B-Sc-II 27/1/22

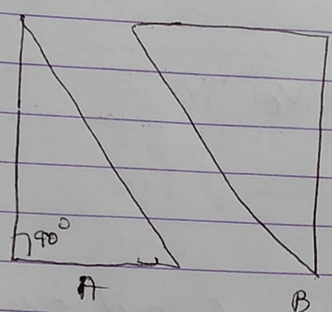
Babinet's compensator →

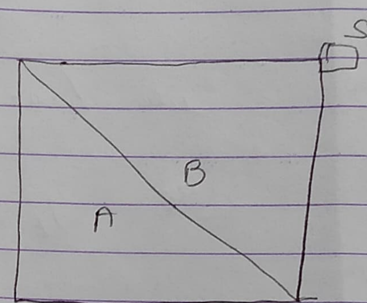
Theory →

Babinet's compensator is a very useful device which is used in the production and analysis of elliptically polarised light.

construction & working →

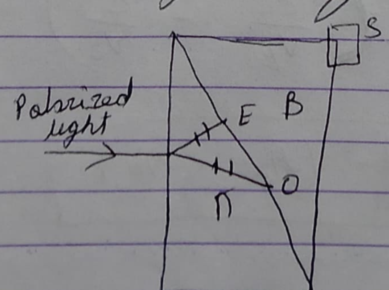
This device is consist of two wedges quartz A and B of equal small actute angles, they are placed with hypotenuses in contact so as to form a small rectangular block.





Now, quartz crystal A is cut with its optic axis perpendicular to its refracting surface, while the quartz crystal B is cut with its optic axis parallel to its refracting surface.

Quartz crystal A is fixed in position while quartz crystal B can be slided in its from plane by a micrometer S, which is given by



When a plane polarised light falls normally on the crystal A, it breaks up in to o-ray and E-ray such $V_E < V_B$

After entering in to crystal B, the o-ray becomes E-rays and E-ray becomes o-ray

Thus two components interchange their velocitis in transegent from on crystal A to the other crystal B and each crystal cancel the effect of other.

Let t_o and t_E be the time taken by o and E ray to travel distance

$$t_o = \frac{d_1}{V_o} \quad \text{and} \quad t_E = \frac{d_1}{V_E}$$

we have

$$V_E < V_B$$

so

$$t_E > t_o$$

Now time difference E and o ray in crystal A = Δt

$$\Delta t = t_E - t_o$$

$$\Delta t = \frac{d_1}{V_E} - \frac{d_1}{V_o}$$

$$= d\left(\frac{1}{V_E} - \frac{1}{V_o}\right)$$

Multiplied by c

$$= \frac{d}{c}\left(\frac{c}{V_E} - \frac{c}{V_o}\right)$$

$$\boxed{\Delta t = \frac{d}{c_1}(\mu_E - \mu_o)}$$

Similarly
Path difference O and E-ray of crystal A is given by

$$\Delta_1 = c \times \Delta t$$

$$\Delta_1 = c \times \frac{d_1}{c} (\mu_E - \mu_0)$$

$$\boxed{\Delta_1 = d_1 (\mu_E - \mu_0)}$$

and path difference O and E-ray of crystal B is given by

$$\boxed{\Delta_2 = d_2 (\mu_0 - \mu_E)}$$

Now, Total Path difference

$$\Delta = \Delta_1 + \Delta_2$$

$$= d_1 (\mu_E - \mu_0) + d_2 (\mu_0 - \mu_E)$$

$$= d_1 (\mu_E - \mu_0) - d_2 (\mu_E - \mu_0)$$

$$\boxed{\Delta = (d_1 - d_2)(\mu_E - \mu_0)}$$

Proved