

# Light-Matter Interaction

Maricor Soriano

Why do surfaces look the way they do?

Incident Light

Reflected

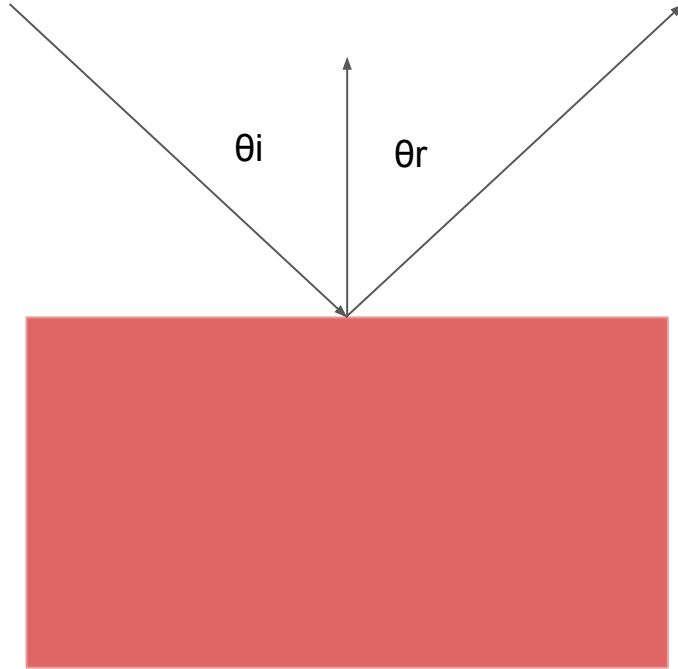
- Direction
- Speed
- Spectral power distribution
- Polarization



