Unit C – Practical 5

Determination of wavelength using Young's double-slit experiment

Safety

Do not look directly into a laser beam or its reflection.
Do not point the beam at someone else's eyes.

Apparatus and materials

- laser
- double-slit aperture of known slit separation
- support for aperture
- screen
- ruler
- metre rule

Introduction

Young's double-slit experiment supports the wave model for the nature of light. It shows that when light goes through a double slit, it produces an interference pattern on a screen due to diffraction.

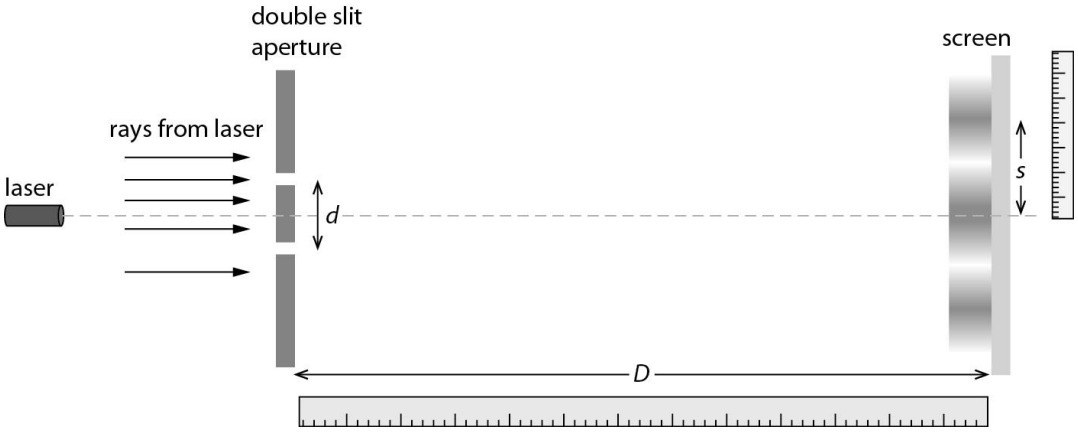
When parallel rays of monochromatic light of wavelength λ go through a double slit of separation d, then on to a screen that is distance D from the slits, an interference pattern is formed and the distance between the position of the central maximum and the first secondary maximum s is given by:

$$s = \frac{\lambda}{d} D$$

In this investigation, you will use Young's double-slit experiment to determine the wavelength of the laser being used.

Procedure

1 Set up the apparatus as shown in the diagram below, using the support to place the aperture.



2 After you turn on the laser and ensure that the beam goes through both slits, position the screen at the largest distance (several metres) where the interference pattern is visible so

that you can measure the distance between the central maximum and the first secondary maximum.

3 Record your measurements in a suitable table.

4 Repeat the same process four more times, each time reducing the distance of the screen from the aperture.

5 Plot a suitable linear graph and calculate the gradient of the line.

6 Use the value of the gradient to calculate the wavelength of the laser and compare it with the marked value on the laser.

Questions

1 Were there any sources of uncertainty in your measurements?

2 What differences would you expect to see in the interference pattern if a laser with a smaller wavelength were used?

3 What would you expect to observe if white light were used?

