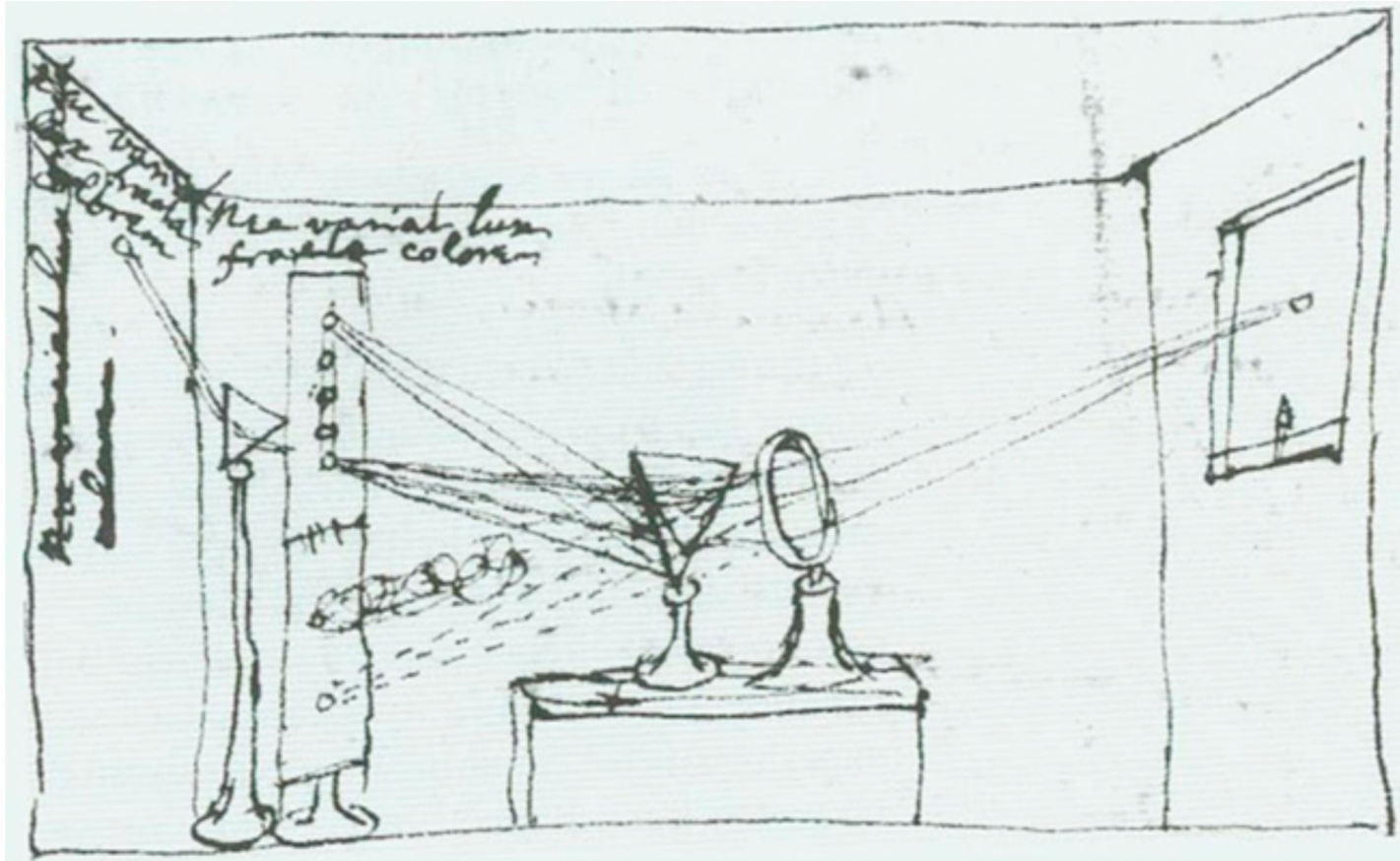


Image Formation

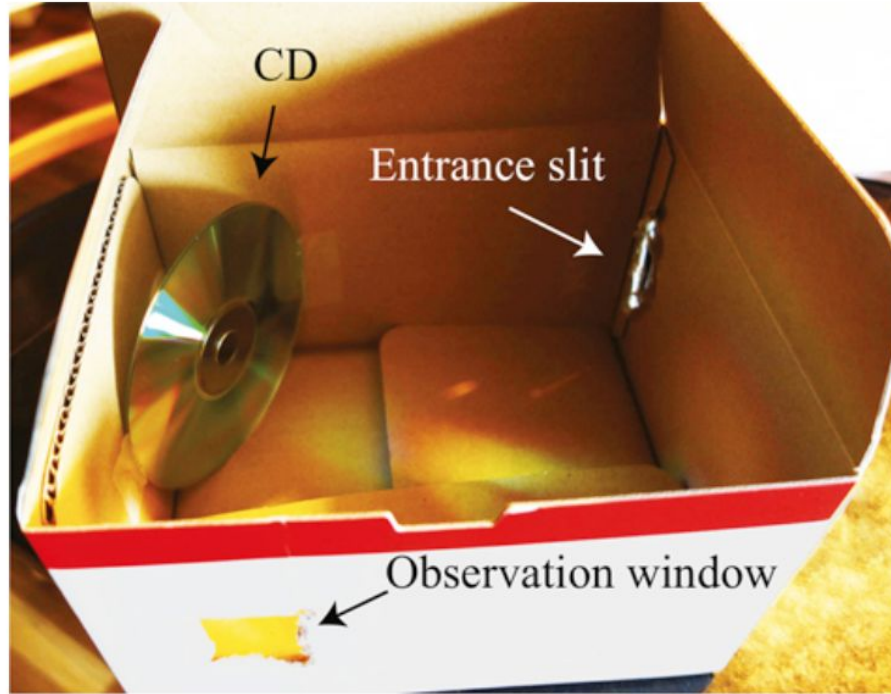
Color

Light and its colors - refraction



Light and its colors - diffraction

