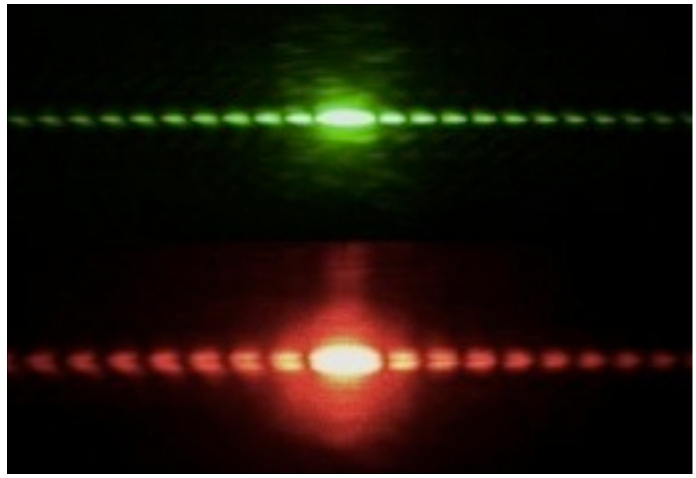
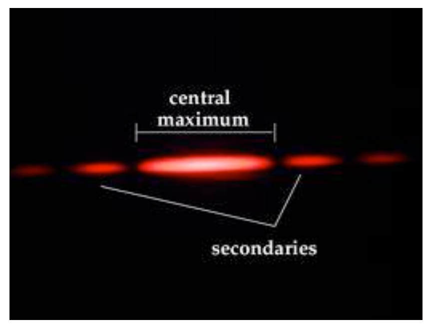
# Measure the wavelength of LASER Light



## Overview

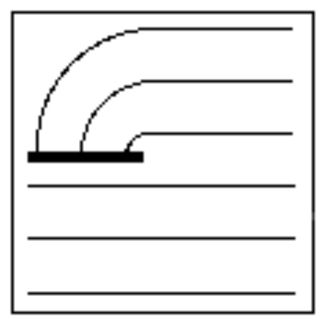
Students will determine the wavelength of a LASER Blox by collecting six sets of measurements which will allow them to solve for the wavelength.

## Time: 60-90 minutes
## Grades: 9-12




## Materials

- Red Laser Blox
- Green Laser Blox
- 10 diffraction gratings
- Blank Wall or Screen
- Ruler/Meter Stick



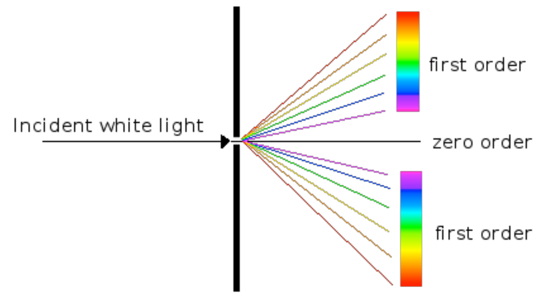
Diffraction of Waves

## Discussion and Background

Diffraction is a phenomenon that describes how light bends as it passes through very narrow slits or around a very small barrier (like a hair). See image to the right showing diffraction (bending) of waves around a “corner”. Thinking of light as a wave, consider that as light passes a very small barrier (like a hair), two distinct wave patterns are formed. Those waves interfere with the each other to either amplify the wave pattern (constructive interference) or dampen the wave pattern (destructive interference).

## Observing and Investigating

1. Hand out diffraction gratings and allow students to observe the spectrum they see when they look at various light sources through the grating.




2. Explain that the grating has many, many (we'll see how many shortly) tiny 'scratches', around which the light bends as it passes. As the white light bends, its component wavelengths bend and interfere with each other and are separated into a spectrum.

3. What happens when monochromatic (a single color/ wavelength) light passes through the very narrow slits of a diffraction grating? What would you expect to happen when a single wavelength encounters interference? You won't see a spectrum of colors - because monochromatic light is not composed of many wavelengths.

3. Set a red Laser Blox on a stable surface and shine it through the diffraction grating towards a blank wall. Tape the diffraction grating to the front of the Laser Blox to secure it.

4. Do the same with a green Laser Blox on a different wall.

5. Explain that the pattern they see is due to the interference pattern of the light wave as it passes through the slits.

6. Introduce the math that describes this phenomenon: $\lambda = (X)(d)/L$ ; where d = the distance between the slits (cm/line), L = the distance from the grating to the screen and X = the distance from maximum to maximum.

7. Divide the class into two groups, one will work with the red Laser Blox and the other will work with the green Laser Blox.

8. Give each group a student data form.

9. Have each group of students record the lines/mm and convert to cm to determine slit width.

# Student Data Sheet

## LASER COLOR:________________________________________

| Diffraction Grating Lines/mm | Slit Width (d) cm/line | Distance from grating to screen (L) in cm | Distance from maximum to maximum (X) |
|---|---|---|---|
| | | | |
| | | | |
| | | | |

Choose 3 distances from the screen

## Determine the wavelength of the laser

Use the values of X, d and L from the data above and the double slit formula

$$\lambda = (X)\ (d)/\ L$$

to determine the wavelength of the laser. Average your three computed values and determine a final average for the wavelength.

| | $\lambda = (X)\ (d)/\ L$ | $\lambda = (X)\ (d)/\ L$ | $\lambda = (X)\ (d)/\ L$ | Average Wavelength |
|---|---|---|---|---|
| Show all substitutions of data into formula | | | | |
| Final Value (cm) | | | | |
| Final Value (microns) | | | | |