Boğaziçi University

Introductory Phys Labs

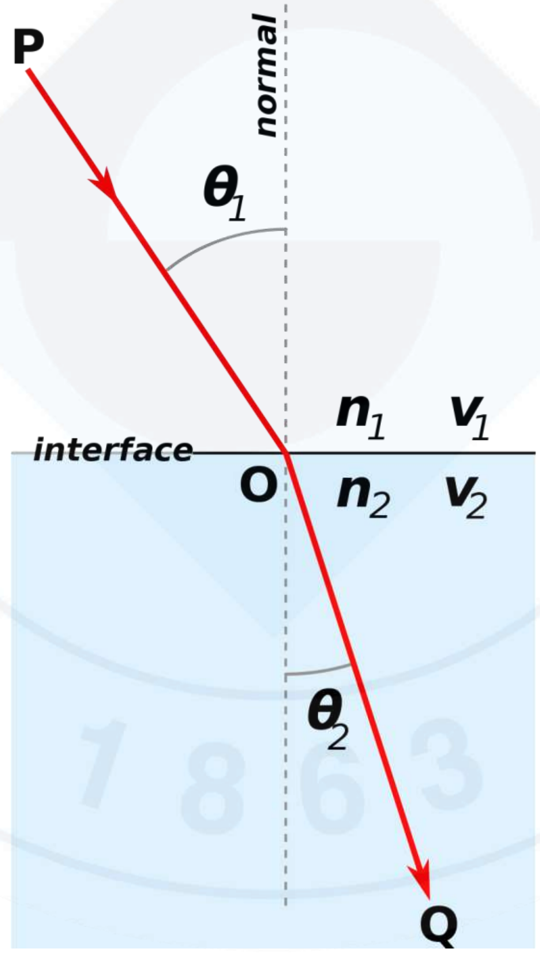
PRISM SPECTROMETER

PHYL 202

THEORY

- **Snell's law states a relation between incoming and refracted angles between two different environments**

