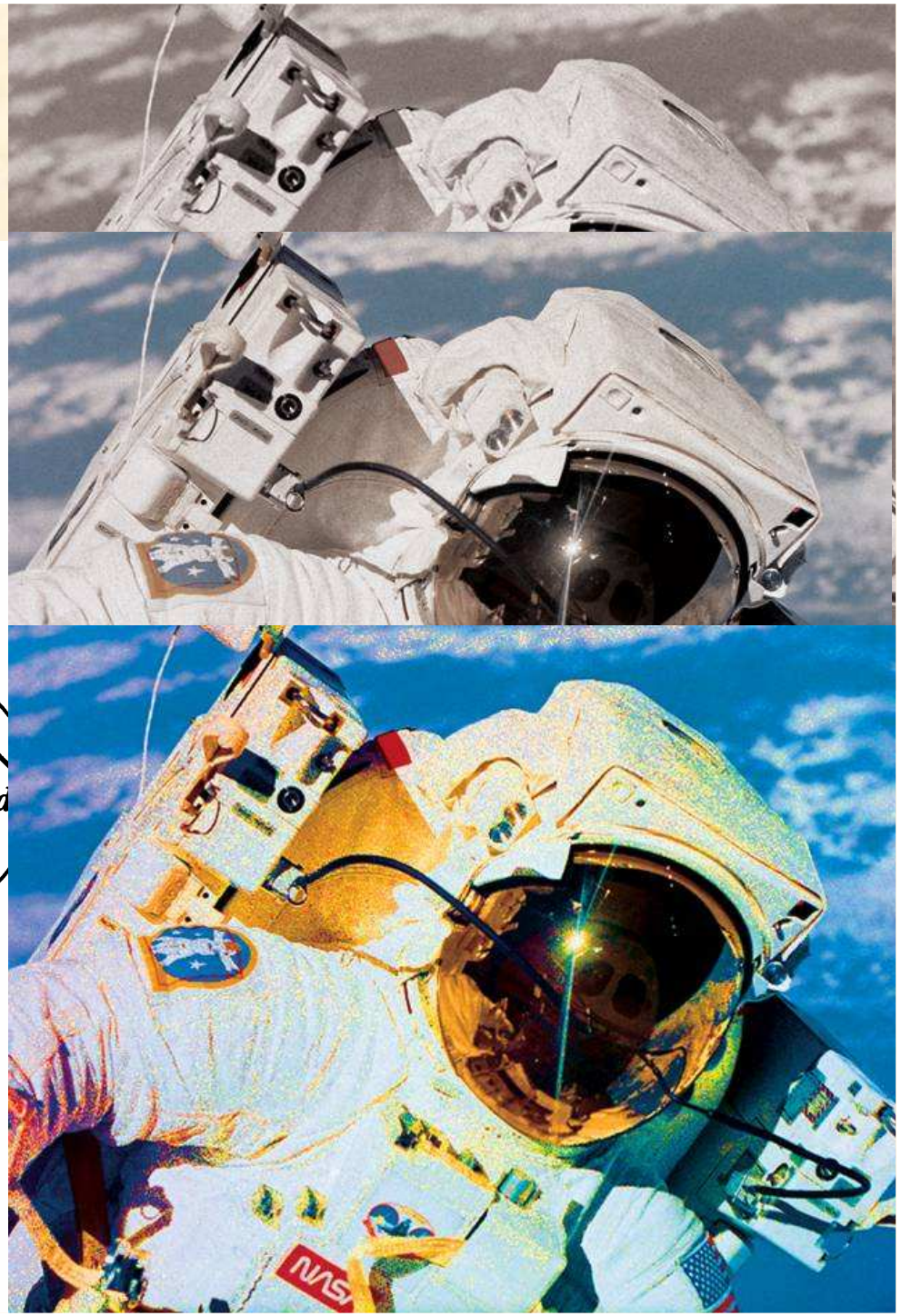
Hue



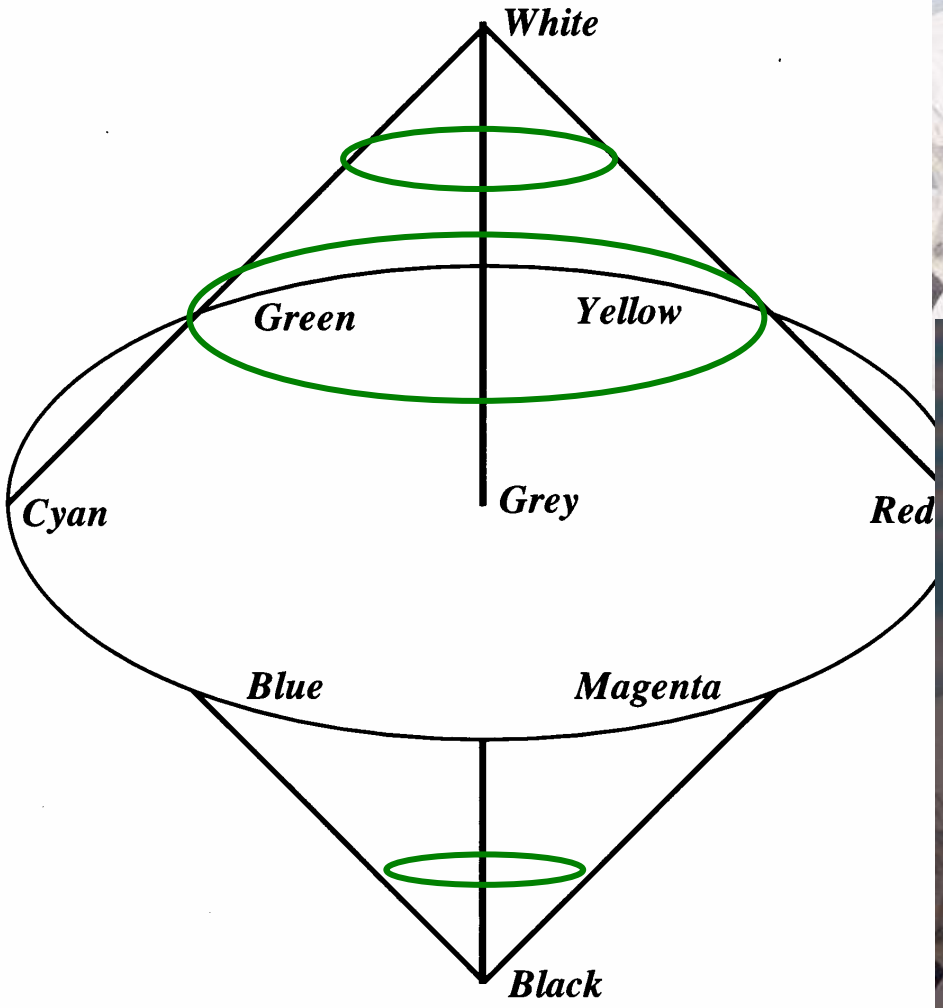