A simple spectograph

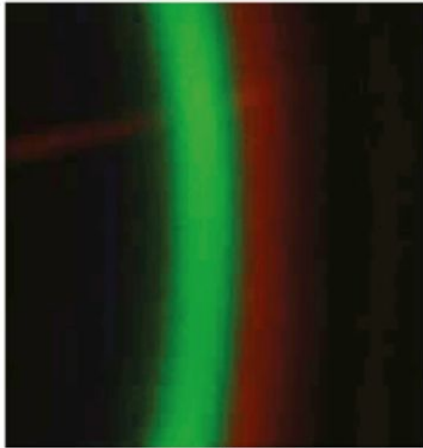


(a)

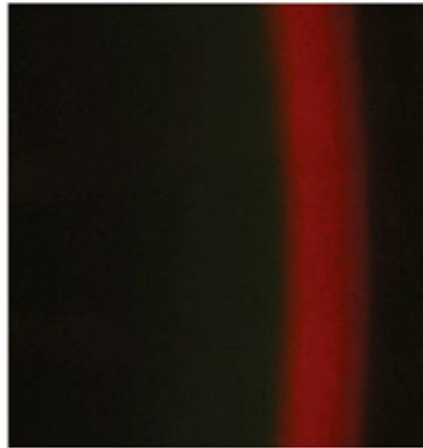


(b)

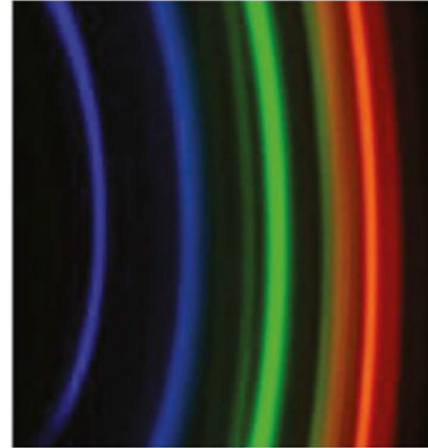
Light and its colors - diffraction



(a)

