



PHYSICS OF COLOUR

SPECTRA, EMISSION, ABSORPTION,
TRANSMISSION AND DISPERSION

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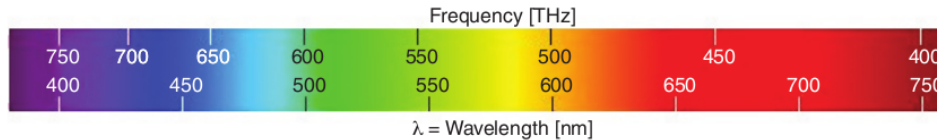
OVERVIEW

- ▶ Colour in Physics
- ▶ Spectrum and Spectral Energy
- ▶ Modes of Generating Colour
- ▶ Colour Terminology

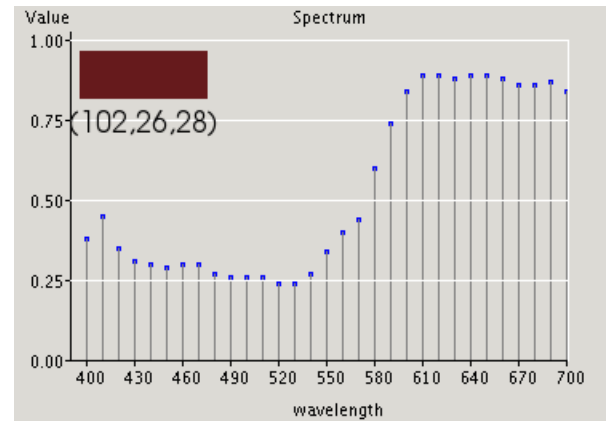
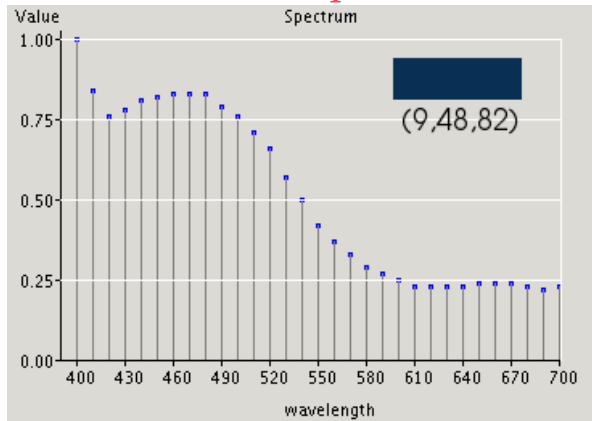


THE PHYSICS OF COLOUR

► Colour is *electromagnetic radiation* within a specific range of wavelengths ($380\text{nm} < \lambda < 780\text{nm}$)



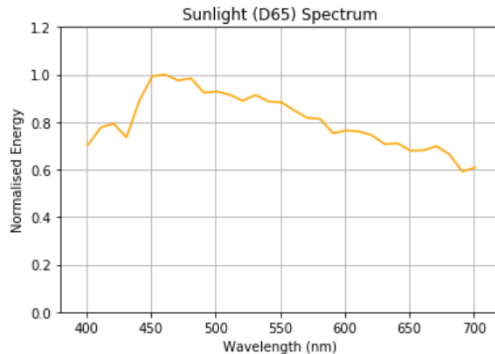
► Colour is a *Spectral Power Distribution (SPD)*





SPECTRA

- ▶ Spectrum gives the relative fractions of energy present at each wavelength
- ▶ Wavelength of visible light is measured in *nanometres (nm)*, where a nanometre = 10^{-9} m.
- ▶ Spectrum may be represented mathematically as a function $S(\lambda)$ where λ is the wavelength

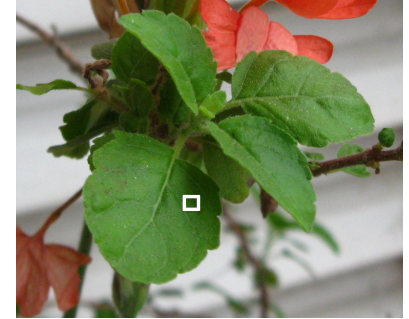


- ▶ For visual spectra,
 $380nm \leq \lambda \leq 780nm$
- ▶ Spectrum for sunlight shows that all wavelengths are present. Normally, humans perceive this colour as *white*.



CAUSES OF COLOUR

- ▶ Kurt Nassau¹ stated that there are *fifteen* causes of colour, but, we list only four!
- ▶ *Emission:*
 - ▷ Any hot object emits light according to the black-body law
 - ▷ The colour emitted depends on the temperature: **blue** means very high, and **red**, low temperature
- ▶ *Scattering and Absorption:*
 - ▷ Objects illuminated by a light source *selectively absorb certain wavelengths*
 - ▷ Leaf absorbs **red** and **blue** and scatters **green**, thus appearing **green**





CAUSES OF COLOUR ...



► *Dispersion:*

- Certain materials change the speed of light according to the wavelength and are called *dispersive media*
- Dispersion causes light to split into its individual wavelengths and produce colours
- Rainbow is caused by such a process

► *Transmission:*

- Light passing through a medium transparent to certain wavelengths results in colour
- Sunglasses, coloured glass and camera filters are examples



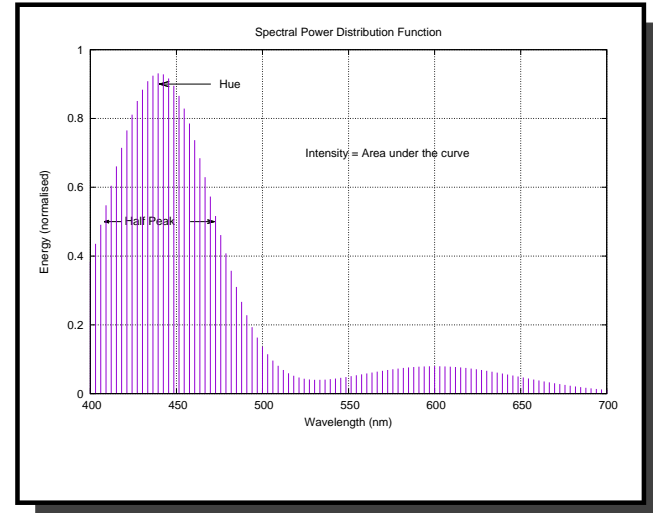
TERMINOLOGY

There are *four* important terms in relation to physics of colour

Intensity: Total Energy falling on an object or emitted by an object; units *Watts/m²*

Brightness: How human vision perceives intensity; subjective

Hue: Dominant colour; measured as the peak wavelength



Saturation: Purity of colour; how dominant is the peak?



SUMMARY

- ▶ Colour starts as a *physical process*
- ▶ Colour is how the human vision system responds to a *spectrum*
- ▶ Visible spectrum lies between 380 nm and 780 nm
- ▶ Four major features of colour are defined on a spectrum

END OF MODULE I