Absorbed

Transmitted

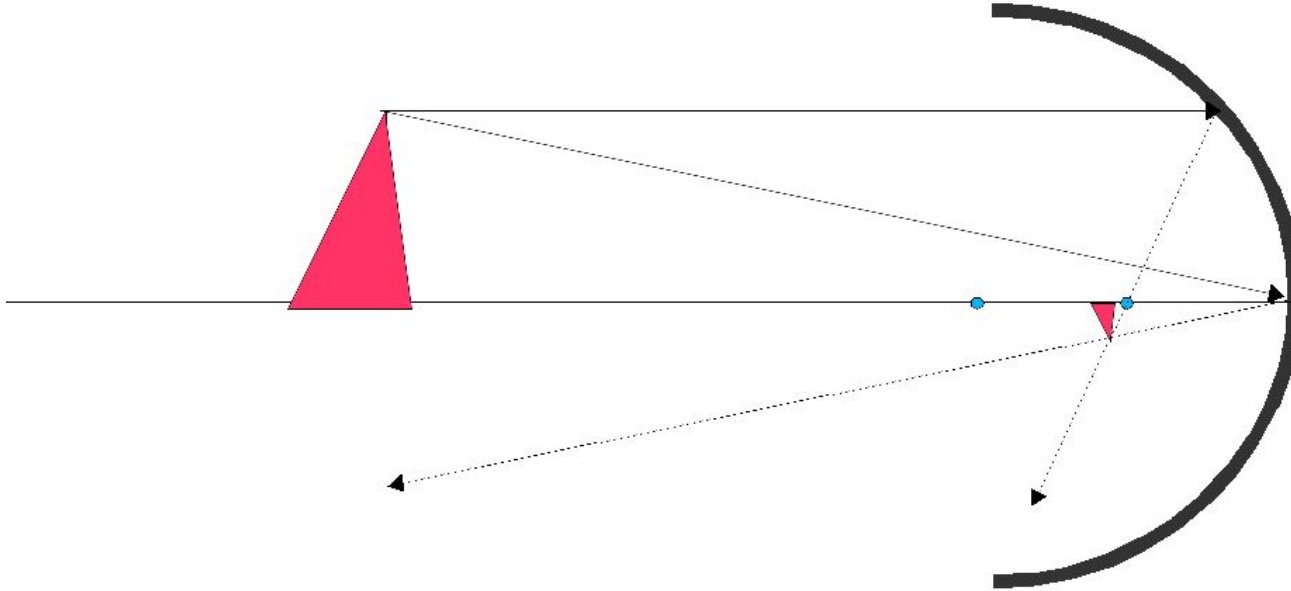
# Surface Reflection



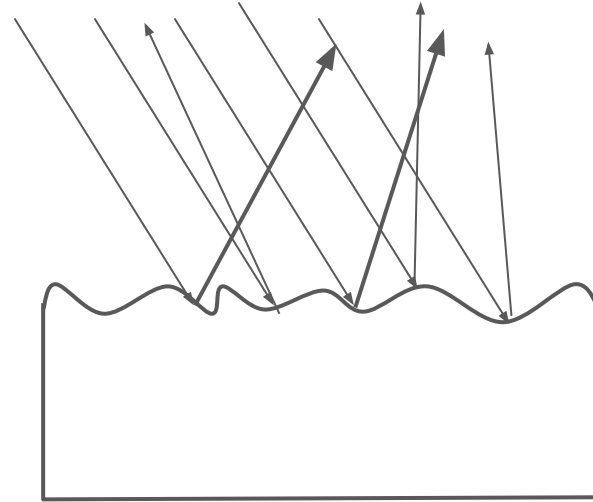
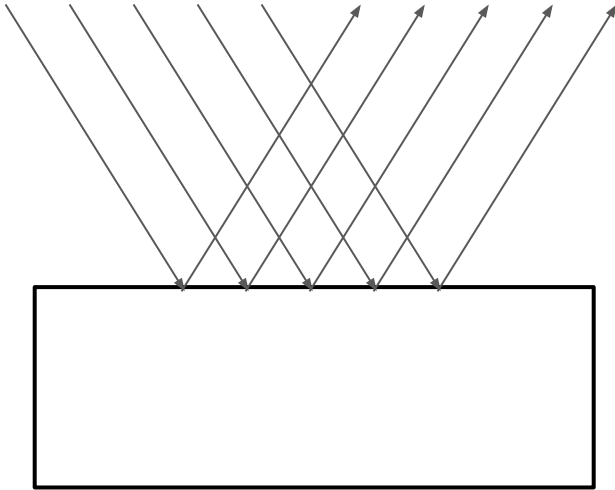
## Law of Reflection

