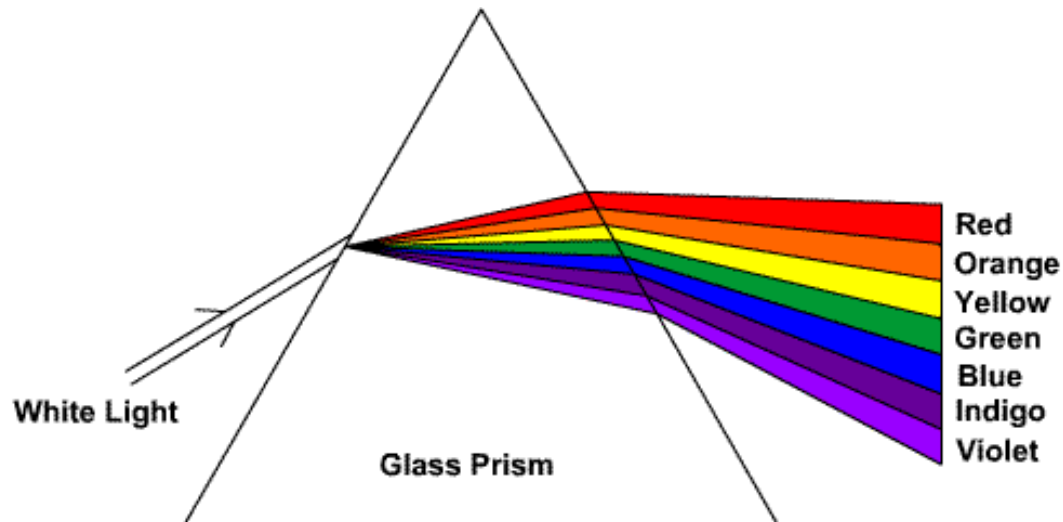


Dispersion, Diffraction, and Interference

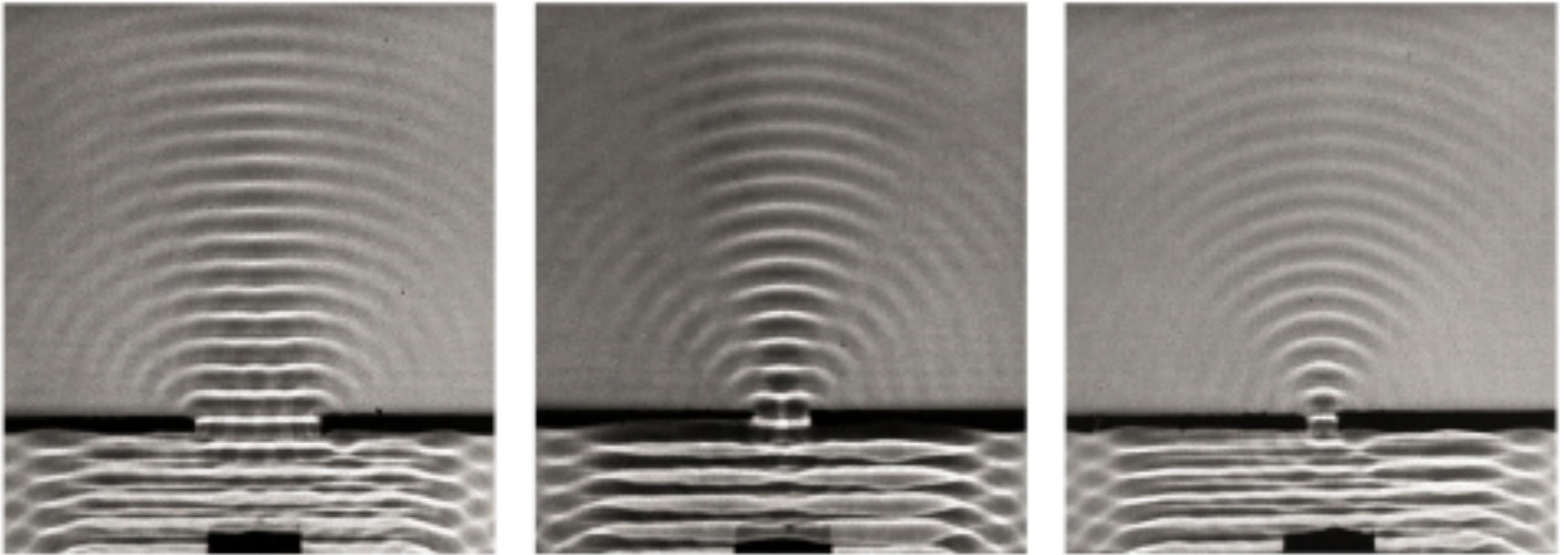
Dispersion

- **Dispersion** - Property by which light spreads out according to its colors as it passes through an object.



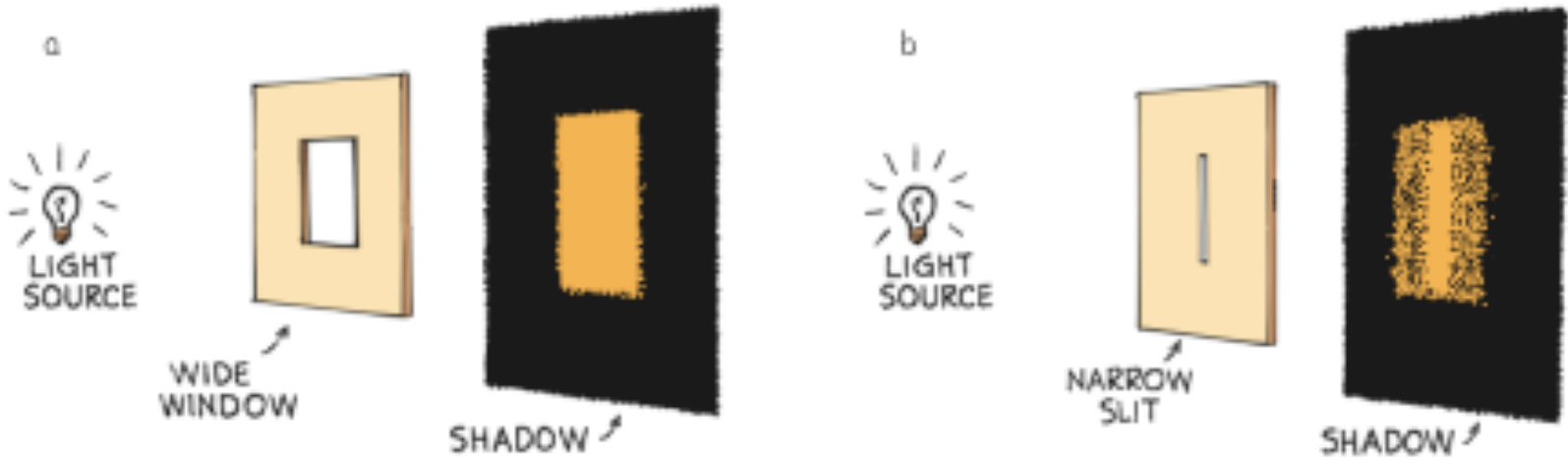
- The index of refraction is slightly different for each wavelength of light, so each color is refracted by a different amount.
- Red light bends the least; violet light bends the most.

Diffraction



- Diffraction – the bending of waves around an object or through an opening.
- The extent to which light waves bend depends on the size of the opening and the size of the waves.