$$n_1 sin\theta_1 = n_2 sin\theta_2$$

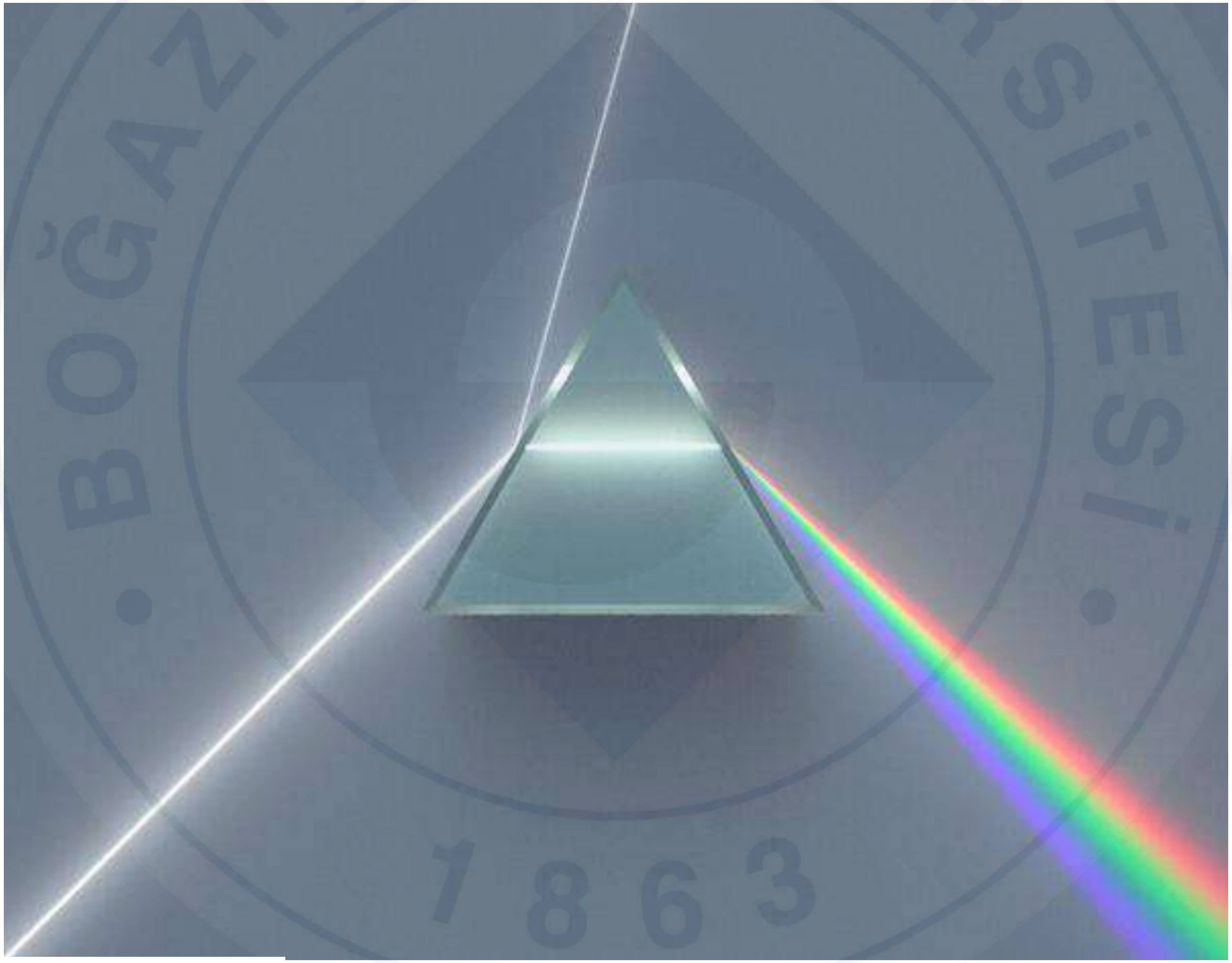


- **But, if Snell's law would be the only equation that governs refraction, then why we would observe different lights coming out of a prism?**
- **There is one more equation that states the index of refraction of a material also depends on the incoming light.**