$$\theta_{\text{incidence}} = \theta_{\text{reflection}}$$

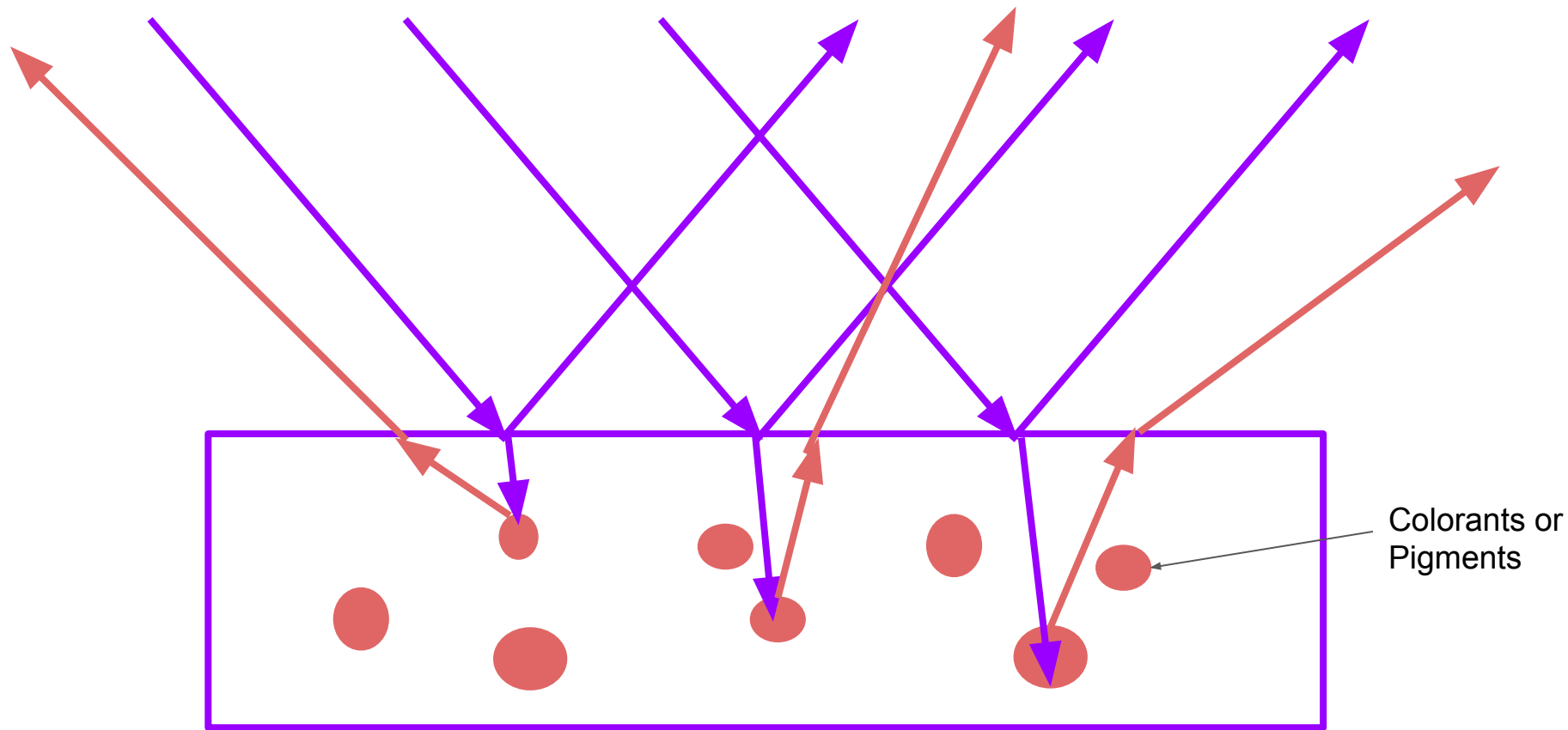
# Reflection from curved surfaces

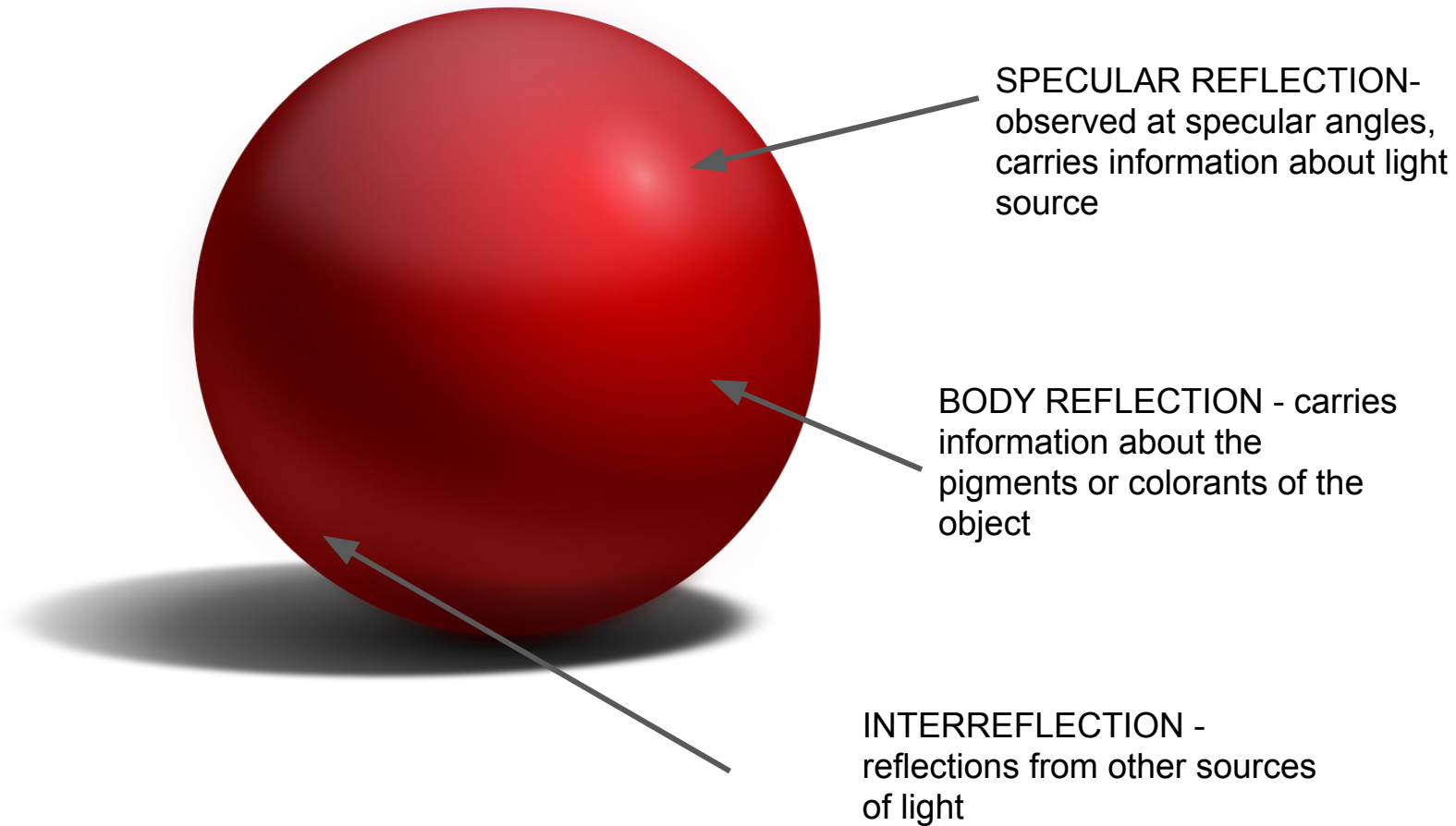


# Smooth vs. Rough Surface



# Specular vs. Body Reflection

