MM02 : Particles and Fields of Modern Physics

Practical Session 1, 10th November 2005

Name of Student : .....

Safety advice : never look directly into a laser beam ! Do not remove the laser from its holder or stand. Do not place reflective objects such as watches or jewellery in the path of the laser beam.

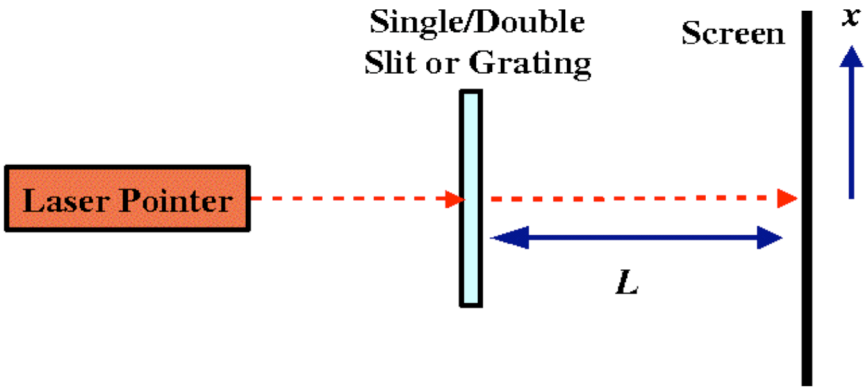
Ask a demonstrator if you are unsure how to use the apparatus.

Hand in answers to Dr.Waters at the end of the session.

1.Double Slit Experiment

Principle :

Light from the laser diffracts at the two slits, which then act as coherent light sources. Interference from the two sources results in a series of bright fringes (constructive interference) and dark fringes (destructive interference) on the screen.



Apparatus :

Procedure :

(1)Place a slide containing a single slit in the path of the laser beam.

Q1 Sketch the single slit intensity pattern observed on the screen.

(2)Place a slide containing a double slit in the path of the laser beam.

Q2 Sketch the double slit intensity pattern observed on the screen. Identify the interference fringes.

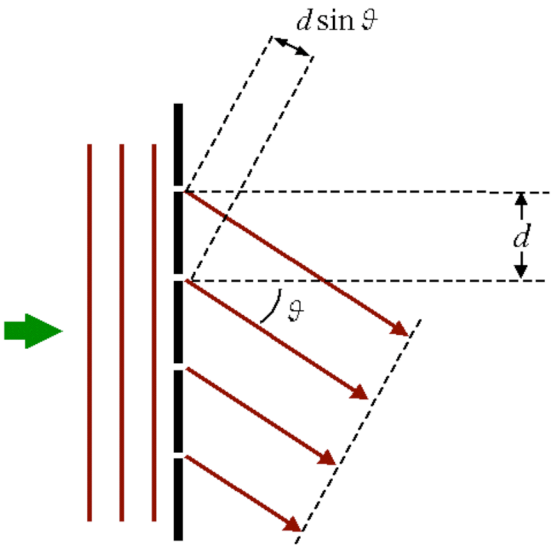
(3)Place slides corresponding to different slit spacings in the path of the laser beam.

Q3 How does the spacing of the interference fringes depend on the slit spacing ?

2.Diffraction Grating

Principle :

A transmission diffraction grating gives rise to an array of equally spaced coherent light sources. The larger number of sources gives rise to brighter and better defined interference fringes than in the case of the double slit experiment.



The condition for constructive interference of the light from each slit is :

$$d \sin \vartheta = n\lambda.$$

The angle ϑ is small, so that the fringe separation observed at the screen is given by :

$$\Delta x = \frac{L\lambda}{d},$$

where λ, the wavelength of the laser light, is 633 nm.

Apparatus :

Replace the double slit slide with a diffraction grating in the apparatus used in in part (1).

Procedure :

Measure the distance from the diffraction grating to the screen. Measure the spacing between fringes observed on the screen.

Q4 What is the line spacing of the diffraction grating (in lines per mm) ?