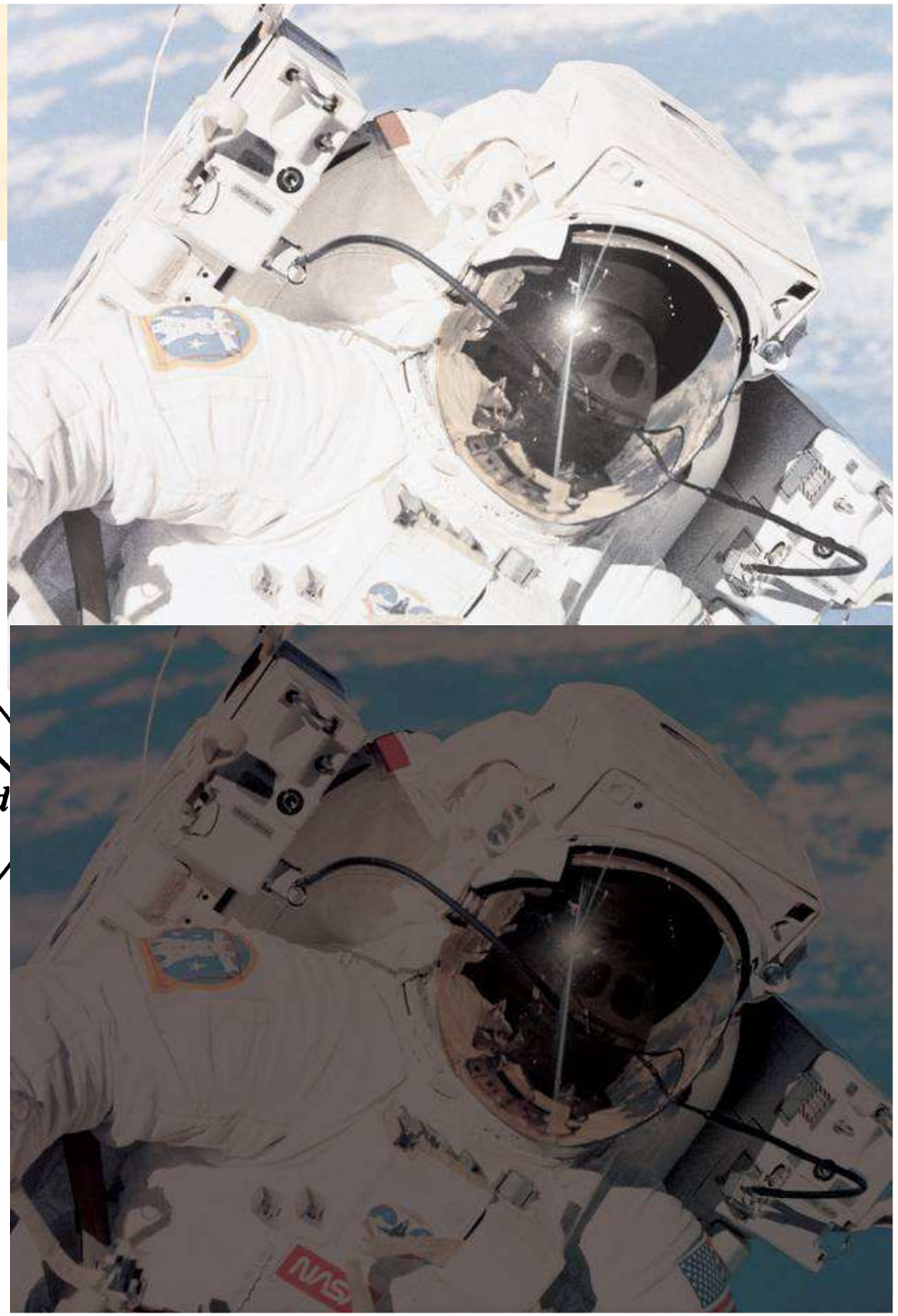
Saturation



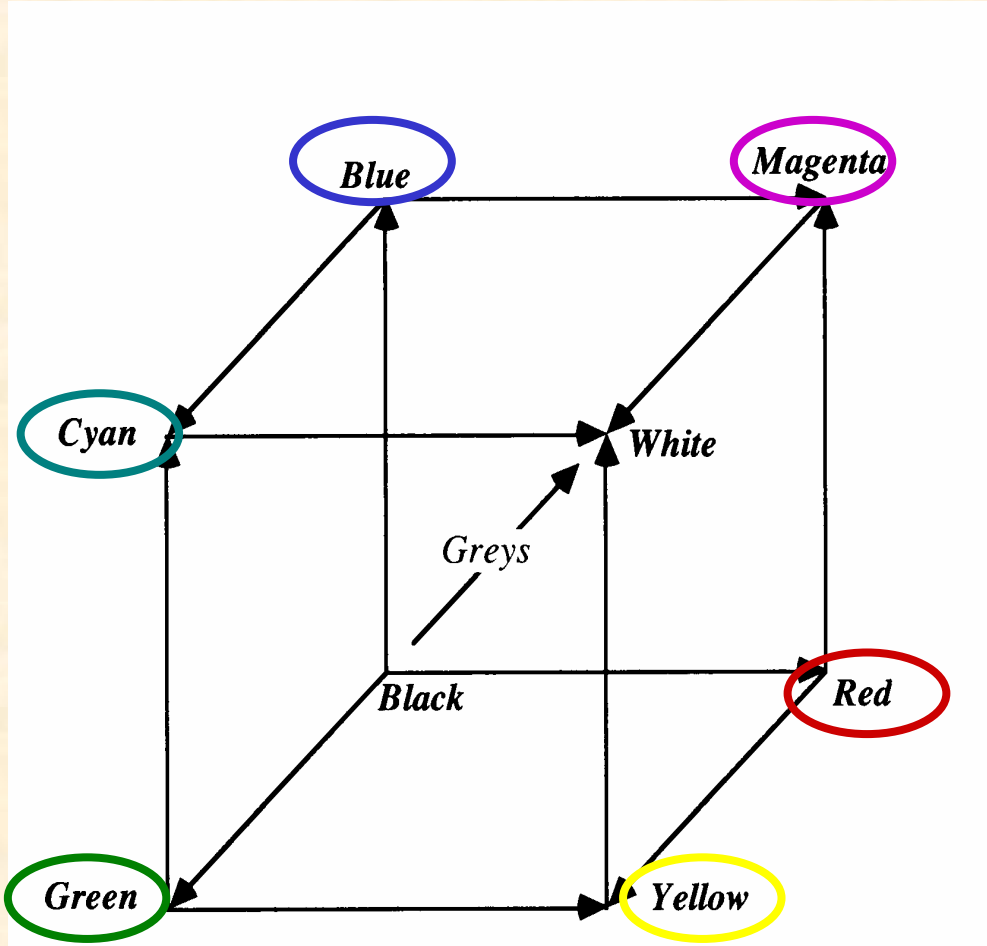


Intensity





CMY colour system

