PHYS143

Physics for Engineers

Lab Report - 8

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Instructor

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Experiment 1 - Track Spacing

Purpose:

To learn how interference can be used to measure small distances accurately such as the spacing between tracks on a CD.

Hypothesis:

Light from the laser hits two very narrow slits, which then act like in-phase points sources of light. However, the light from the two slits travel different distances.

Materials:

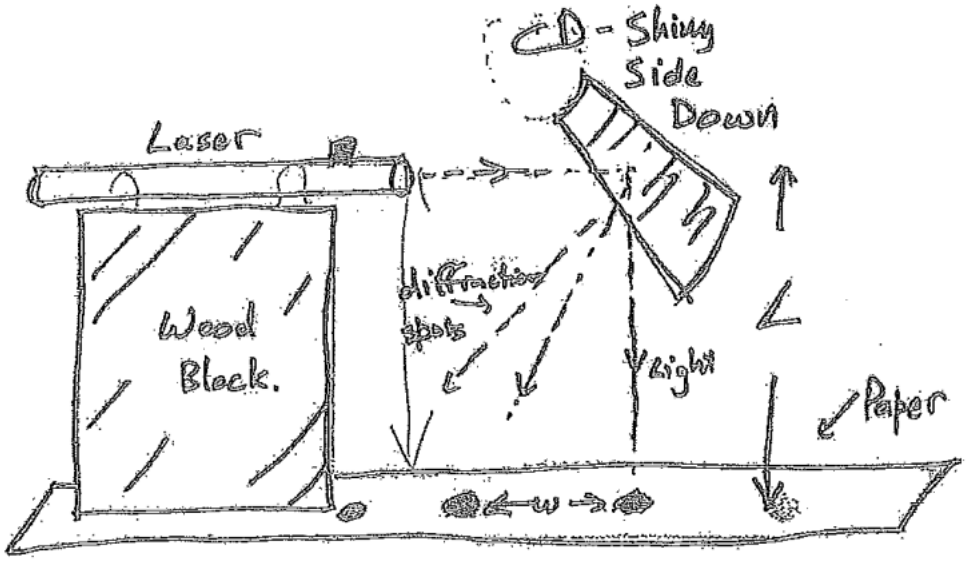
Laser

CD

Paper

Procedure:

1. Set up the laser, CD and a sheet of paper as shown below.



2. When the CD is at a 45° angle to the horizontal, a bright dot on the paper directly underneath the CD will appear along with other diffraction dots in line with the laser.
3. Mark the position of each dot on the paper and measure the distance of the laser beam above paper and distance between the dots.

Data and Observations:

To calculate the track spacing for the disks we use the formula:

$$d = \frac{L \times \lambda}{w}$$

Where: L = distance of laser beam

w = distance between the dots

CD Track Spacing

L = 0.05 m

w = 0.055 m

λ = 650 nm

d = 0.59 μm

Number of tracks per centimeter = 16949

DVD Track Spacing

L = 0.05 m

w = 0.11 m

λ = 650 nm

d = 0.29 μm

Number of tracks per centimeter = 34482

From the results obtained, we can observe that the DVD has a larger number of tracks than the CD which is in accordance with the fact that a DVD has more storage and therefore requires more tracks to store more data.

Conclusion:

Overall, the purpose of measuring track speed in a laboratory setting is to gain a better understanding of the principles of motion and velocity, to test scientific hypotheses and theories. The lab we performed relates to practical work of the theory we studied in our lectures. To do this experiment we First we set up the laser and a sheet of paper. When the CD is 45 angles we see a bright dot we mark it and repeat. We had equipment malfunction and some human errors. We had to repeat due to our mistakes. Our results made sense since the DVD has a larger number of tracks than the CD. We learned in this lab to learn how interference can be used to measure small distances accurately. If we were to repeat this lab we would be more focused and organized.

Experiment 2 - Hair Thickness

Purpose:

To determine the thickness of a human hair using interference.

Hypothesis:

When a wave encounters an obstacle, some of the wave bends or diffracts around the obstacle. This depends on the size of obstacle and wave

Materials:

Laser

Human hair

Procedure:

1. Set up the laser to shine on a distance of 1-2m. The beam from the laser pointer is often a rectangle and set it up such that the long side of the rectangle is horizontal on the screen.
2. Take a human hair and intercept the laser beam with it. A set of bands centered on the main beam will appear. Rotate the hair so it is horizontal and now the bright and dark bands will be easily distinguishable.
3. Measure the spacing between the bands. Width of the hair is give by $d= L*\lambda/w$, where L is the distance to the screen, λ is the wavelength (650nm for a laser) and w the spacing between the bands.

Data and Observations:

Using the same method of calculation as the previous experiment we can determine the thickness of the hair.

L = 0.9 m

w = 0.003 m

λ = 650 nm

d = 195 μm

The thickness of hair obtained is within the acceptable range of typical human hair thickness.

Conclusion:

Finally, Usually the purpose of this experiment is medical diagnosis or for cosmetic purposes or even for research but we are doing it for interference and diffraction understanding. The lab relates to class theory wise because we use the same formulas to find the length of the screen and so on. We set up the laser and then take a human hair and intercept the laser beam with it. Finally you'll be able to see the bright and dark bands. Our results make sense because the thickness of hair obtained from the experiment is within the normal acceptable range of human hair thickness. If we were to repeat the lab we would've used a darker type of hair.