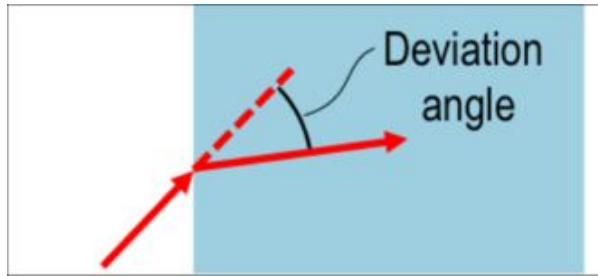


Lab - 10

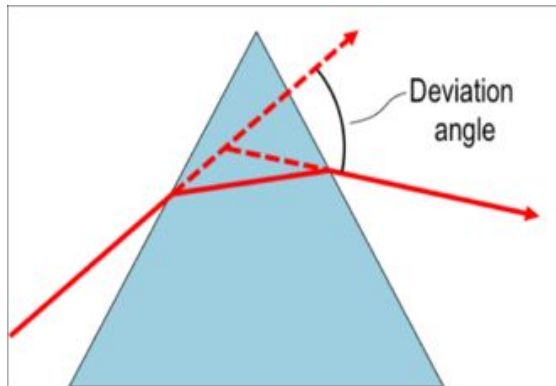
Spectrometer, Refractive Index of the material of a prism

Refractive Index of the material of a prism

When a beam of light strikes on the surface of transparent material (Glass, water, quartz crystal, etc.), the portion of the light is transmitted and other portion is reflected. The transmitted light ray has small deviation of the path from the incident angle. This is called **refraction**.



Light is deflected as it enters a material with refractive index > 1 .

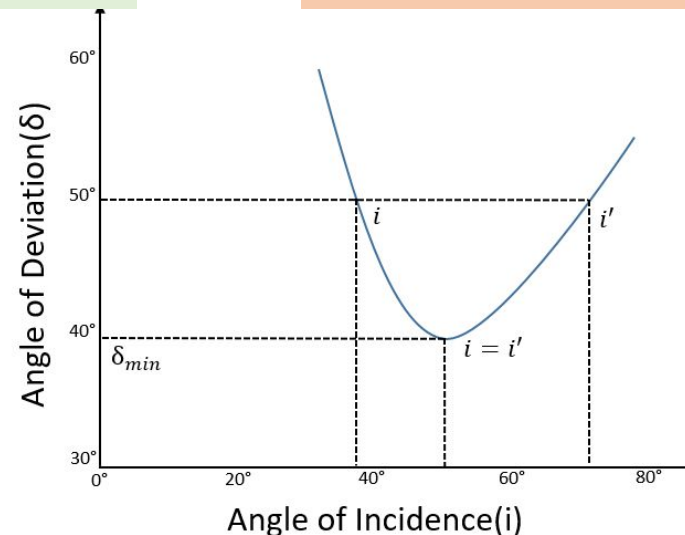


A ray of light is deflected twice in a prism. The sum of these deflections is the deviation angle.

In a prism, the angle of deviation (δ) decreases with increase in the angle of incidence (i) up to a particular angle. This angle of incidence where the angle of deviation in a prism is minimum is called the **minimum deviation position** of the prism and that very deviation angle is known as the **minimum angle of deviation** (denoted by δ_{\min} , D_{λ} , or D_m).

