Assignment-8 Experiment-8

PARTICLE SIZE DETERMINATION USING LASER

AIM

To determine the size of micro particles using laser.

APPARATUS REQUIRED

Fine micro particles having nearly same size (say lycopodium powder), a glass plate (say microscopic slide), diode laser, and a screen.

PRINCIPLE

When laser is passed through a glass plate on which fine particles of nearly uniform size are spread, due to diffraction circular rings are observed. From the measurement of radii of the observed rings, we can calculate the size of the particles. Since for diffraction to occur size of the obstacle must be comparable with wavelength, only for extremely fine particles of micron or still lesser dimension, diffraction pattern can be obtained.

Diffraction is very often referred to as the bending of the waves around an obstacle. When a circular obstacle is illuminated by a coherent collimated beam such as laser light, due to diffraction circular rings are obtained as shown in the figure 3.1 . If "r" is the radius of the first dark ring and "D" is the distance between the obstacle and screen on which the diffraction pattern is obtained, then.

$$\tan\theta = \frac{r}{D}$$

Since θ is very small in this experiment

$$\tan\theta = \theta = \frac{r}{D}$$

According to the theory, the diameter 1a' of the circular obstacle is given by

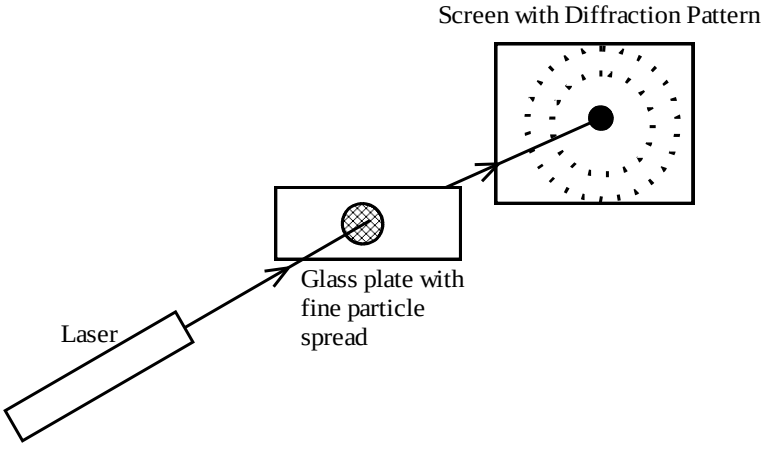
$$2a = \frac{1.22n\lambda D}{r_n}$$

where

r_n = radius of the n^{th} order dark ring (m)

D = distance between the obstacle and the screen (m)

λ = wavelength of the laser light (Å)



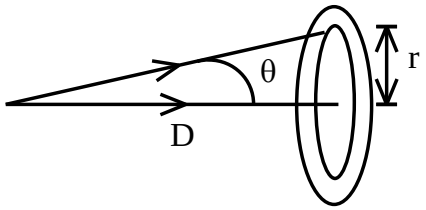


Fig. 8.1b Particle size determination using Laser

Table: Determination of particle size

Sl.No.	Distance (D)	Diffraction order (n)	Radius of dark ring (r_n)	Particle size (2a)
Unit	cm		cm	μm
1	15	1 2	1.3 2.6	? ?
2	20	1 2	1.7 3.5	? ?
3	25	1 2	2.2 4.4	? ?
			Mean	?

Observation:

Wavelength of the laser light (λ) = 6328 Å

Diffraction Order n = 1 and 2

Distance between Obstacle and Screen D = 15 cm, 20 cm and 25 cm

Assignment Question:

1. From the readings (D, n and r_n) in the tabular coloum to calculate the particle size using the formula and enter the values in last coloum of the tabular coloum in your observation note book.

2. Write the result in the following order

(i) The average size of the particles measured using laser =……μm

Finally, submit the scanned copy of your observation note book in GCR on (or) before THREE working days from the date of experiment.