SSM-0032 : 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.

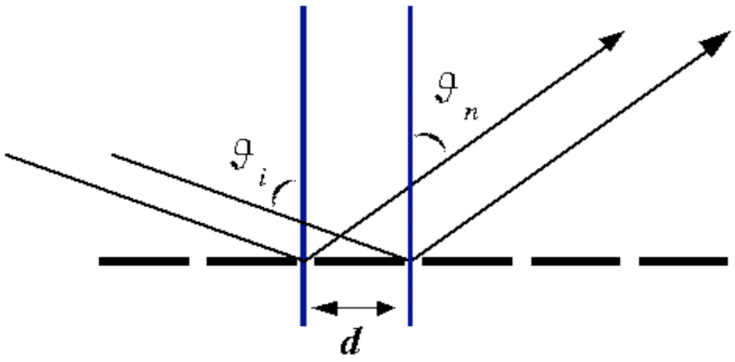
Ask a demonstrator if you are unsure how to use the apparatus.

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

Reflection Grating

Principle :

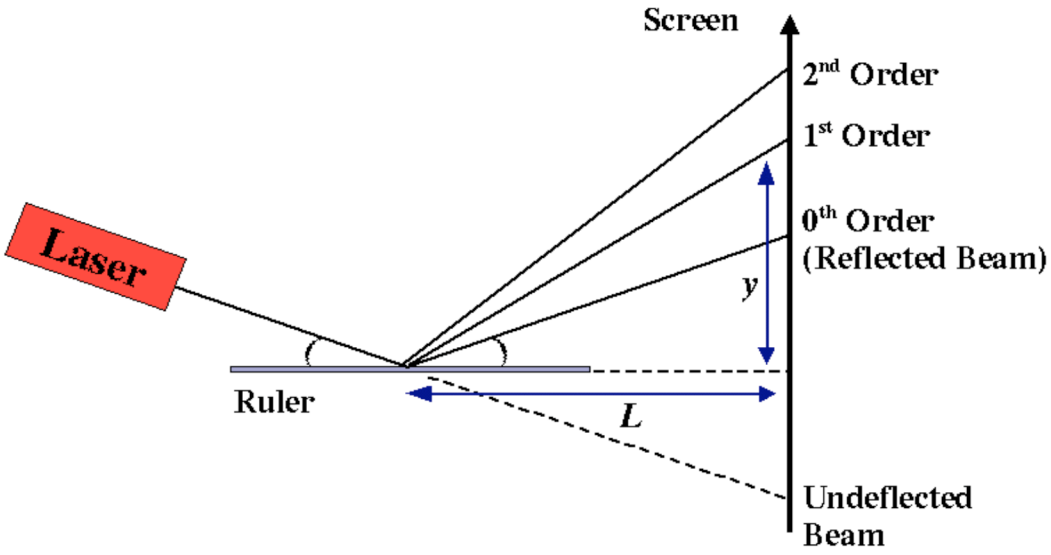
A reflection grating operates on a very similar principle to a diffraction grating. Diffraction of the incoming beam of laser light at a series of features (in this case, the marks on a metal ruler) gives rise, in effect, to a set of equally spaced coherent light sources just like the slits in a diffraction grating. Bright fringes are observed when the path difference between neighbouring marks is equal to an integer number of wavelengths.



From simple geometry, the path difference between the two rays indicated is given by $d\sin\vartheta_i - d\sin\vartheta_n$. Therefore, the condition for a bright fringe is :

$$n\lambda = d\sin\vartheta_i - d\sin\vartheta_n$$

Apparatus :



Procedure :

(1)Mark the position of the laser beam on the screen with no ruler. This is the undeflected beam position.
(2)Put the ruler in position, such that the spot of the laser falls onto the smooth surface of the ruler away from the markings. Mark the position of the reflected beam on the screen. Measure the distance ***L*** from the laser spot on the ruler to the plane of the screen.
(3)Shift the ruler such that the laser spot falls onto the 0.5 mm graded markings. Mark the position of as many bright fringes *further out than the reflected beam position* as possible.

Q1 Use your data to estimate a value for the wavelength of the laser light.

Q2 What happens when the laser light falls onto the part of the ruler with coarser markings ?

Q3 What happens to the spacing and relative intensity of the fringes as you go outwards from the reflected beam position ?