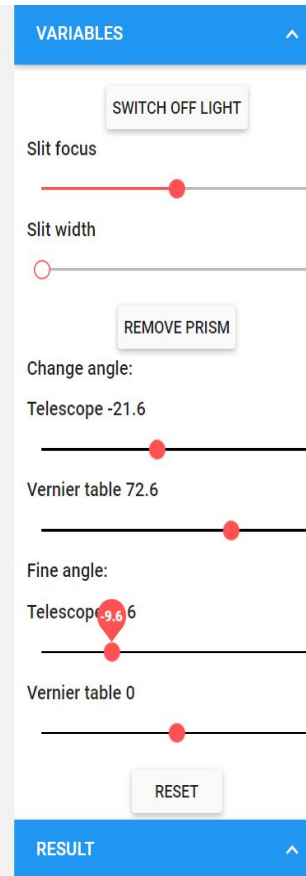
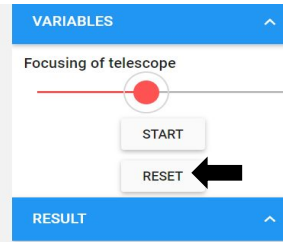
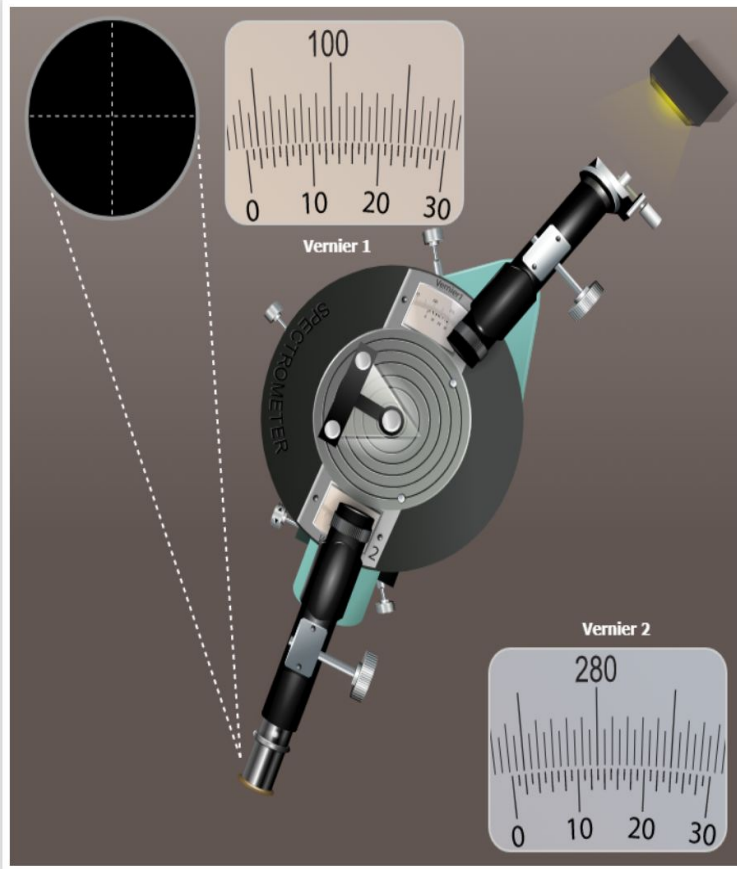
The angle of minimum deviation is related with the Refractive index as:

$$n_{21} = \frac{\sin\left(\frac{A + D_m}{2}\right)}{\sin\left(\frac{A}{2}\right)}$$



When the entrance and exit angles are equal, the deviation angle of a ray passing through a prism will be minimal.

Procedure



Steps to follow for preliminary adjustments

1. Focus the telescope from this slider and start the experiment.
2. Switch on the light
3. Focus the slit from the slit focus slider.
4. Coincide the slit with cross wire in the telescope.

Steps To determine the angle of the Prism:

1. Place the Prism .
2. Place the edge of prism, pointed towards collimator.
3. Move the telescope using Telescope slider up to see the slit on side. Make coincide the slit with the cross wire using fine angle adjusting slider. Then note the reading in the tabular column.
4. Move the telescope in the opposite direction and do the same.
5. Find the difference between two angle ie 2θ . Hence, find the angle of prism i.e θ .