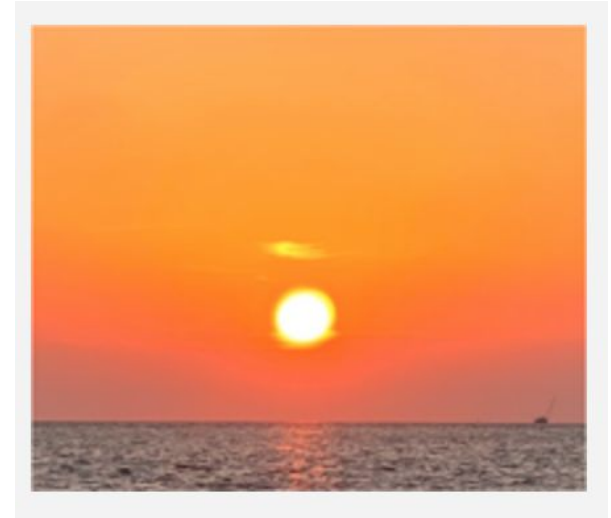
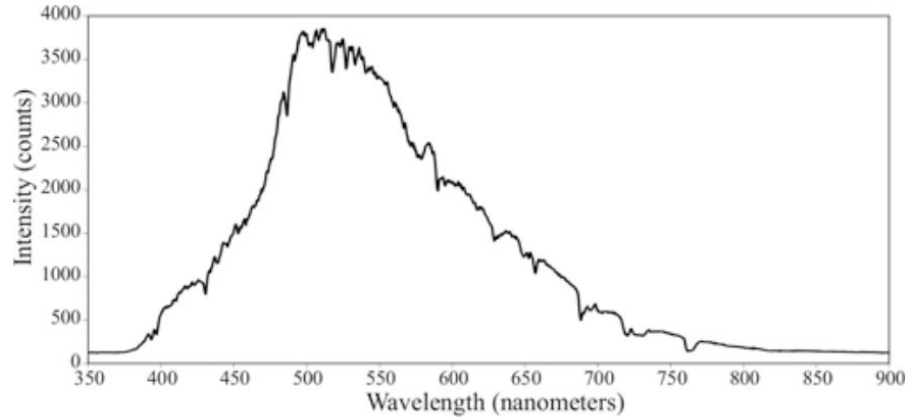


(b)

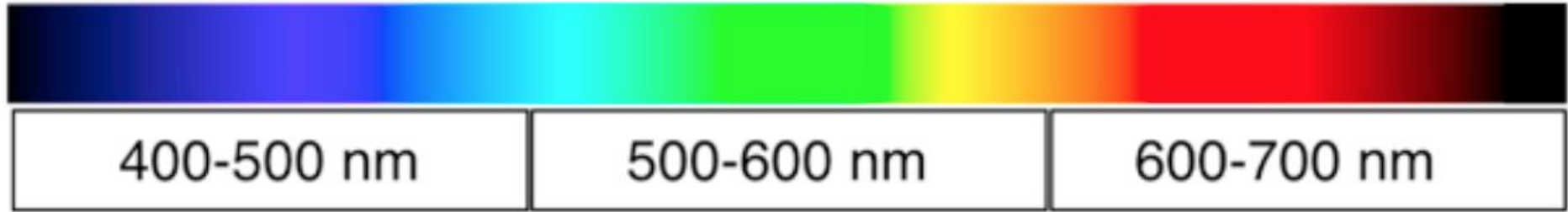


(c)

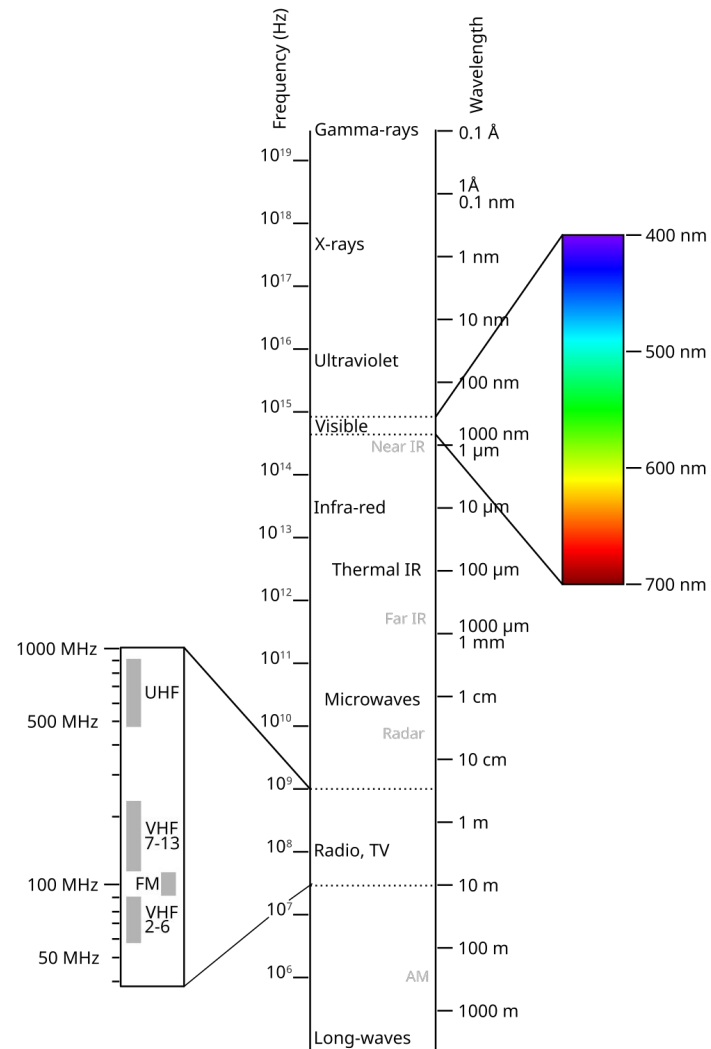
Why does the sky look blue? And why does it look orange during a sunset?