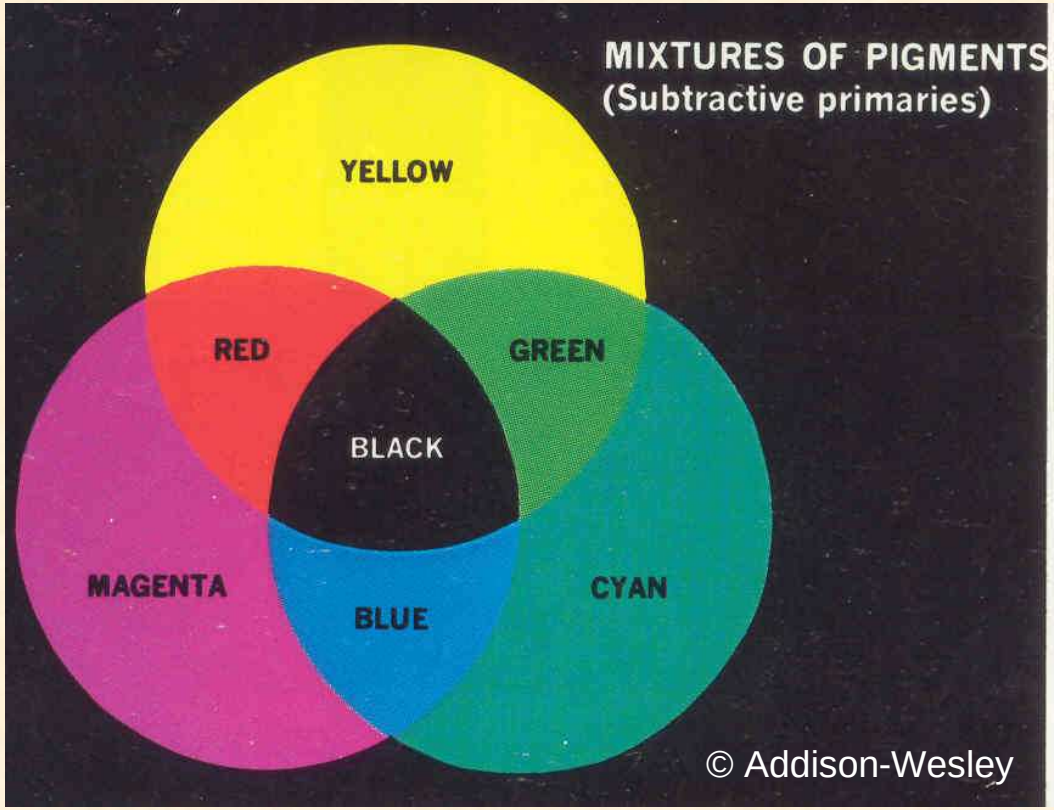


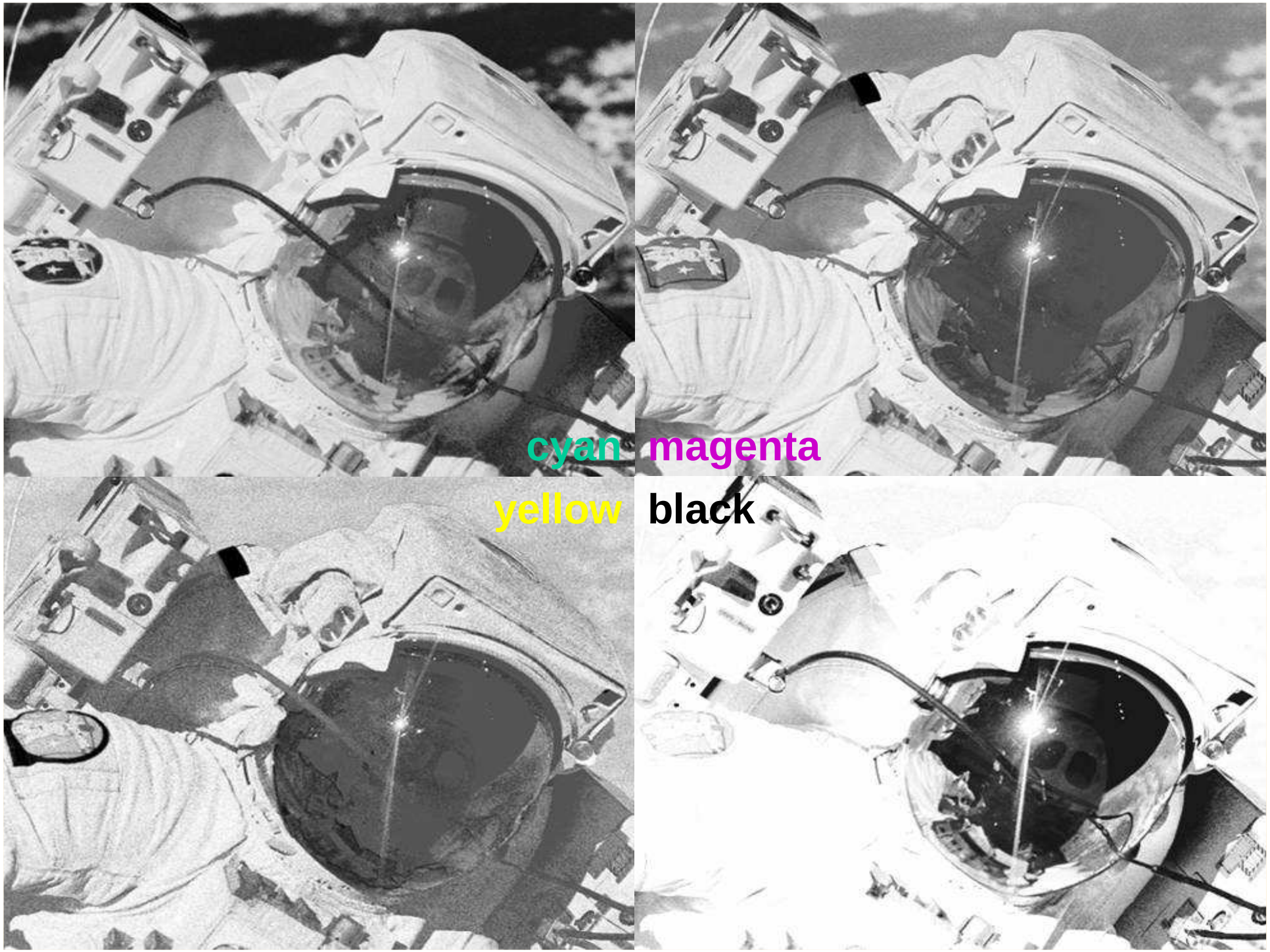
$$\begin{bmatrix} C \\ M \\ Y \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} - \begin{bmatrix} R \\ G \\ B \end{bmatrix}$$

