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EXPERIMENT-1

AIM:

To determine the wave length of sodium light by using Newton's ring.

APPARATUS USED :

Travelling microscope (for Newton's Ring), Sodium vapour lamp, a thin plano - convex lens of large focul length, a convex lens of short focus, an optically plane glass plate.

THEORY AND FORMULA USED :

When a monochromatic parallel beam of light is incident on a thin air film enclosed between a plano - convex lens and a plane glass plate, the two reflected rays - one from top and another from bottom surface of thin air film (ray 2 and ray 3) will interfere. Ray 1 and ray 4 shown in Figure will not take part in interference due low coherency of the sodium light source. Around the point of contact, the points having equal thickness of air film lie on circles concentric with the points of contact. Hence due interference between the two reflected ray a series of alternate dark and bright fringes will be produced. These are called Newton's rings. The thickness of air film at the contact point is infinitesimally small. But due to phase change of π by reflection form rarer to denser medium (air to glass), the central ring will be dark.

The wavelength of sodium light which is used for the Newton's ring setup is given by the formula :

$$\lambda = \frac{D_{n+m}^2 - D_n^2}{4mR}$$

where,

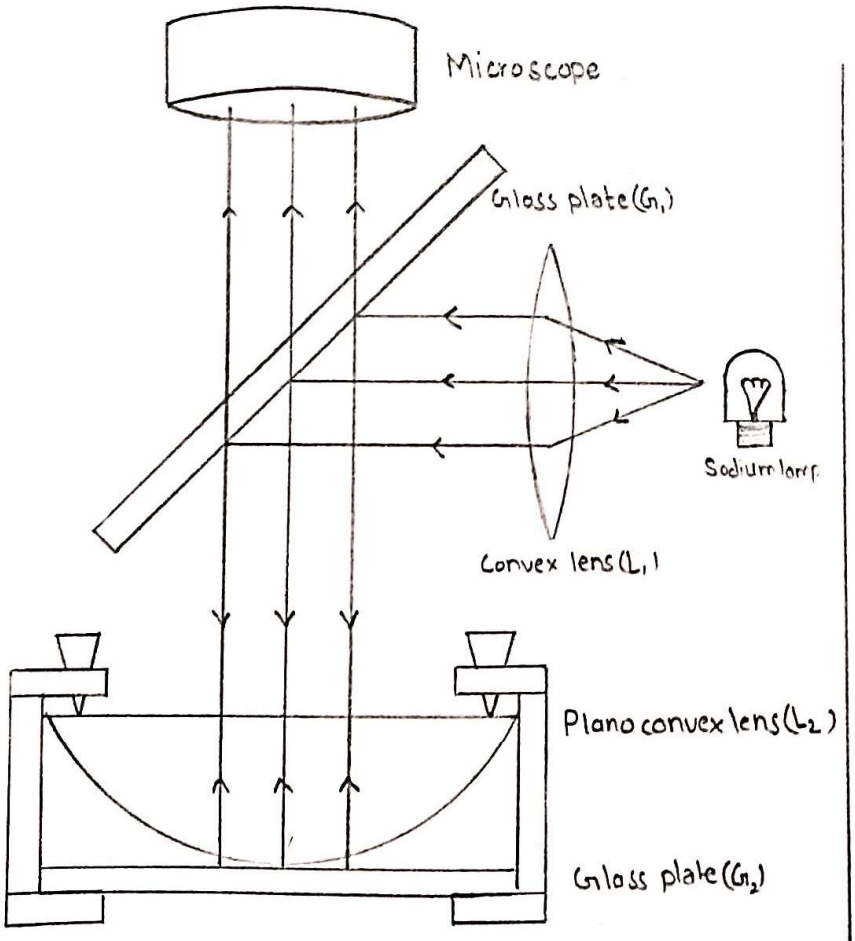
λ = wavelength of sodium light

D_{n+m} = diameter of $(n+m)$th ring

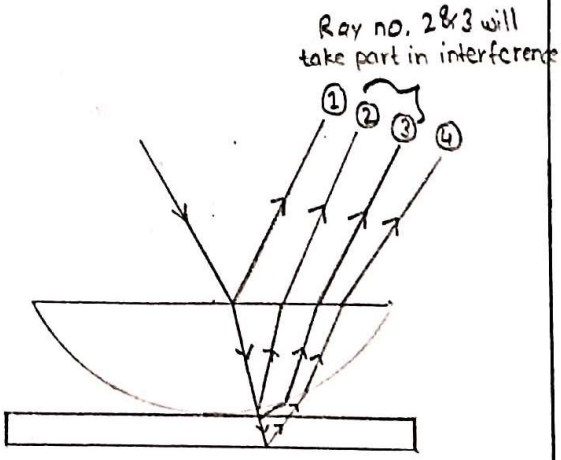
D_n = diameter of n^{th} ring

R = Radius of curvature of the convex surface of the plano - convex lens.

SCHEMATIC OF THE NEWTON'S RING SETUP :



Newton's ring arrangement



Interference between light waves reflected from different surfaces of plano - convex lens and plane glass plate.

PROCEDURE :

1: Select the medium (air), light source (Sodium) and click the knob light ON.

2. Order no. of the rings can be view varied by moving the knob of microscope position.

3. According to the theory, the center of interference fringes should be dark.

4. Move the ~~dark~~ microscope in horizontal position direction to the left side of the fringes. Fix up the cross-wire tangentially to the $(n+m)^{th}$ bright ring and note down the readings of both the main scale and vernier scale. Then the microscope is moved in horizontal direction to the right side and should be fixed up tangentially to the successive bright fringes up to the 1^{st} ring. Write down the readings of all successive rings. The the microscope is moved to the right side of the fringes and should be fixed up tangentially to the first bright fringe. Write down the readings of both scales. In this way, all the readings of successive bright fringes should be noted down up to $(n+m)^{th}$ bright ring.

OBSERVATIONS :

(A) Radius of the plano-convex lens, R = 100 cm.

(B) Vernier constant of microscope : 0.001

(C) Determination of Diameter of the Newton's rings,

Graphical Representation