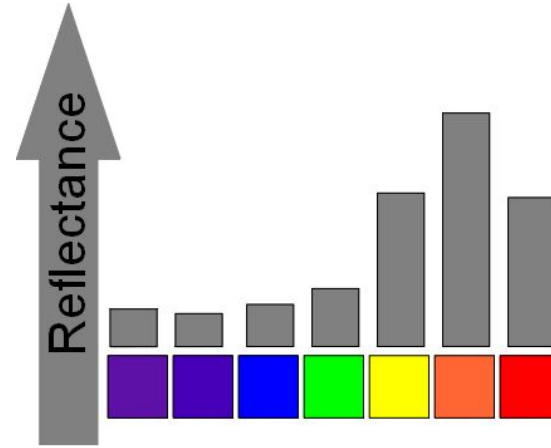






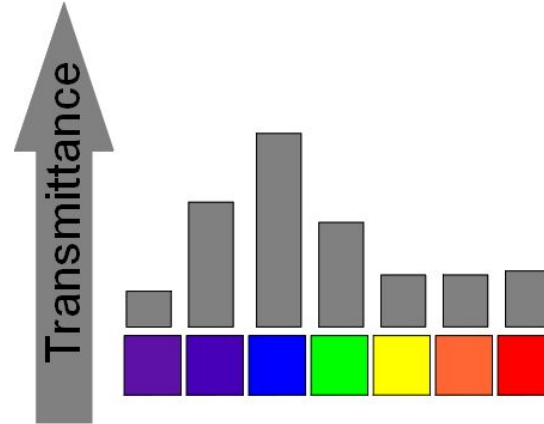
# REFLECTANCE SPECTRUM

How much of each wavelength of light the body reflects



# TRANSMITTANCE SPECTRUM

How much of each wavelength of light a body transmits.



