

Physics 100
Laser Module

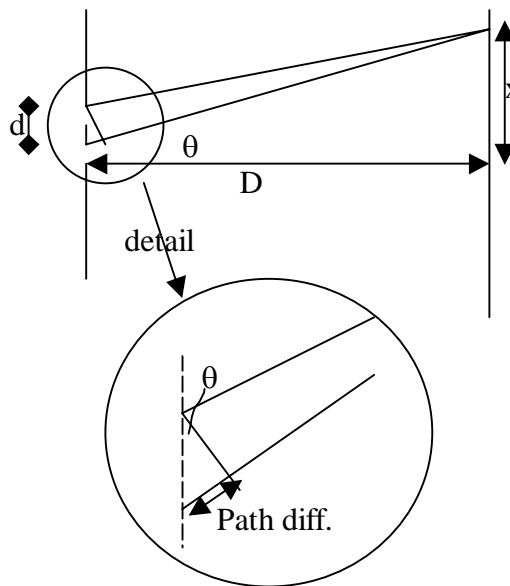
Homework #1

Remember that you can consult with each other on how to approach problems, but that you should write up solutions on your own. *Please write explanations in **words*** for your solutions - do not just write equations and numbers.

1. Discuss the double slit experiment with light.

a. Relate the path difference of the beam of light from each slit (see the figure) arriving at a point on the screen to the brightness observed on the screen *in your own words using the picture to the right*.

b. Then write out a derivation of the relation for the spacing between bright fringes on the screen (distance x). First, from the detail in the figure find an expression for the path difference in terms of θ , the angle to the interference point on the screen, and d , the slit spacing. Second, from the main figure, write an expression relating θ to D , the distance to the screen, and x , the distance from the central axis on the screen to the first bright interference point on the screen. Finally, find the condition on the path difference that gives a bright spot at x and using the previous results, find the separation of bright spots (fringes) on the screen. You will need to use the small angle approximation that $\sin \theta \sim \tan \theta \sim \theta$ (in radians) for small angles.



c. For the He-Ne ($\lambda = 632.8$ nm) and argon (514.5 nm) laser beams, find the distance between light minima on a screen 3 m away from a pair of slits spaced 0.5 mm apart.