$$n = A + \frac{B}{\lambda^2}$$

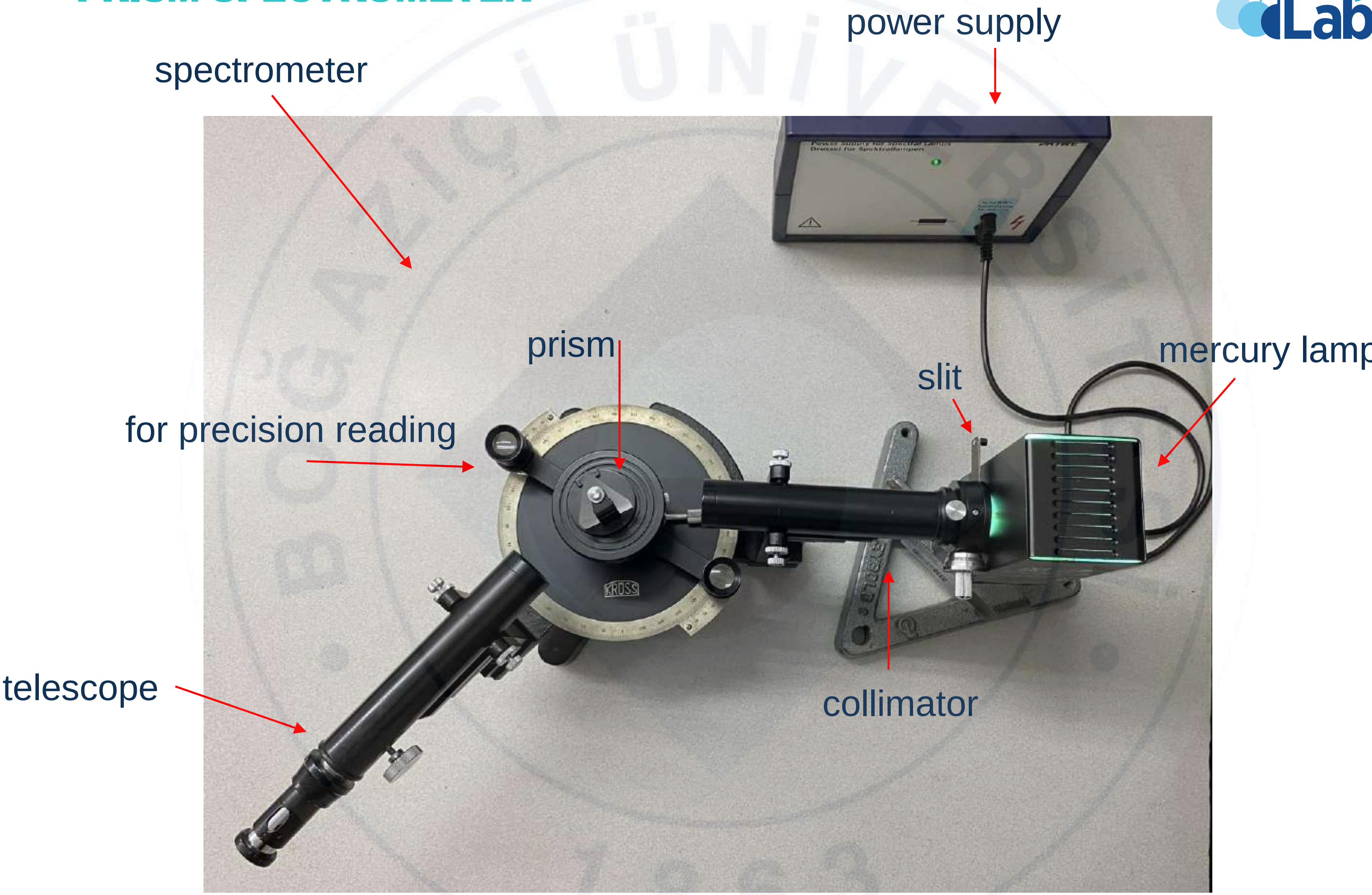
- **In this experiment, we will examine the relation between index of refraction and wavelength of the light.**