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

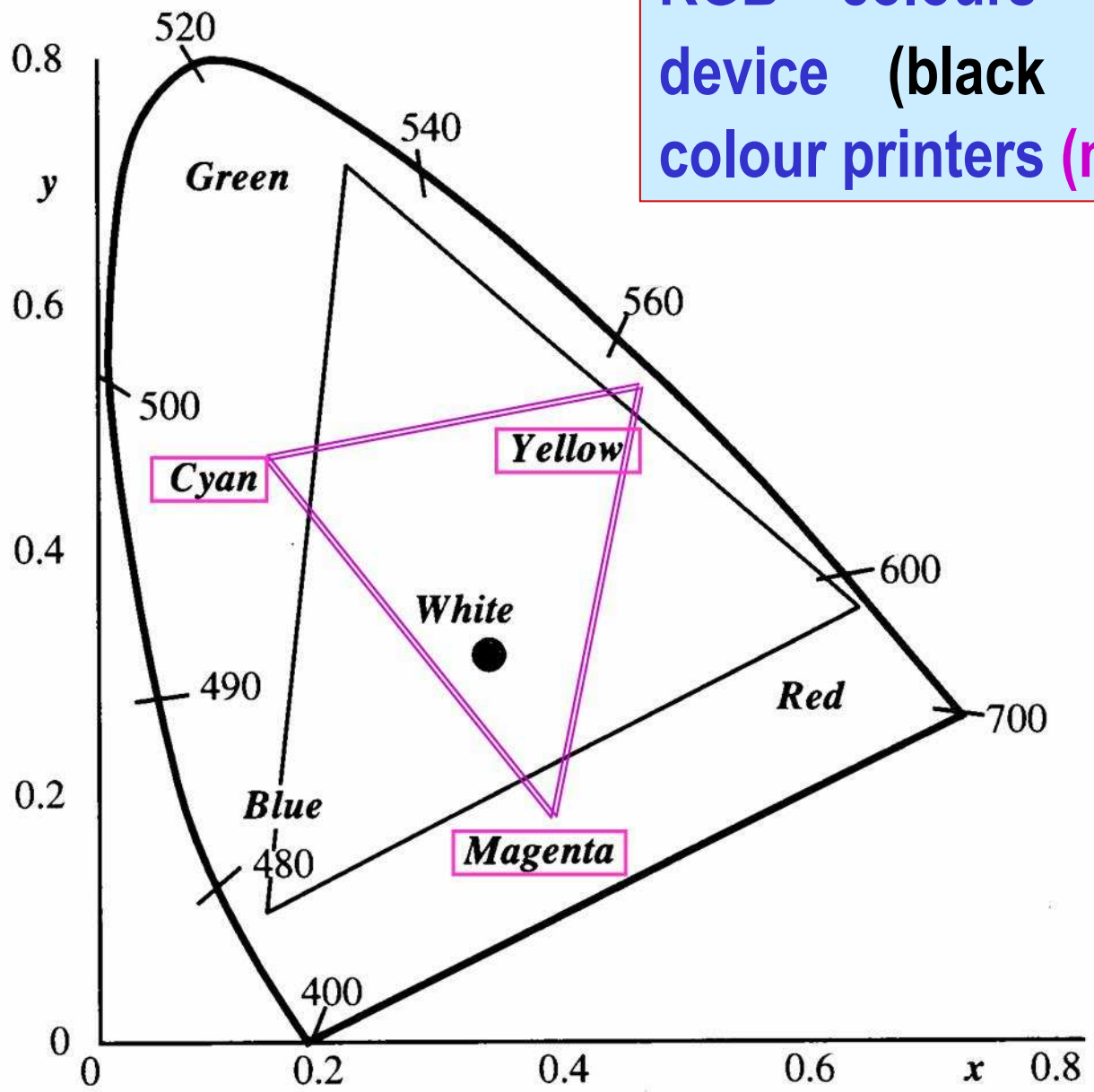
CMY colour components are substractive colours (as opposed to RBG components that are additive colour components)

