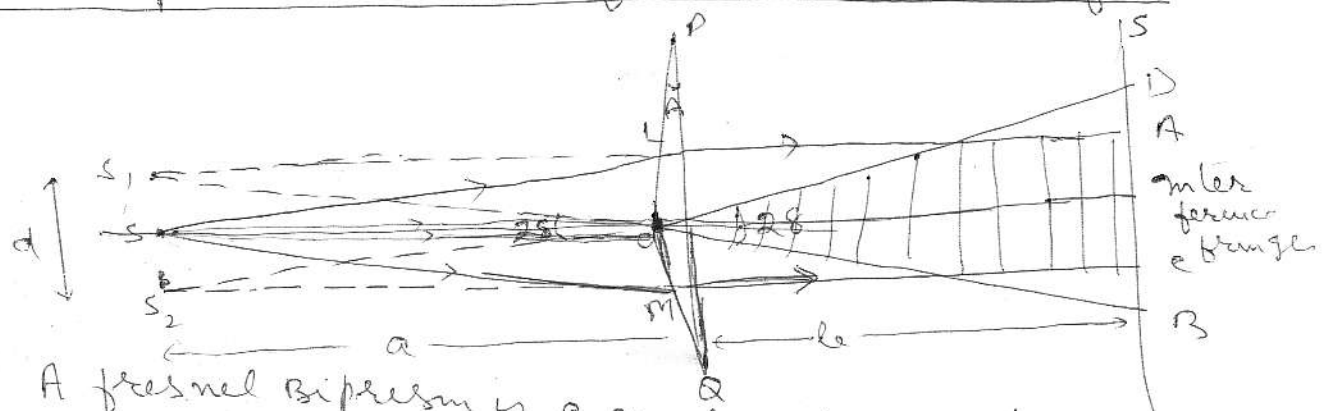
Fresnel Biprism method of determination of λ



A fresnel Biprism is a combination of two right angled prisms with small angles of prisms at P & Q (nearly 1° to 2°).

Two rays from s & incident on upper prism after deviation form virtual image S_1

Two rays from S & incident on lower prism after deviation form virtual image S_2.

S_1 & S_2 then act as coherrent sources seperated by small distance d.

on area S_1AB rays come from source S_1

on area S_2CD rays come from source S_2

on shaded region waves come from both sources and form interference fringes with fringe width

$$\beta = \frac{\lambda D}{d} \quad \text{——} (1)$$

If a = distance between sources & Biprism

and b = distance between Biprism and Screen

then $D = a + b$

$$(1) \Rightarrow \lambda = \frac{\beta d}{D} \quad \text{——} (2)$$

β can be determined by moving microscope over the fringes & counting the no of fringes n in a distance x

$$\therefore \beta = \frac{x}{n} \quad \text{——} (3)$$

Determination of d :-

d can be measured in two ways

i) By knowing μ and A of Biprism

If δ = deviation produced by each prism

then total deviation produced for forming S_1 & $S_2 = 2\delta$

Also for small angled prism

$$\delta = A(\mu - 1) \quad \text{——(4)}$$

where A = Angle of prism &
μ = refractive index of material of Biprism

$$\therefore 2\delta = 2A(\mu - 1) \quad \text{——(5)}$$

Also from figure

$$2\delta = \frac{d}{a} \quad \text{——(6)}$$

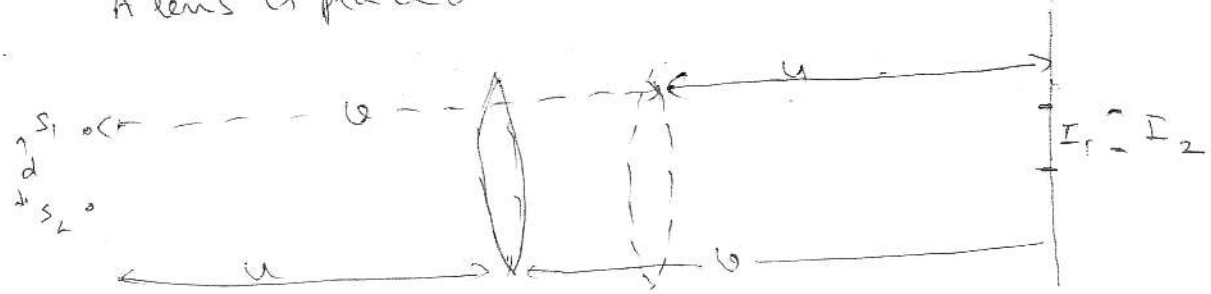
(5) & (6) $\Rightarrow$ $\frac{d}{a} = 2A(\mu - 1)$

$$\Rightarrow d = 2aA(\mu - 1) \quad \text{——(7)}$$

knowing d, D & β we can calculate λ

ii) By Displacement method

A lens is placed between Biprism and screen



(Biprism is not shown figure.

Distance I_1 between two images is measured such that

$$\frac{I_1}{d} = \frac{v}{u} \quad \text{——(8)}$$

Keeping source and screen fixed in their position, the lens is displaced towards longer distance side till images are again formed on screen. This happens when u and v are interchanged.

Distance I_2 between two new images is measured so that

$$\frac{I_2}{d} = \frac{u}{v} \quad \text{——(9)}$$

(8) × (9) $\Rightarrow$ $\frac{I_1 I_2}{d^2} = \frac{v}{u} \times \frac{u}{v} = 1$

$$\therefore d = \sqrt{I_1 I_2}$$

Thus d can be measured without knowing A & μ and knowing d, D & β we can calculate λ.