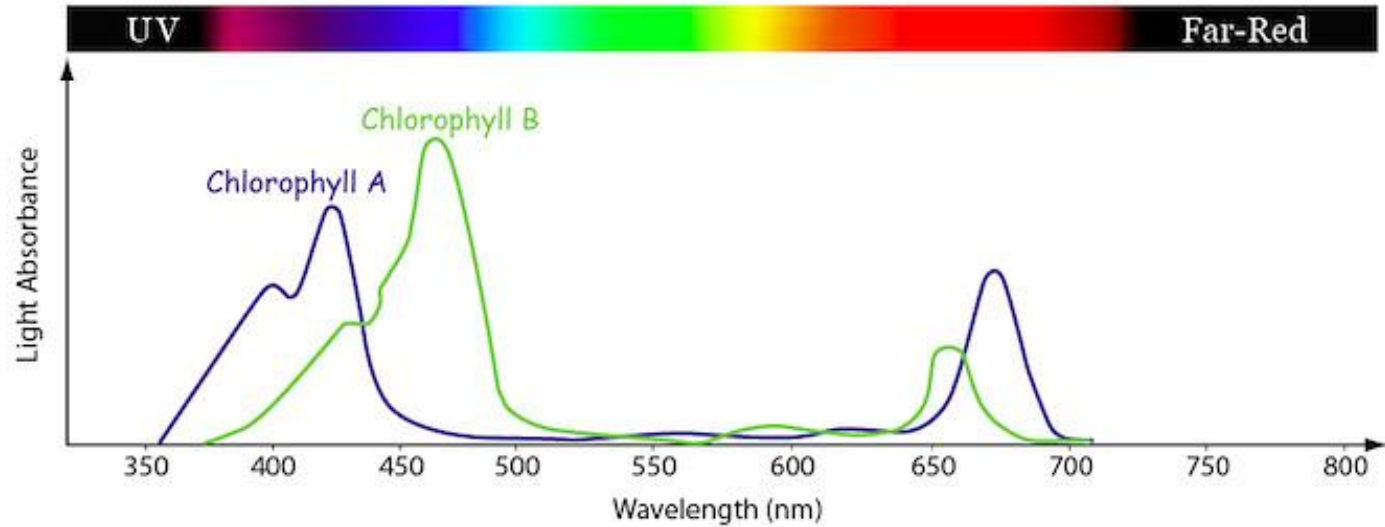
# ABSORBANCE

How much of each wavelength of light the body absorbs

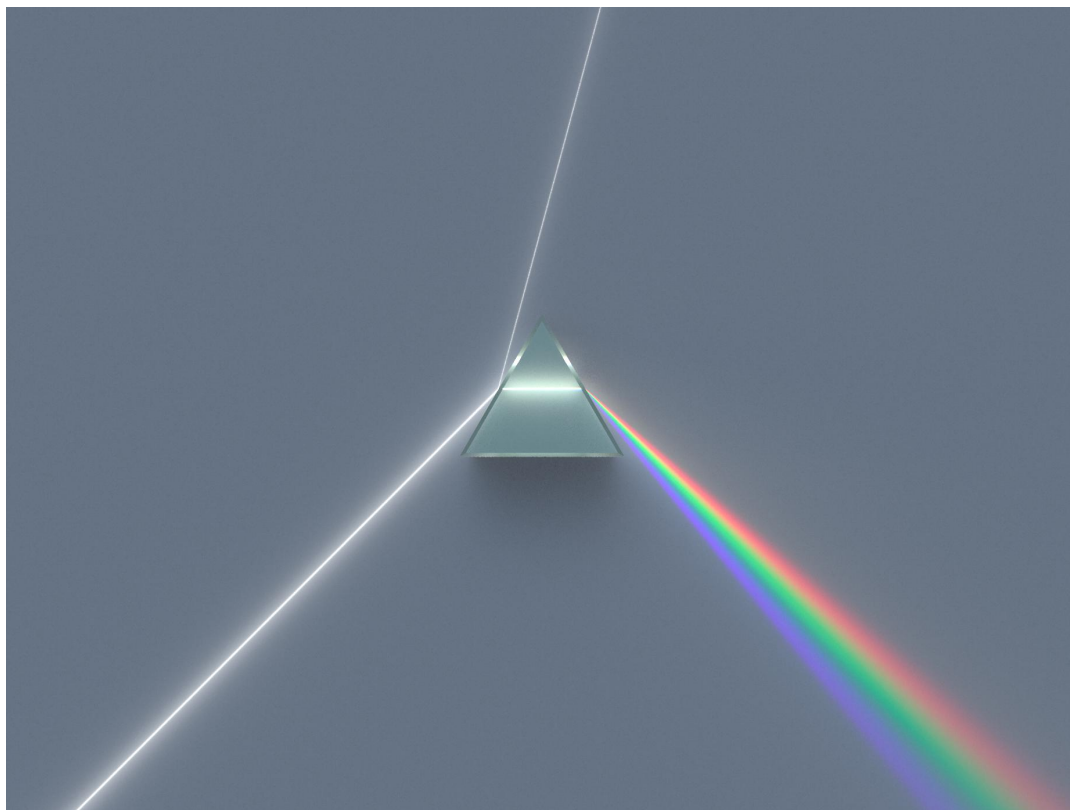


POP QUIZ : Sketch the shape of the reflectance, transmittance, and absorbance of a leaf.