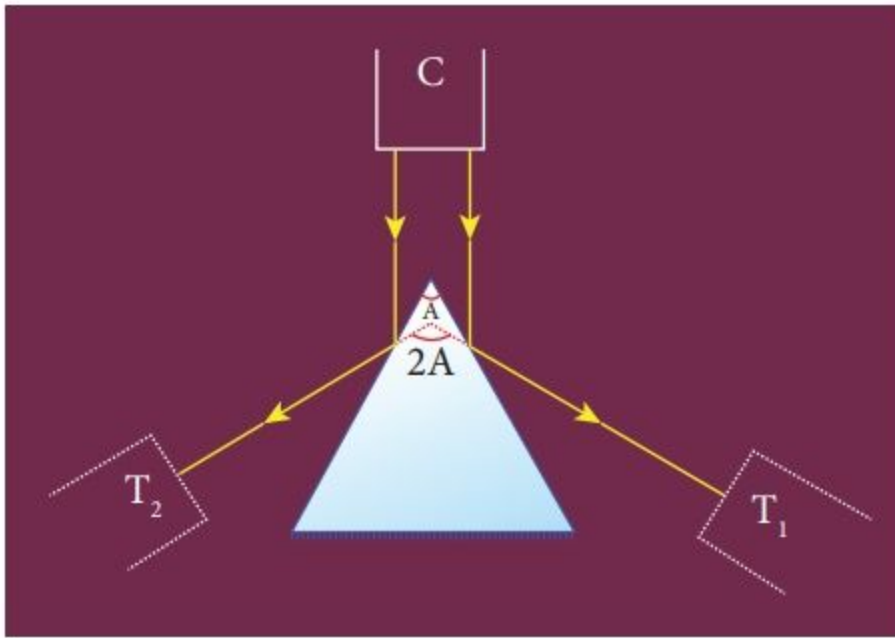


Figure (b) Angle of the prism

Position of prism, collimator and telescope to calculate the angle of prism.



Position of prism, collimator and telescope to calculate the angle of deviation.

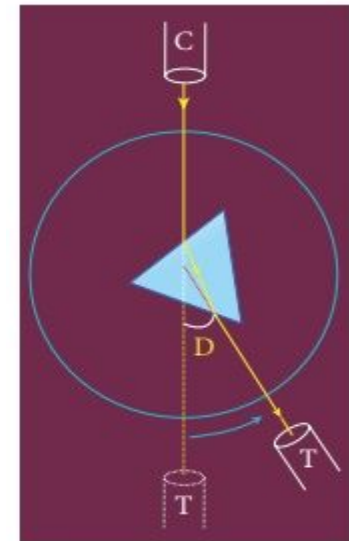
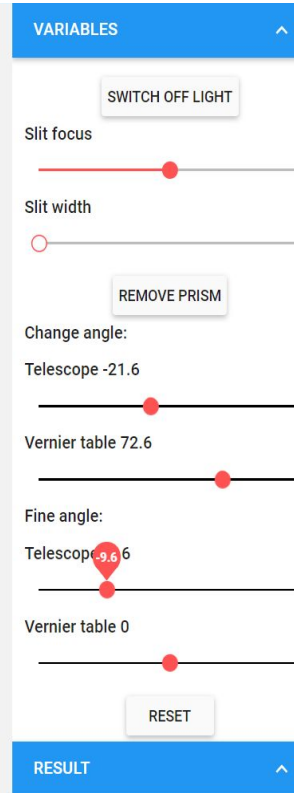
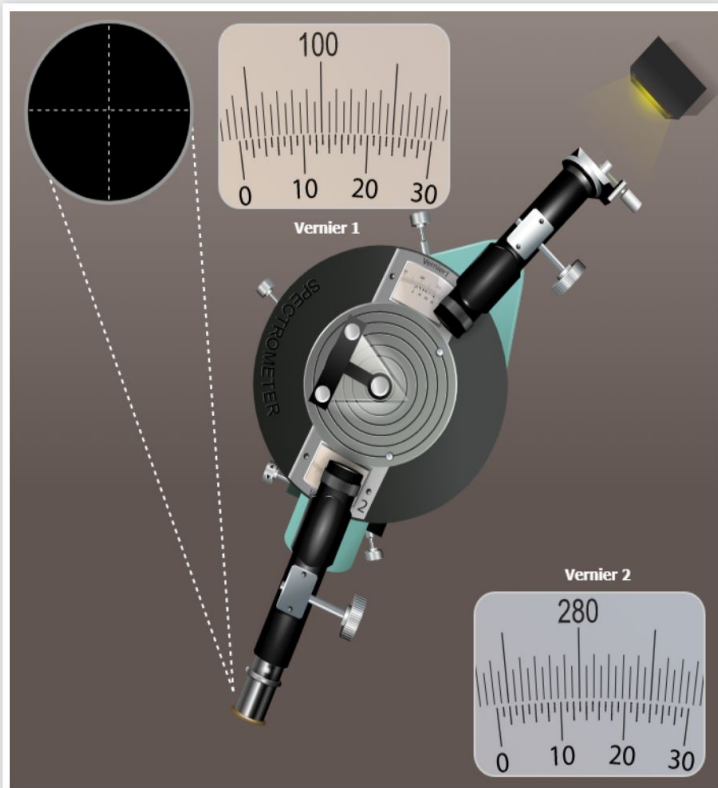


