Lab experiment: interference reports examples

Technology, Development

Theory

In our experiment, we study the interference of light using coherent, monochromatic light and two slits. The two slits, separated by a distance d, act as two light sources and their light waves interfere. The light passing through them is captured on another slide kept at a distance D. Here we see the interference pattern consisting of alternating bright and dark light. This effect is seen as the light waves from the two sources meet in phase (increased amplitude) and out of phase (decreased amplitude) creating the bright and dark spots. If hm is the distance of the mth bright band from the central band (where m is the order of the band), then the wavelength λ is

λ = (dhm)/(Dm)eq (1)

E. g. In pattern A, we know the distance between the slits (dA) and we measure the distance (D) between the slides. We also measure the distance of the first bright band from the centre to get h1. Based on this we calculate the wavelength.

Consecutively, the distance between the two slits can be calculated as

d = (λDm)/hm eq (2)

E. g. For pattern B, we know the wavelength from A and, hence, we can calculate d

Questions

- When the slit pattern is changed we see that the distance between the bright bands decreases from pattern A to pattern B and the widths of the bands also decrease. As pattern B had the higher distance, we can say as

distance between slits increase, the width of the bands and the distance between them decreases

- In both C and D, the diffraction pattern is different from A and B. The distance between the dark bands of diffraction decreases from A to C and from B to D. Thus, the diffraction pattern becomes narrower as the widths of the slits increase.
- Even though the double slit interference pattern creates equally bright maxima it is superimposed by the diffraction pattern of each individual slit. This diffraction creates minima which increase in size as we move away from the centre. Hence, the pattern fades out.
- As the number of slits increase, we see that the width of the brighter bands keeps on narrowing and becomes more focused.
- With diffraction grating we see extremely narrow strips of bright light separated by dark bands. This is in line with what we see in Q4.

Conclusion

The experiment demonstrated the interference pattern seen in light waves using a double slit slide. We assessed the impact of change in the distance between the slits. As the distance between the slits increased (d), the distance between the bright bands decreased (h). As per equation (2), d and h are inversely proportional. The findings are, therefore, in line with the theory and hence the experiment was successful. We also assessed the impact of change in slit width and number of slits on the interference pattern. We could have improved our experiment by taking greater care in measurement of the distances as even minor errors could have a big impact on the wavelength calculated evidenced by the 12. 5% discrepancy seen.