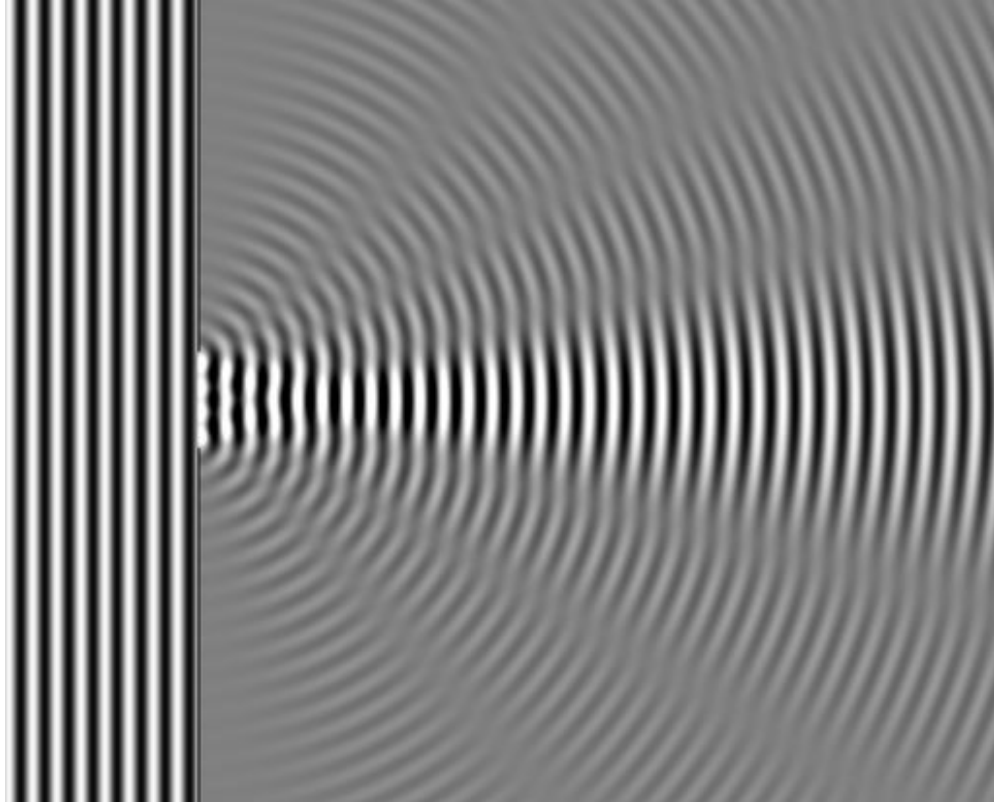
# Chlorophyll Absorbance



# Dispersion

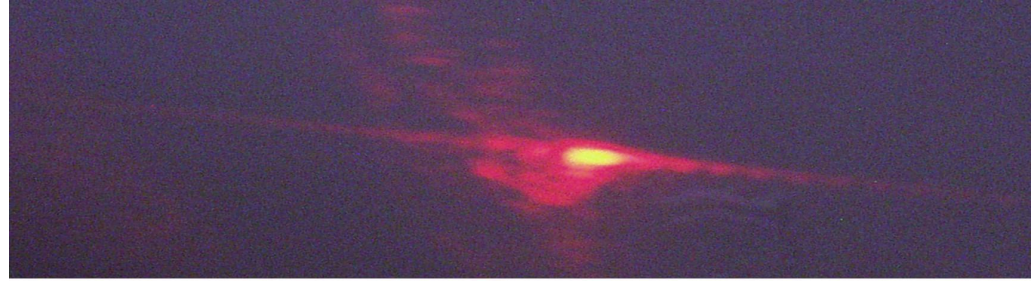
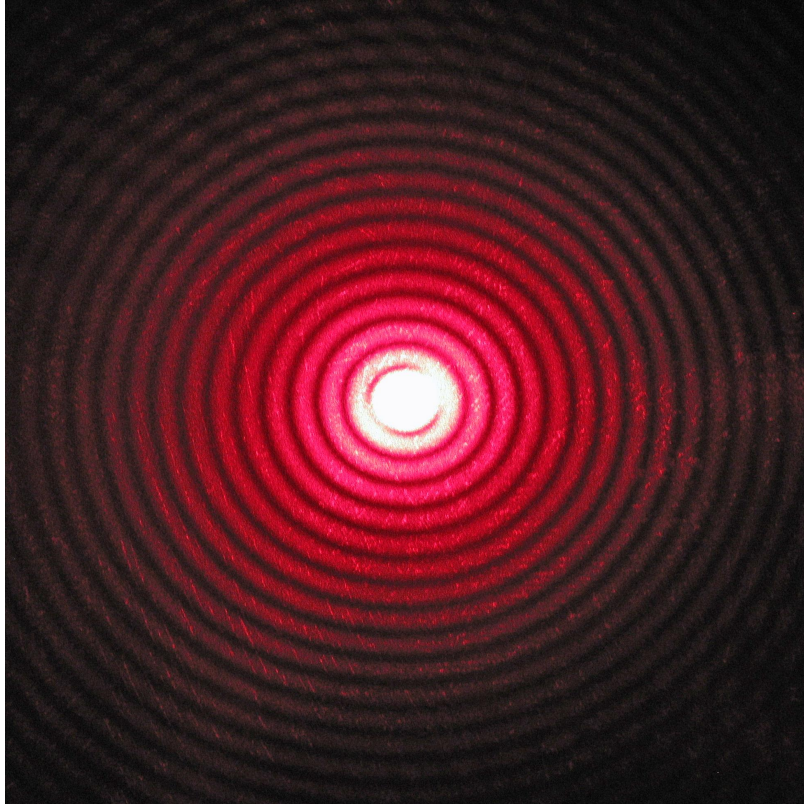


# Diffraction and Interference

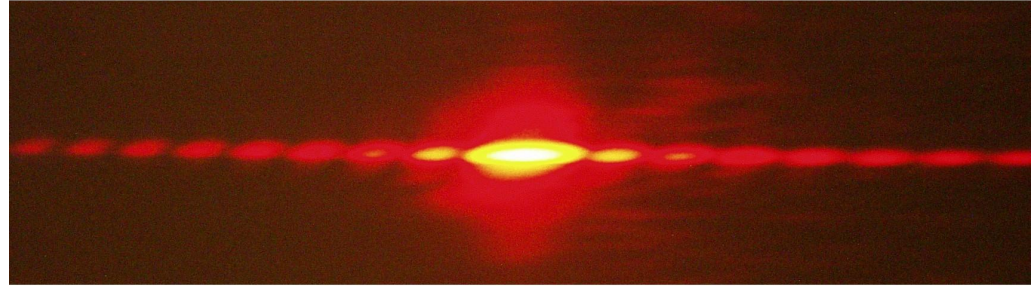




# Diffraction and Interference



Pattern produced from a single slit.



Pattern produced from a double slit.

# Thin film interference in Papilos butterfly wings (Bragg reflectors)





# Thin Fil Iridescence in shells





Millais  
Oil on canvas  
The Black Brunswicker  
1860

# Activity 3

1. Take pictures of objects demonstrating different light-matter interactions (even those not discussed in class). Explain each light-matter interaction phenomenon. PLEASE TAKE NOTE OF THE CAMERA AND CAPTURE SETTINGS YOU'VE USED (e.g. Canon D10 at EV 0 , Autowhite balance, F5.6, etc...)
2. Create a light box. <https://www.youtube.com/watch?v=OyxzC5kqbyw>.
3. Pick a light source and measure its emittance spectra. Place objects of known reflectance (eg. Leaf, a Macbeth color chart, commercial paints) in the light box and measure the REFLECTANCE of each object. Be careful to avoid specular reflection. Compare your measurement with online database values.
4. Take a picture of the objects you used in 3.