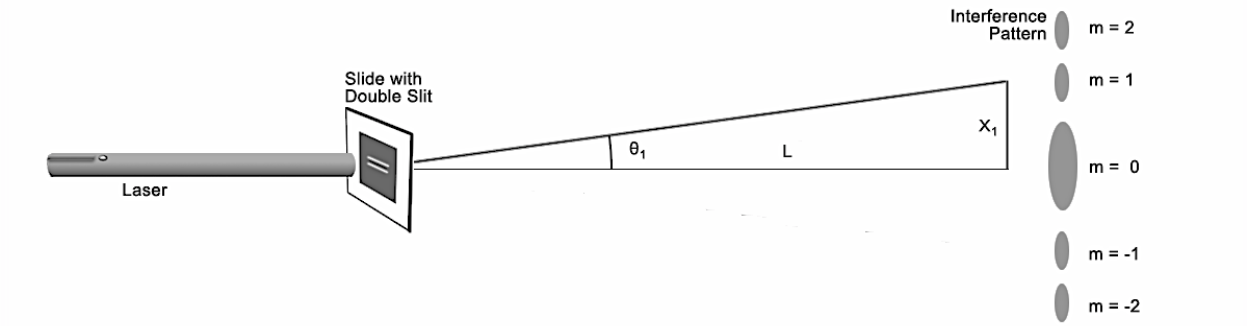
## Interference and Diffraction

A green laser (λ = 532 nm) and a red laser (λ = 650 nm) provide the light source for the first part of the experiment. Once again, the same effects occur for sound waves but are more easily demonstrated using light waves.

**Do not shine the laser in anyone's eyes!**

**Part one: Double slit interference**

Pick either a green or red laser and set it up on one side of the room with the slits and tape a large sheet of white paper on the other side of the room (you will have to arrange things so as not to be in other people's way).




*Use the double slits labeled A* to form an interference pattern. It will be necessary to adjust the alignment very carefully and turn off the lights to get good results.

1) Trace the pattern on the paper (turn this in with your report). Label the central spot m = 0, the first spot on the left m = 1, the second spot on the left m = 2, the first spot on the right m = -1, etc.
2) Measure the distance from the center of the central spot out to the center of each of the other spots (the distances $x_1$, $x_2$, etc.) .
3) Repeat using the same slits but with the green laser light. (You can move the paper up a little and put the green pattern just underneath the red pattern.) Why aren't the spots in the same place as with the red laser?
4) What is *interference* (you can look this up in your book or on the internet)?
5) Explain in your own words why you get a pattern of several spots rather than just two spots.
6) Find a group who used a different color laser than you group and compare. What is different about the two colors?

**Part two: Single slit diffraction**

A similar sort of pattern occurs for light passing through a single slit but in this case it is called *diffraction* instead of interference.

7) Trace the pattern on the paper for the single slit (use the slit labeled A on the *other* mounted slide; the one with single slits) and turn this in with your report. Note that these are much larger spots than for the double slit case, trace as many as you can see.
8) Compare your result with a group using a different color laser. How are the patterns different?
9) What is the definition of *diffraction*?
10) How are the diffraction patterns different from the interference patterns in part one?
11) If you point this laser beam through the doorway of the classroom it does not form a diffraction pattern, yet when it goes through the slit on the slide there is a pattern. What is the difference between the two cases? (Why do you get a pattern in the one case and not in the other?)
12) Based on your comparisons between colors, what would you expect to see if you were to shine white light (made of all colors) through a small opening?