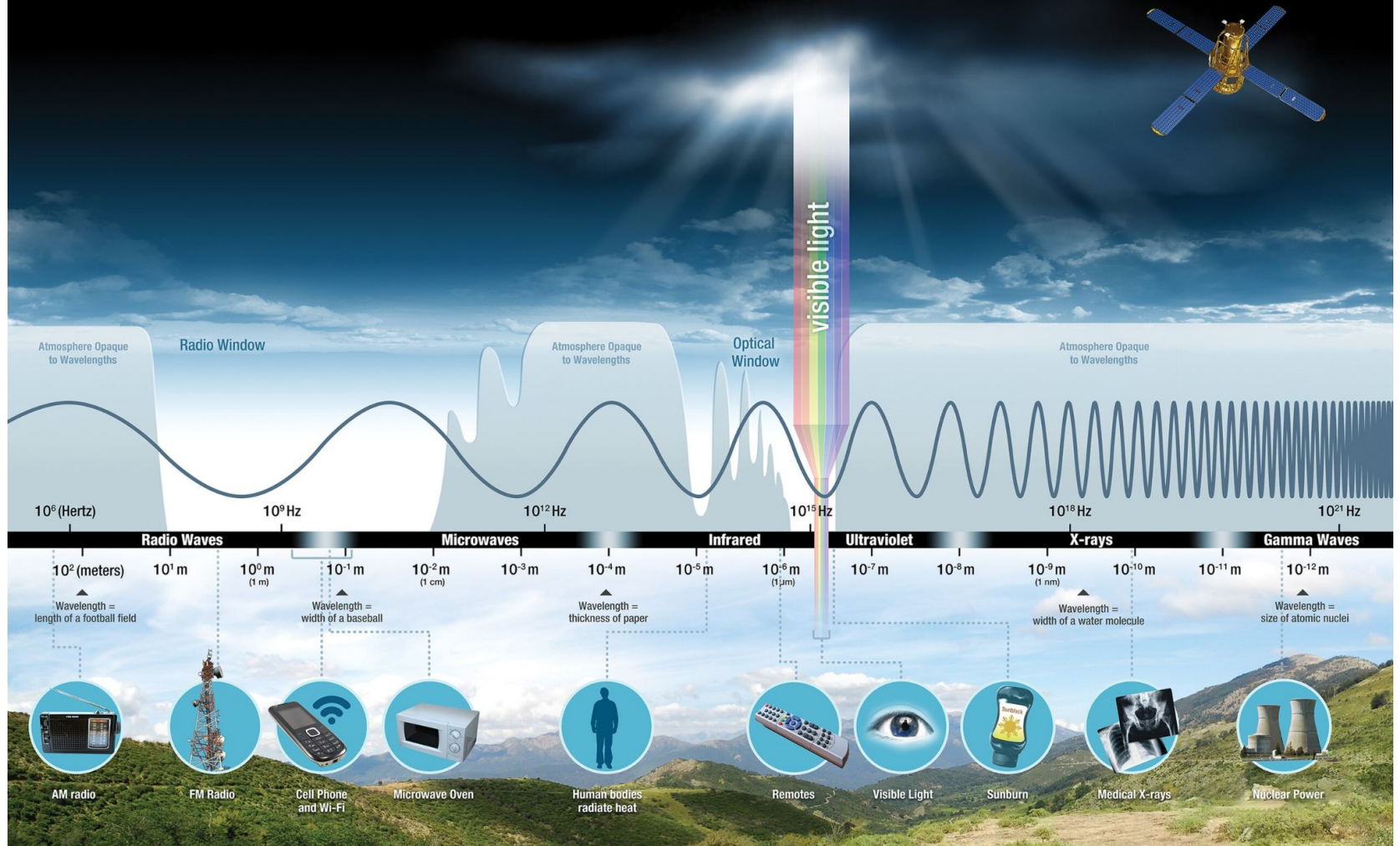


Light Power Spectrum



“A spectrum of light containing power evenly distributed over 400—700 nm would appear approximately white.”





“Light Reflecting from Surfaces”

1. “These changes in light allow us to perceive objects and surfaces by observing their influence on the reflected light.”
2. “The interaction between light and a surface can be quite complex. Reflections can be specular or diffuse,”
3. “and the **reflected power spectrum** may depend on the relative orientations of the incident light, surface, and the observed reflected ray.”

“Light Reflecting from Surfaces”

$$r(\lambda) = k\ell_{\text{in}}(\lambda)s(\lambda), \quad (8.1)$$

1. power spectrum of the reflected light, $r(\lambda)$
2. wavelength-by-wavelength product of the power spectrum of the incident light, $\ell_{\text{in}}(\lambda)$,