Figure (c) Angle of minimum deviation

Steps to find minimum angle of deviation

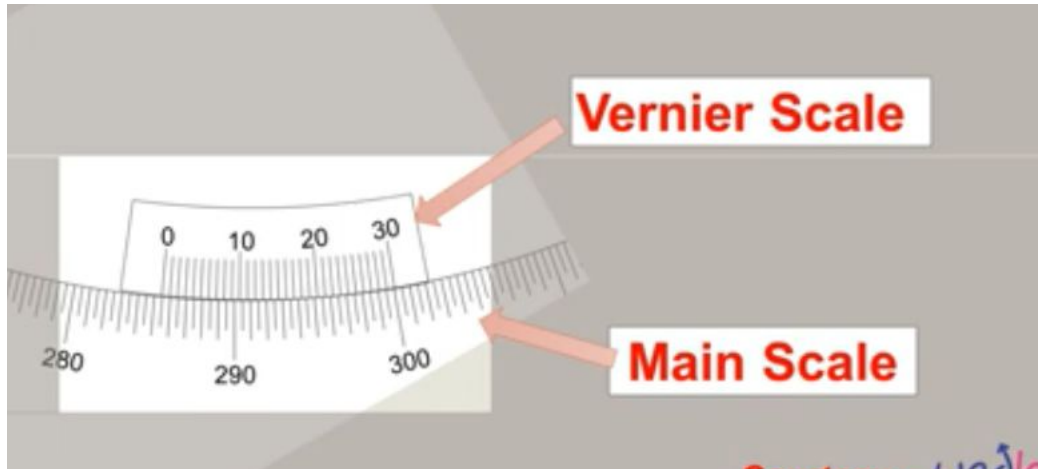
Reading of reflected ray from	Vernier 1			Vernier 2		
	MSR	VSR	Total	MSR	VSR	Total
face 1 (say a)						
face 2 (say b)						
Difference between a & b						

- Now we have to change the position of prism using vernier table slider for its base to be parallel to the prism.
- Now we have to move the telescope to obtain the deviated light, bring the deviated light to cross section of the wire.
- Now to obtain the minimum angle of deviation use fine angle slider of vernier table you will notice at some point deviated light retrace its path that is the minimum angle of deviation.
- Bring the cross wire of the telescope to that minimum deviated ray.
- Take the Main scale and Vernier scale readings on vernier 1 and 2.
- Then remove the prism using the button "Remove Prism".
- Carefully turn the telescope so as to get the direct ray from collimator, make it coincide with cross wire in the telescope and again note vernier 1 and 2 readings.
- Hence calculate the angle of minimum deviation (D) by measuring the difference between emerged ray readings and direct ray readings.



Now after finding minimum deviation angle and angle of prism using spectrometer we can calculate the refractive index

How to take readings on spectrometer



Final readings = main scale reading + (Vernier scale reading * least count)

Step 1: Find the least count of the system

And the standard formula is –

LC of System = LC of Main Scale – LC of Vernier Scale

Step 2: Take main scale reading

Step 2 - Note down the Main Scale reading
The minimum reading that has been crossed by the 'Zero' of Vernier Scale

Now let us read a random measurement-

Step 3: Take vernier scale reading.

Step 3 - Note down the Vernier Scale reading
Check out which Vernier scale mark is coinciding with any of the main scale mark.

Step 4 : Apply the formulae

How to find least count by example

For example :-

One main scale division (N) = 60 minute

Number of divisions on vernier (v) = 60

Least count = $N/V = 1$ minute

