Physics 12-02 CD Lines Spacing Lab ***Name:*** _____

Objective: Find the spacing of the grooves in a music CD.

Materials

- Laser level
- CD in a jewel case
- Paper
- Ruler
- Protractor

Theory

Diffraction (bending) of light is due to wave properties of light. It means that when a light wave encounters the edge of an obstacle, it bends around the edge. A diffraction grating is made by a series of a large number of parallel slits of equal width. During diffraction on a diffraction grating, a monochromatic light of a wavelength λ creates an interference pattern on a screen. The maximums can be found by

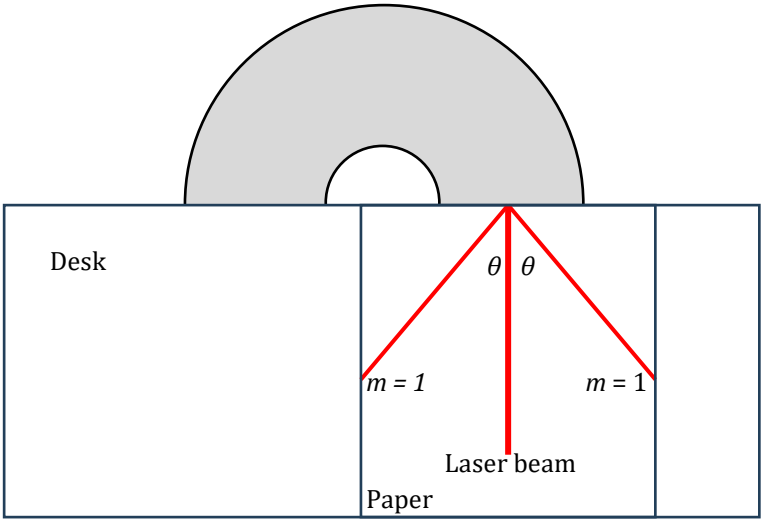
$$\sin\theta = m\frac{\lambda}{d}$$

where d is the distance between two adjacent slits, λ is the wavelength of the light, and m = 0, 1, 2, … is the order of diffraction.

A recording on a CD is in the form of microscopic pits of different lengths that carry the information. These pits are placed in rows of the same width and equal distance, which form a diffraction grating on the mirror surface of the CD.

Procedure

(Never shine a laser beam into anyone's eyes!)



1. Put the CD in the jewel case with the mirror side facing out.
2. Use a ruler to draw a line down the center of the paper long way perpendicular to the edge.
3. Place the paper on the edge of your desk.
4. Place the laser level at one edge of the paper so that its beam is along the line and perpendicular to the edge of the desk.
5. Hold the CD against the desk so that the laser beam strikes the center of the CD.
6. Trace the m = 1 diffraction line on each side of the center line.
7. Use the protractor to measure the angle θ on each side. They should be equal.
   θ_1 = _____
8. Calculate the spacing d of the grooves on the CD. Use the approximation of λ = 650 nm for the laser. d = _____ nm
9. Repeat with m = 2 diffraction lines.
   a. θ_2 = _____
   b. d = _____ nm
10. Average the two values of d. d_{ave} = _____ nm
11. Calculate the %error with the known value of d = 1600 nm.

$$\%error = \frac{theory - experiment}{theory} \times 100\%$$

% error = _____