3. and a reflectance spectrum, $s(\lambda)$ ”
4. “the proportionality constant k depends on the reflection geometry”

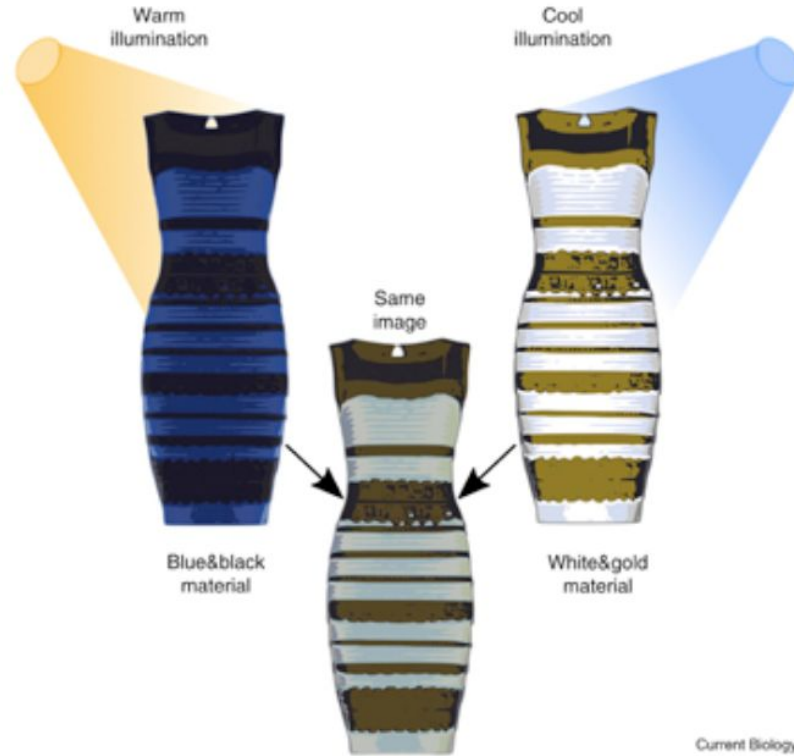
“Light Reflecting from Surfaces”

1. “the human visual system represents color with only three numbers.
2. So it is an important visual task to estimate either the surface reflectance spectrum, or a low-dimensional summary of it”
3. “When the illumination is white light with equal power in all spectral bands, the **observed reflected spectrum** is proportional to the **reflectance spectrum** of the material itself.”
4. “However, under the more general condition of unknown illumination color, a visual system will need to estimate the surface reflectance spectrum, or projections of it, by taking the context of nearby image information into account.”

