

(5)

## Michelson's Interferometer -

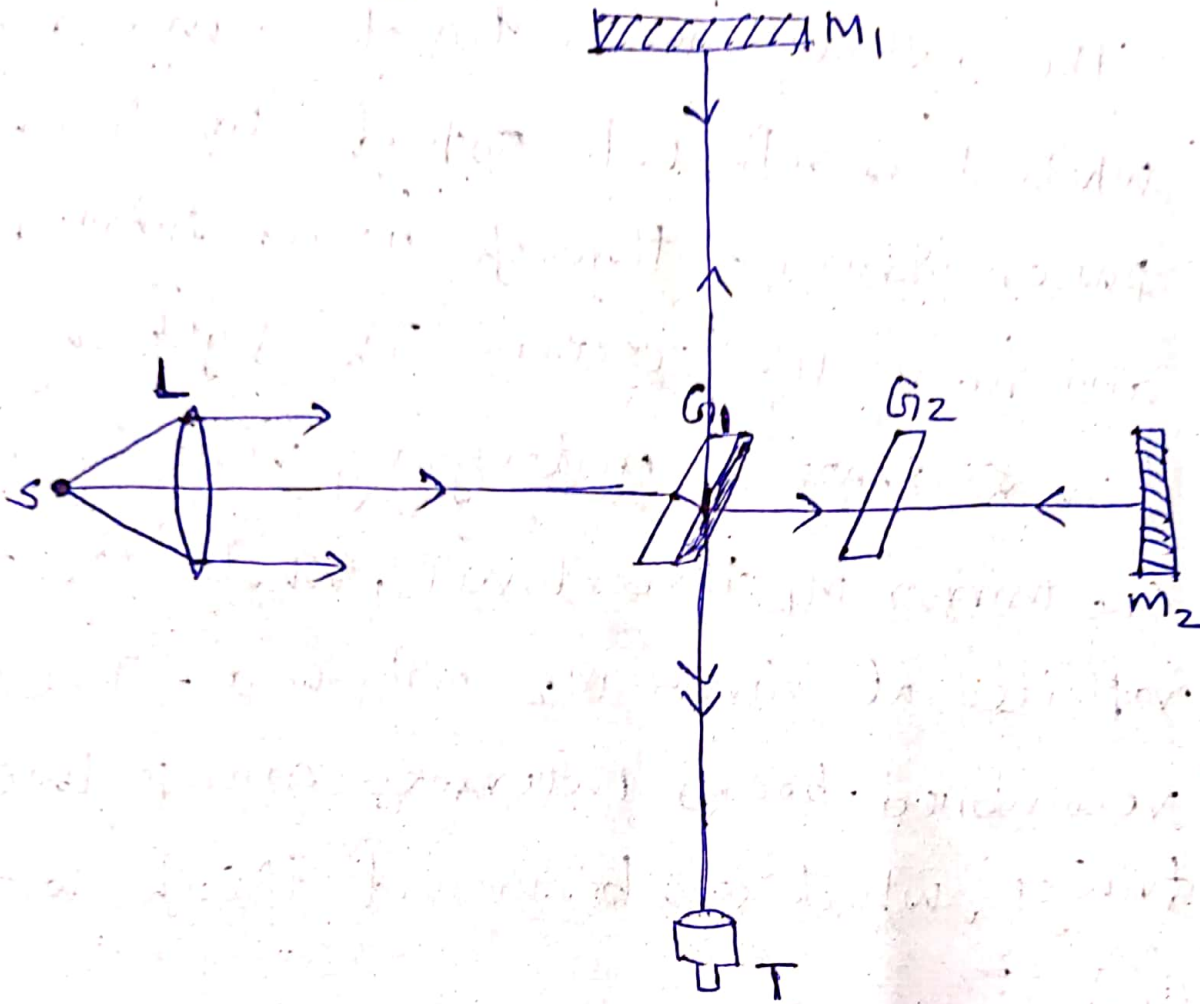
### Determination of wavelength of monochromatic source

Interferometer is an instrument which use phenomenon of interference is used to make precise measurement of wavelength of light.

Principle: A beam of light from an extended source is divided into two equal intensities by partial reflection and refraction.

These beams travel in two mutually perpendicular directions and come together after reflection from plane mirrors. The beams overlap on each other and produce interference fringes.

(6)



Light from a monochromatic source (S) is divided by a beam splitter ( $G_1$ ), which is oriented at an angle  $45^\circ$  to the beams, producing two beams of equal intensity.

The transmitted beam travels to mirror  $M_2$  and it is reflected back to  $G_1$ . 50% of returning beam is reflected by the beam splitter and strikes the ~~screen~~ T.

(7)

The reflected beam travels to mirror  $M_1$ , where it is reflected. 50% of the beam passes straight through beam splitter and reaches the screen. The light ray from source  $S$ , undergoing reflection at the mirror  $M_1$  three times, while the ray reflected at mirror  $M_2$  only once. The recombined beams interfere and produce fringes, which can be viewed through Telescope (T).

### Measurement of wavelength ( $\lambda$ )

Using the Michelson Interferometer, the wavelength of light from a monochromatic source can be determined. If mirror  $M_2$  is moved forward or backward through a distance,  $d$  and the  $N$  number of fringes are formed. For one fringe to appear or disappear, the mirror must be moved through a distance  $\lambda/2$ .

⑧

$$d = \frac{N\lambda}{2}$$

$$\lambda = \frac{2d}{N}$$

(OR)

$$2x = (n + \frac{1}{2})\lambda, \text{ for bright fringes}$$

$$2x = n\lambda, \text{ for dark fringes}$$

$$2(x + d) = (n + N)\lambda$$

$$2x + 2d = n\lambda + N\lambda$$

$$2d = N\lambda$$

$$\lambda = \frac{2d}{N}$$

$m_1$  moved through a distance  $x$

$$2d = N\lambda$$

$$2x = n\lambda$$

$$2(d+x) = (N+n)\lambda$$