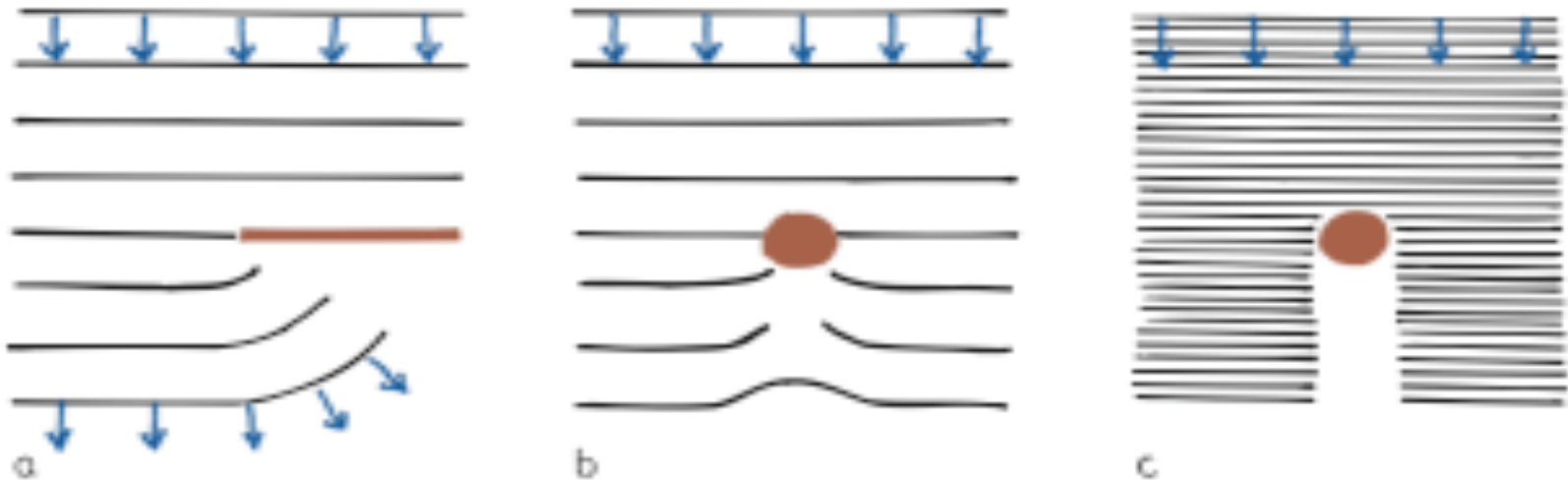
Diffraction



Diffraction occurs when light waves pass through an opening.

- a. If opening is large compared with the wavelength of the light
Light casts a sharp shadow with some fuzziness at its edges
- b. If opening is extremely narrow
Because of diffraction, it casts a fuzzier shadow

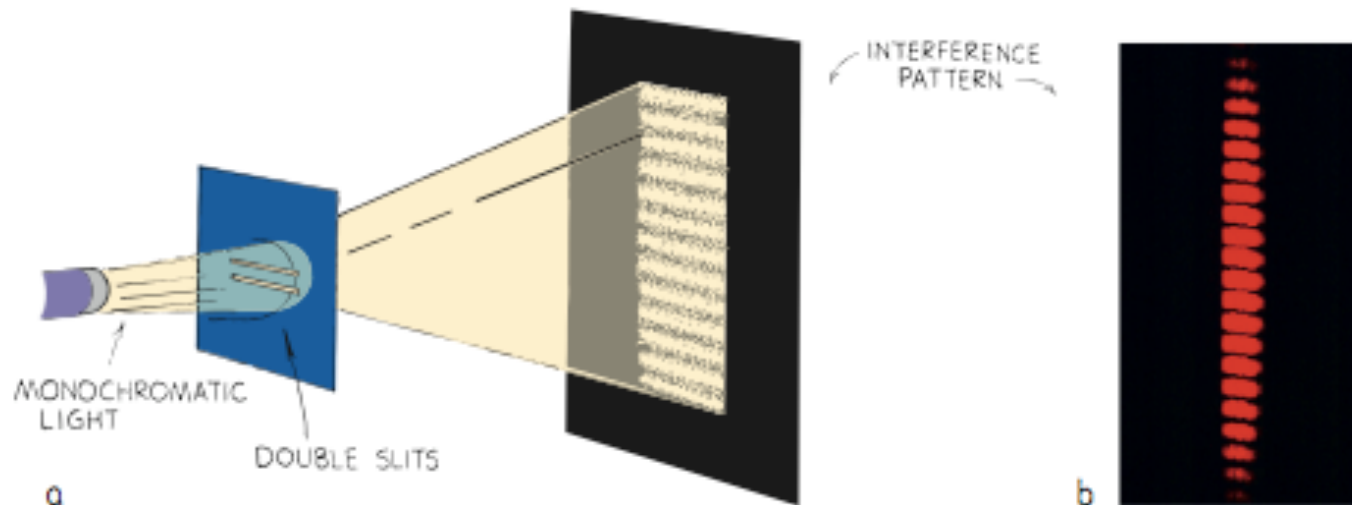
- The extent of diffraction depends on the relative size of the wavelength compared with the size of the obstruction that casts the shadow