“Light Reflecting from Surfaces”



(a)



(a)

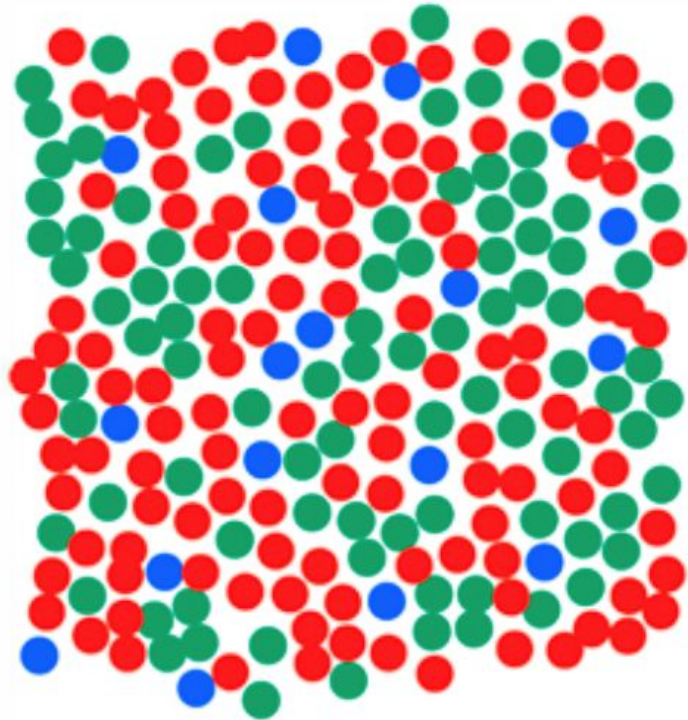
“Light Reflecting from Surfaces”

1. “The perceived colors of the dress depend on the assumed color of the illumination, and people can disagree significantly about the colors they see”

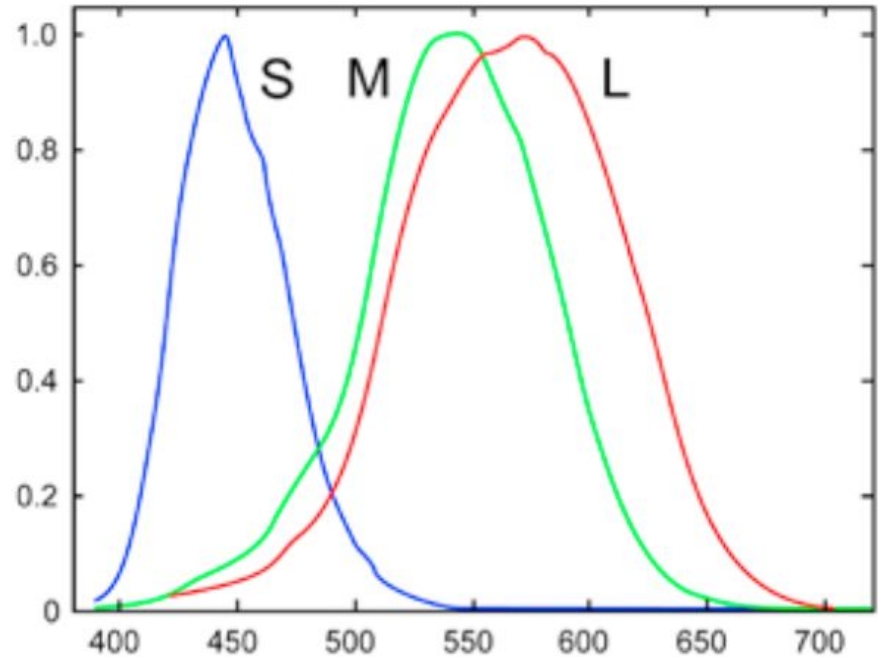
Color Perception

1. “The retina contains photoreceptors called the rod and cones. Rods are used in low-light levels, and the cones are used in color vision. In low-light, only the rods operate and our vision becomes black and white.”
2. “The human visual system analyzes the incident light power spectrum with only three different classes photoreceptors, called the L, M, and S cones because they sample at the long, medium, and short wavelengths.”

Color Perception



(a)



(b)

Color Perception

1. “(a) shows the spatial sampling pattern, for each of the three cone classes”
2. “(b) shows the spectral sensitivity curves for the L, M, and S cones.”

References

1. Foundations of Computer Vision - Chapter 8
2. Columbia University <https://fpcv.cs.columbia.edu>