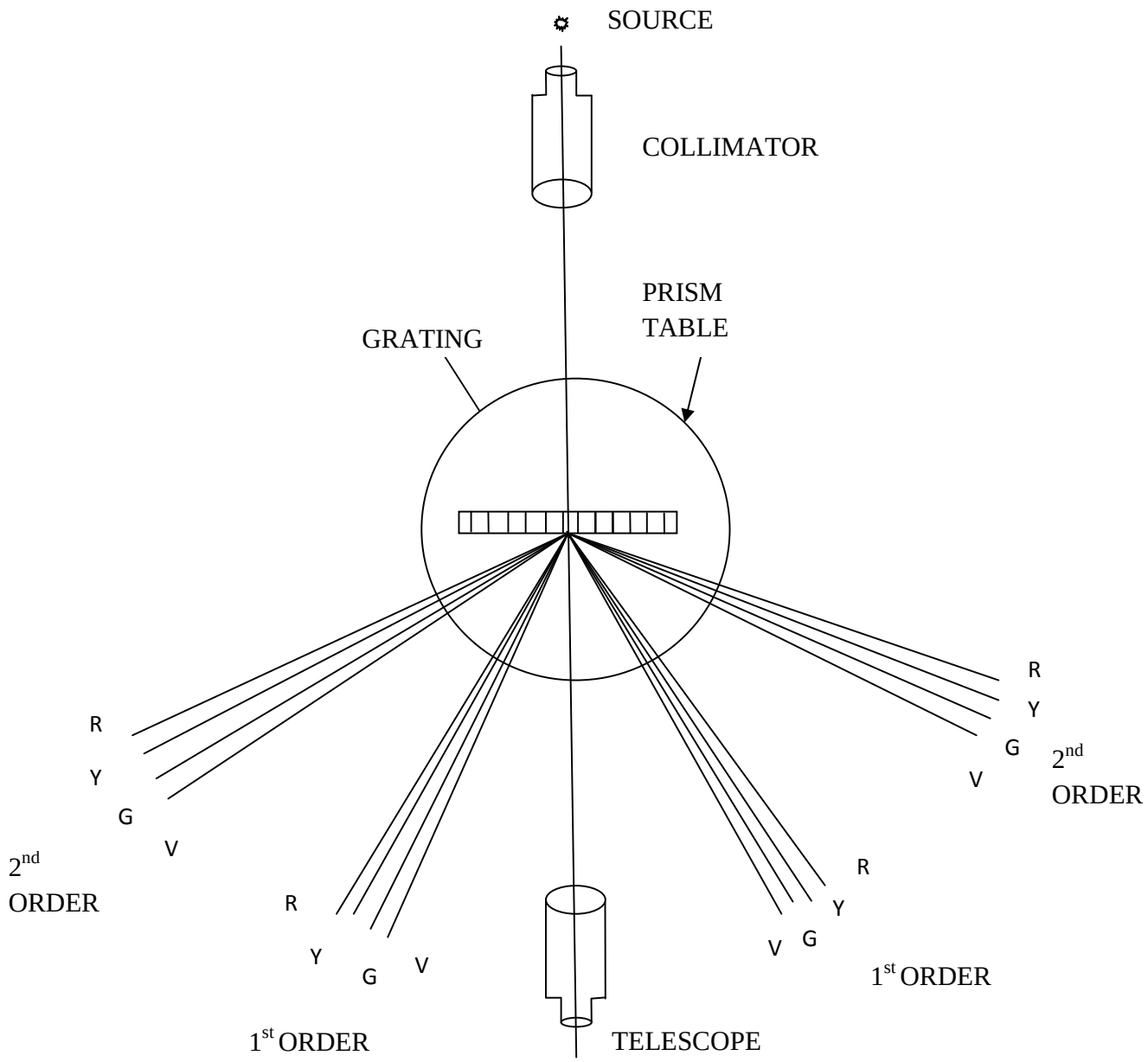
EXPERIMENT NO. 6

OBJECT: To determine the wavelength of any three lines of mercury light by diffraction grating in1st and 2nd order spectrum.

APPARATUS: A diffraction grating, Spectrometer, spirit level, magnifying lens and mercury Lamp.

DIAGRAM:



THEORY AND FORMULA: The wavelength λ of any line is given by

$$\lambda = \frac{\{(a+b)Sin\theta\}}{n} \text{ cm.}$$

where (a+b) = $\frac{2.54}{N}$ cm is the grating element.

N = number of lines per inch. (N = 15,000 lines per inch)

θ = angle of diffraction

n = order of spectrum

PROCEDURE:

Check that both cross wire are present and are at right angles to each other.

following adjustments are made before performing the experiment.

1. Level the prism table and do all adjustments of spectrometer for parallel light rays.
2. Adjust windows of the vernier so that they are about 45^0 /135^0 to the collimator.
3. Adjust the height of the prism table so that light falls on the central position of the grating.
4. Make grating normal to the axis of collimator by following method:
5. All observations should be recorded in degrees and minutes (L.C. of vernier is 1 minute)
6. Without placing the grating, bring the direct image of slit on vertical cross wire of the telescope and note any one of the vernier.
7. Rotate the telescope through 90^0 and fix it (note the reading).

8. Mount the grating on the prism table and do not loosen its upper screw during the experiment after the height has been adjusted.

9. Unscrew the lower most screw and rotate the vernier table until the reflected image from the diffraction grating coincide with the vertical cross wire of the telescope, note any of the vernier reading. In this position grating is at 45^0 to incident light.

10. Turn the prism table to exactly 45^0 /135^0 (after noting in the vernier table) so that grating is exactly normal to collimator.

Determination of angle 2θ :

1. Rotate the telescope to the left of direct image and adjust the vertical cross wire for 1st order (in different spectral lines violet, green and yellow I and II). Note the reading of both the verniers.

2. Rotate the telescope further to obtain the 2nd order spectrum and again adjust the vertical cross wire on different spectral lines and note the readings.

3. Now rotate the telescope to the right of the direct image and repeat the procedure at the steps 4 and 5.

4. Take the difference of corresponding V_1 and V_2 on the left and right for the same colour and find mean as noted in observation table.

<u>OBSERVATION</u>:

Order of spectrum	Colour of light	Vernier no.	Spectrum on left side			Spectrum on right side			Difference	
			M.S.	V.S.	Total (a) (in degrees)	M.S.	V.S.	Total(a) (in degrees)		θ

									{2θ} (a-b) (in degrees)	
FIRST	Violet	V_1								
		V_2								
	Green	V_1								
		V_2								
	Yellow	V_1								
		V_2								
SECOND	Violet	V_1								
		V_2								
	Green	V_1								
		V_2								
	Yellow	V_1								
		V_2								

CALCULATIONS:

$$(a+b) = \frac{2.54}{N} \text{ cm}$$

First order : $\lambda = \frac{\{(a+b)Sin\theta\}}{1}$

$\lambda_v =$ A^0 , $\lambda_G =$ A^0 , $\lambda_Y =$ A^0

Second order: $\lambda = \frac{\{(a+b)Sin\theta\}}{2}$

$\lambda_v =$ A^0, $\lambda_G =$ A^0, $\lambda_Y =$ A^0

RESULT: The wavelengths are given in the table.

Colour of the spectral line	Observed λ (A^0)	Standard λ (A^0)	% error
Violet			
Green			

Yellow			

PRECAUTIONS:

1. Before performing the experiment spectrometer and grating must be properly adjusted.
2. The slit should be narrow.
3. Do not touch the grating from the middle but hold it from the edges.
4. Read both the verniers.