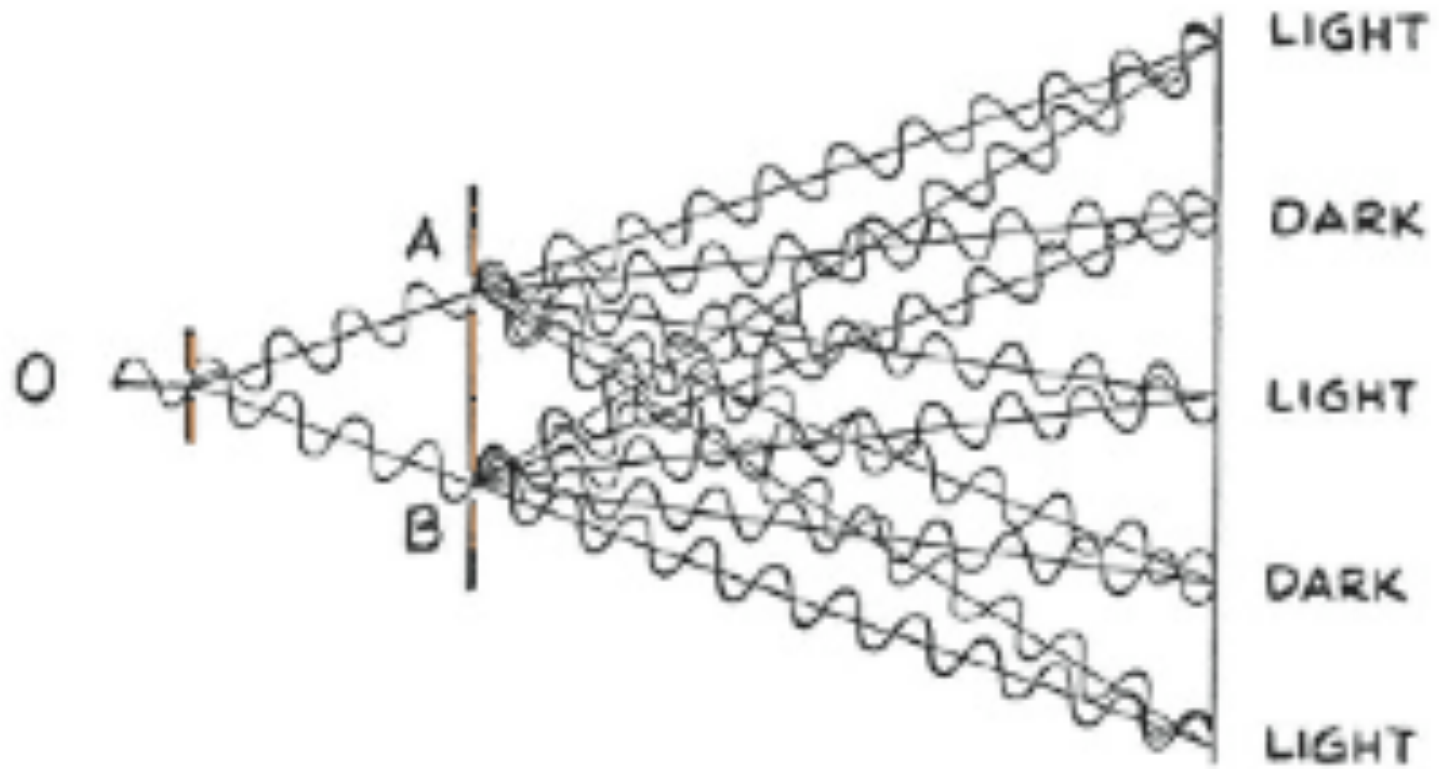


- a. Waves tend to spread into the shadow region
- b. When the wavelength is about the size of the object, the shadow is soon filled in.
- c. When the wavelength is short compared with the width of the object, a sharper shadow is cast.