CMY subtractive primaries

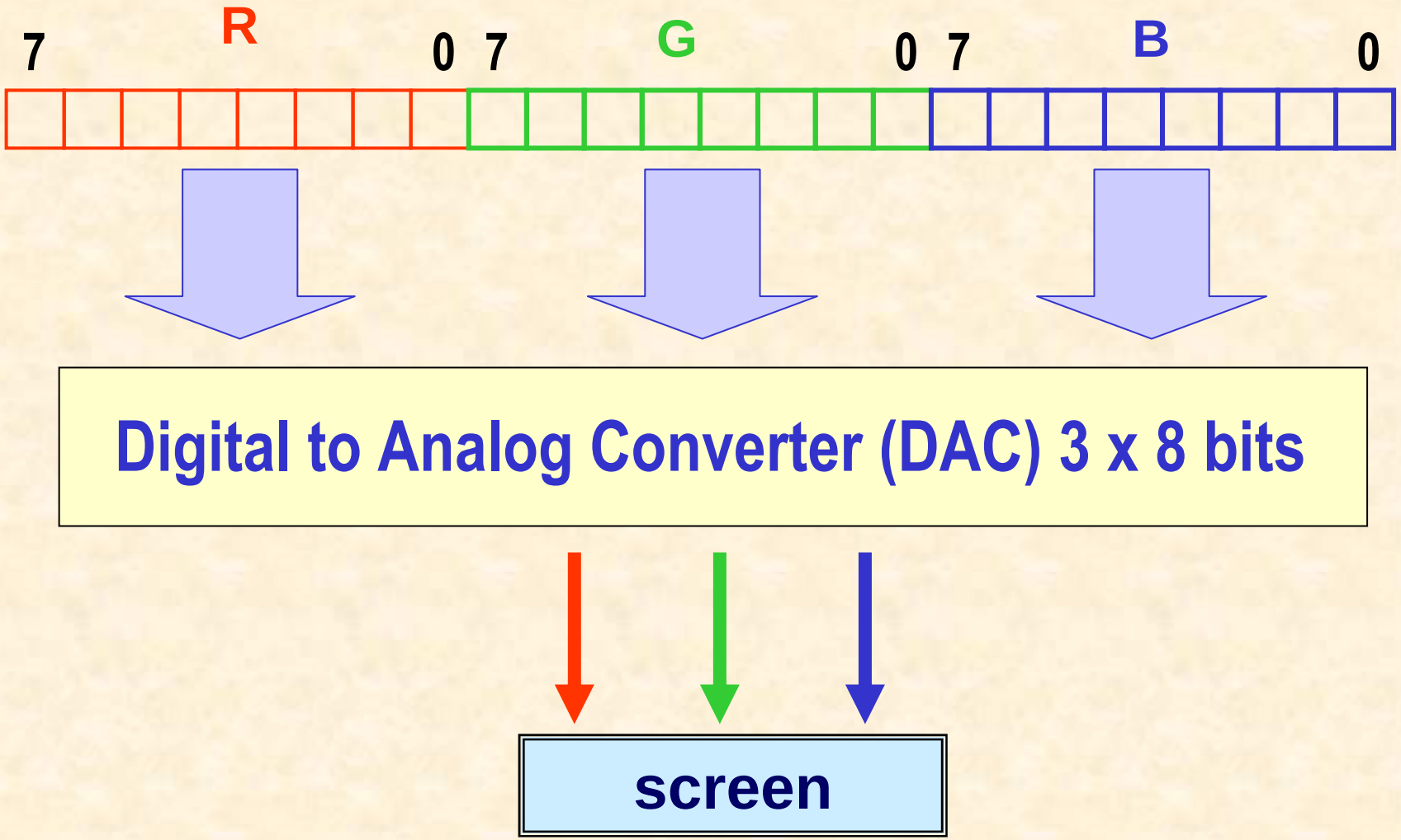



cyan
magenta
yellow
black

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



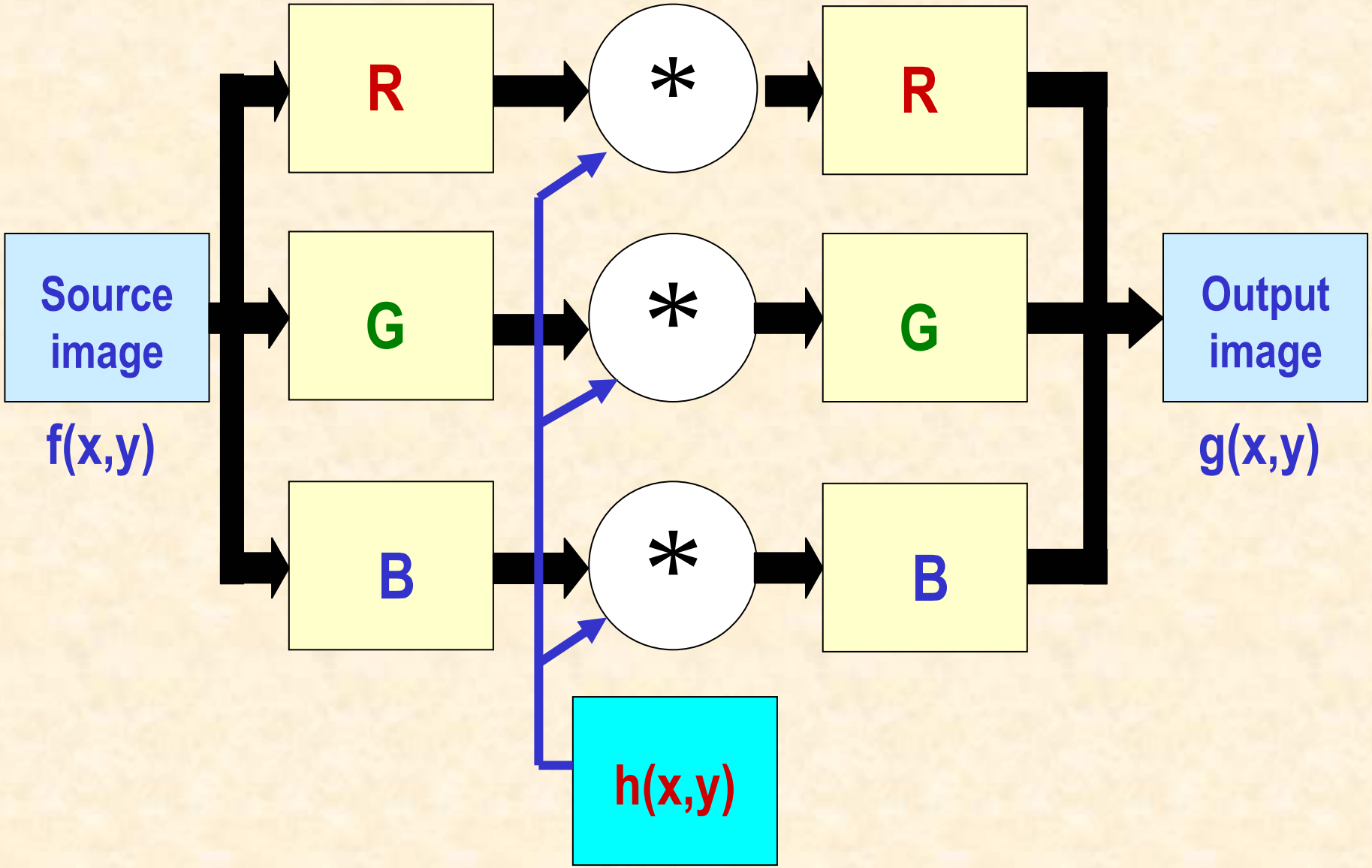
Colour coding in SVGA graphics boards