Young's Interference Experiment

- With an interference pattern, wave amplitudes may be increased, decreased, or neutralized.
 - Constructive interference/Destructive interference
- In Young's experiment, Monochromatic light—light of a single color—was directed through two closely spaced holes, and fringes of brightness and darkness were produced on a screen behind.
 - Bright fringes = constructive interference
 - Dark areas = destructive interference
- Demonstrated the wave nature of light.

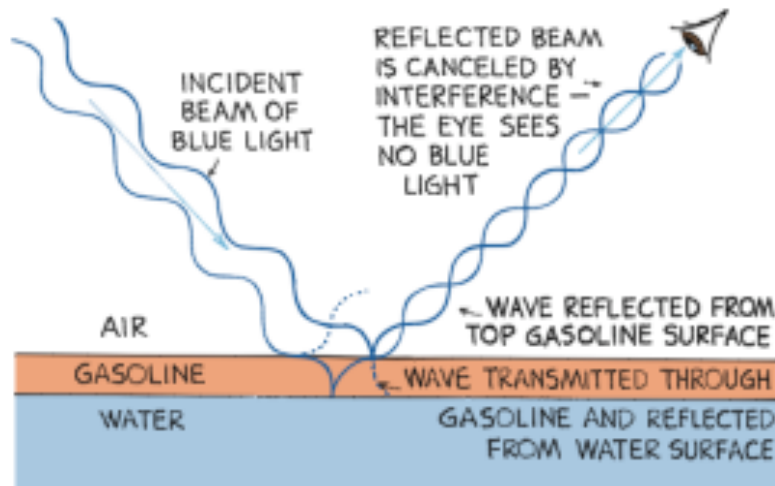




Light from O passes through slits A and B and produces an **interference pattern** in the screen.

Thin film interference

- The colors seen in thin films are produced by the interference in the films of light waves of mixed frequencies.
- Ex: Soap bubble
 - Light that reflects from one surface may cancel light that reflects from the other surface
- Ex: Gasoline on a wet street
 - Colors correspond to different thicknesses of thin film

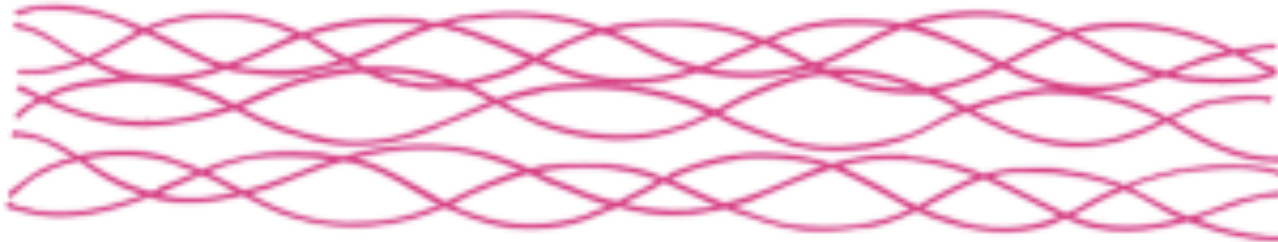


- The thin film of gasoline is just the right thickness that light reflected from the top surface of the gasoline is canceled by light of the same wavelength reflected from the water.

- Light emitted by a lamp is **incoherent**
 - Waves of many frequencies and wavelengths that are out of phase



- Light of a single frequency can still be out of phase



- A beam of light that has the same frequency, phase, and direction is said to be **coherent**

- No interference

- **Lasers** produce coherent light

- LASER = Light **A**mplification by **S**timulated **E**mission of **R**adiation