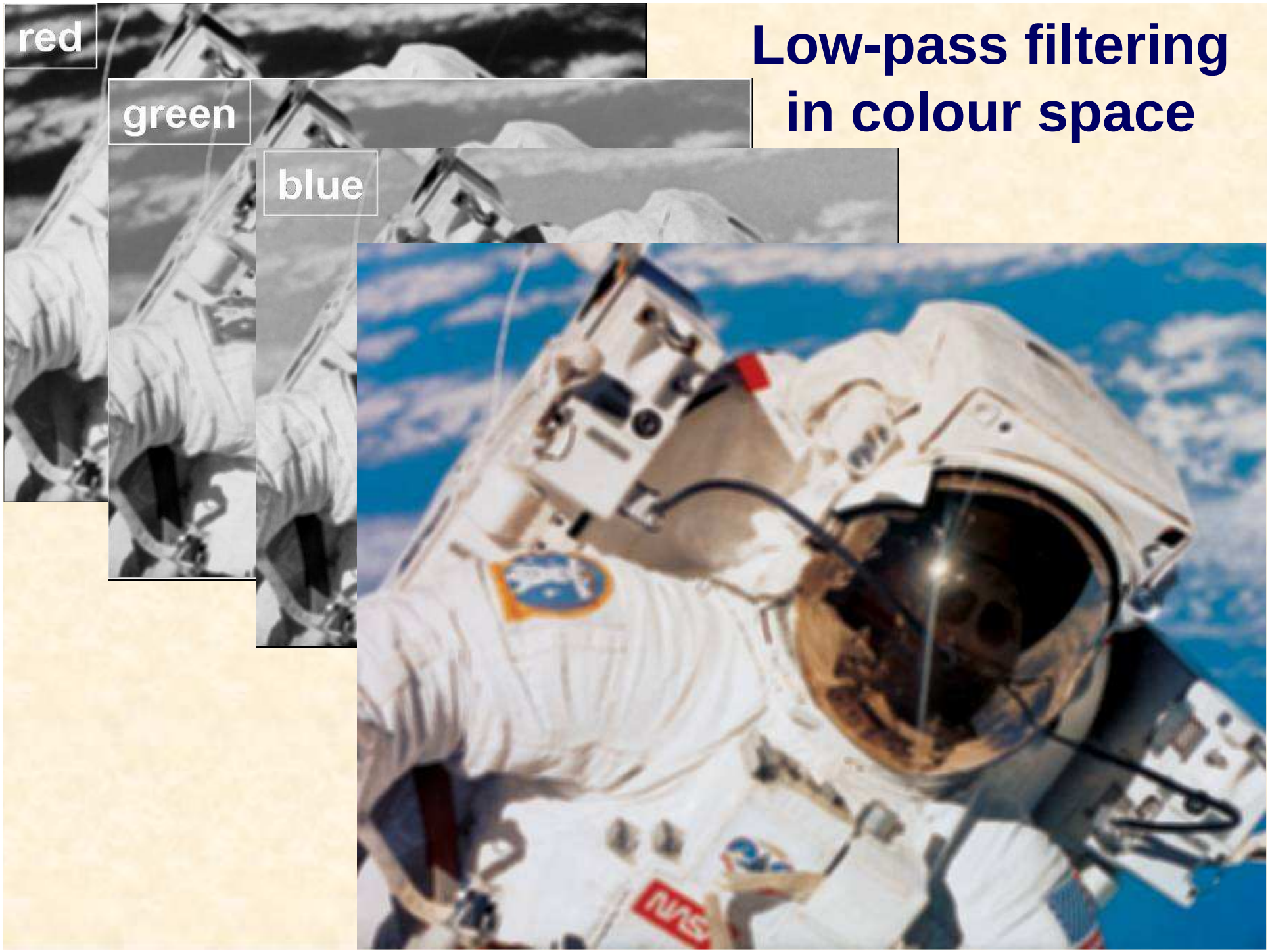
Colour resolutions in PC computers

- True-colour: 2^{24} colours -> 16777216
- High-colour: 2^{16} colours -> 65536 (R5, G6, B5)
- 256 colours (indexed colours from look-up-table)

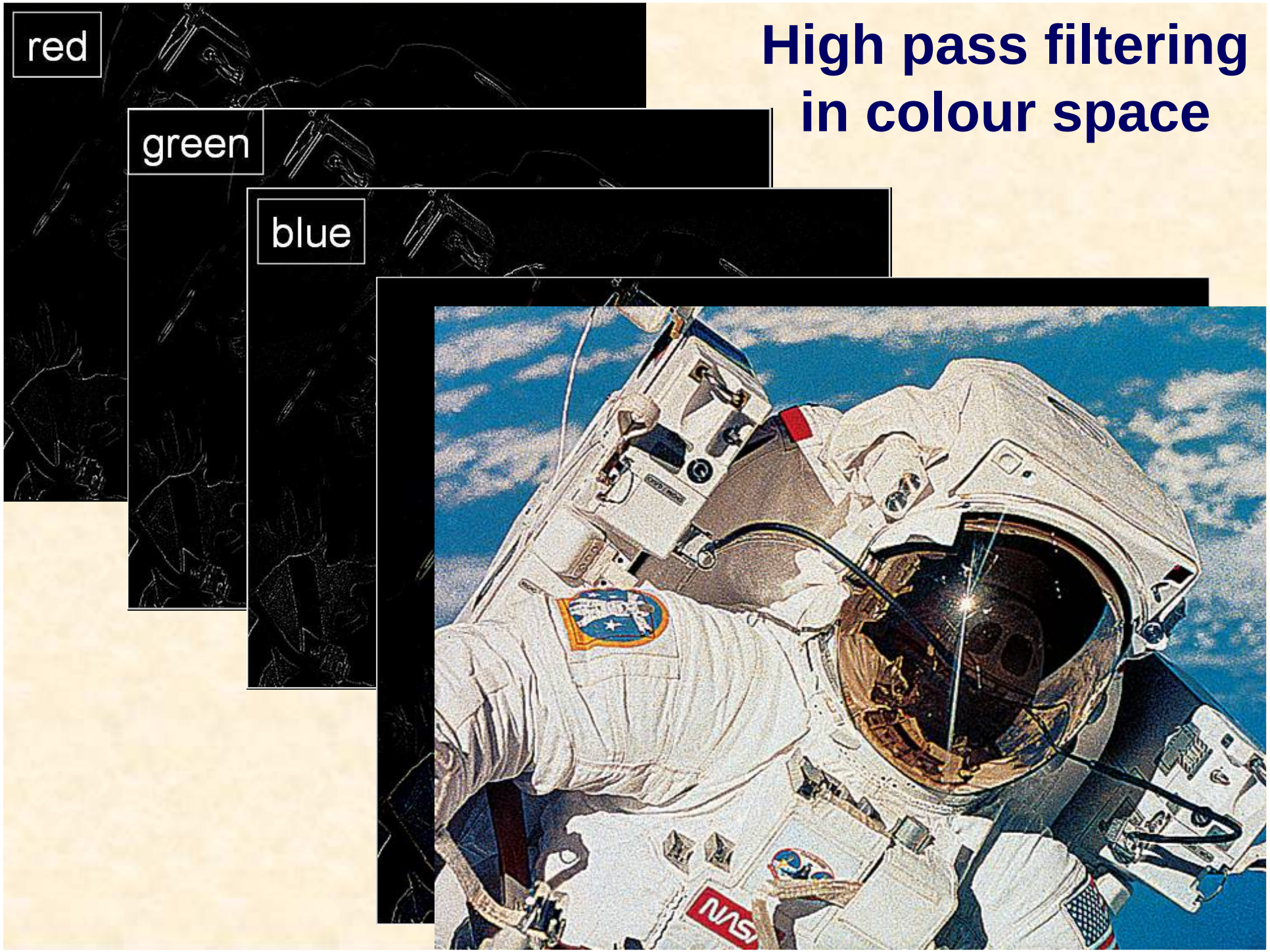
Filtering of colour images in spatial domain



Low-pass filtering in colour space



High pass filtering in colour space



Filtering of colour images in spatial domain

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);
```