Example of $n = A + \frac{B}{\lambda^2}$



APPARATUS

PRISM SPECTROMETER



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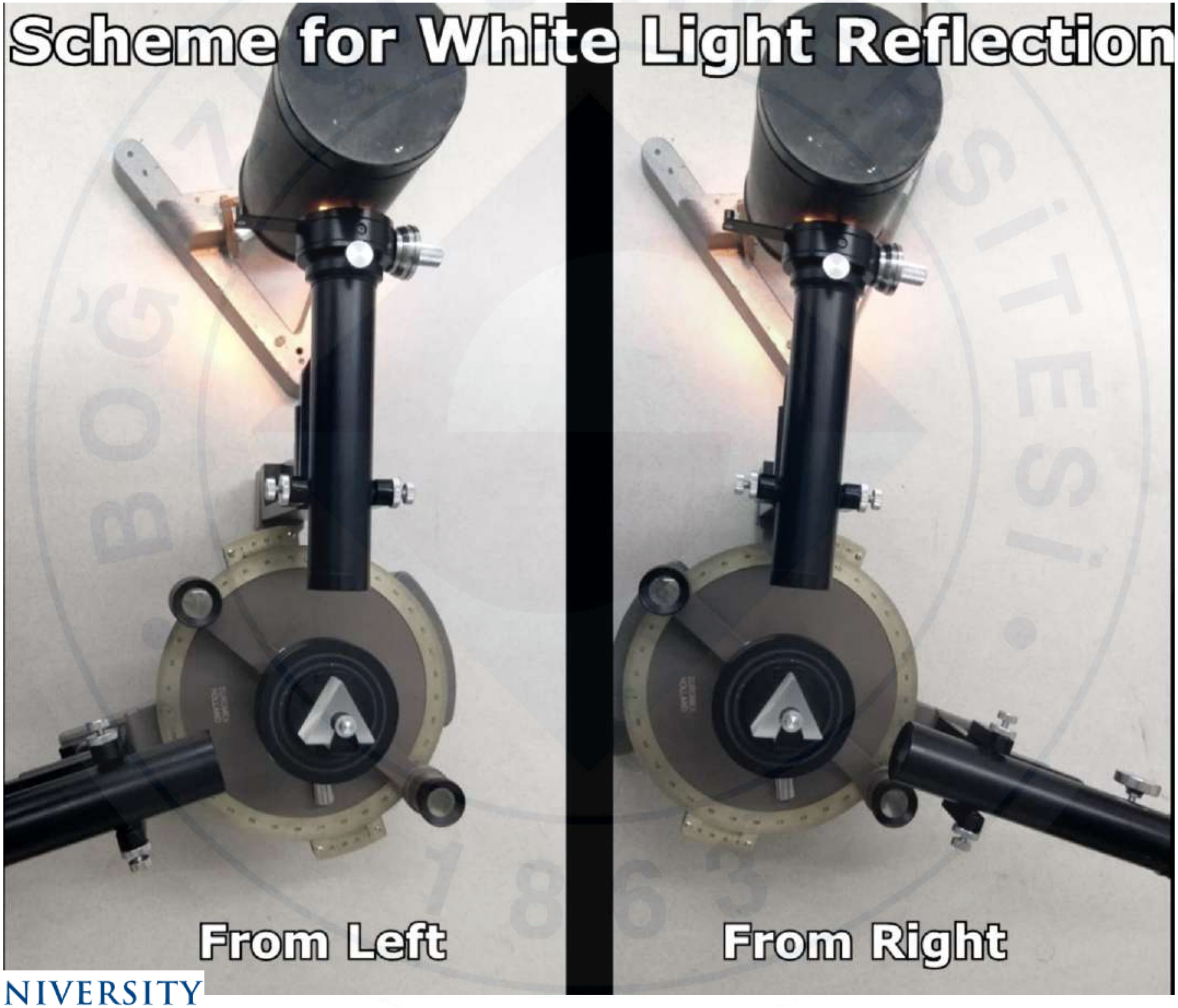
EXPERIMENT

PRISM SPECTROMETER

WHITE LIGHT REFLECTION



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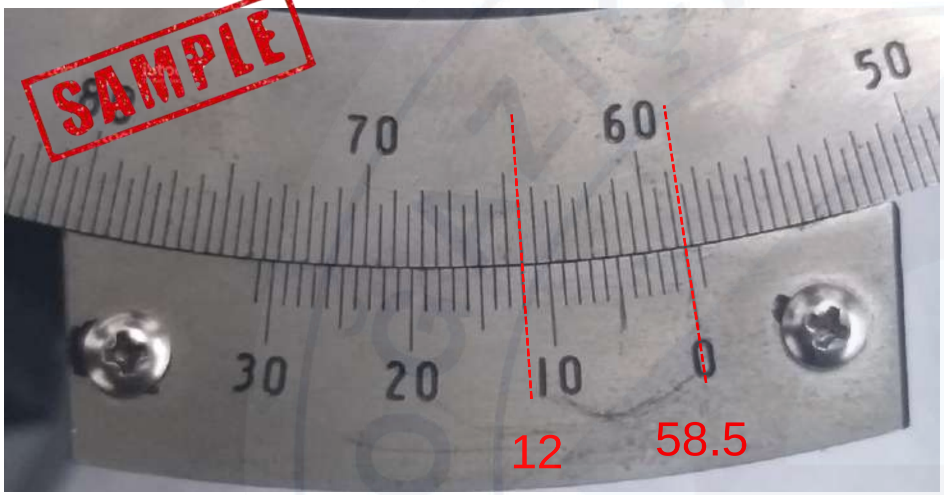
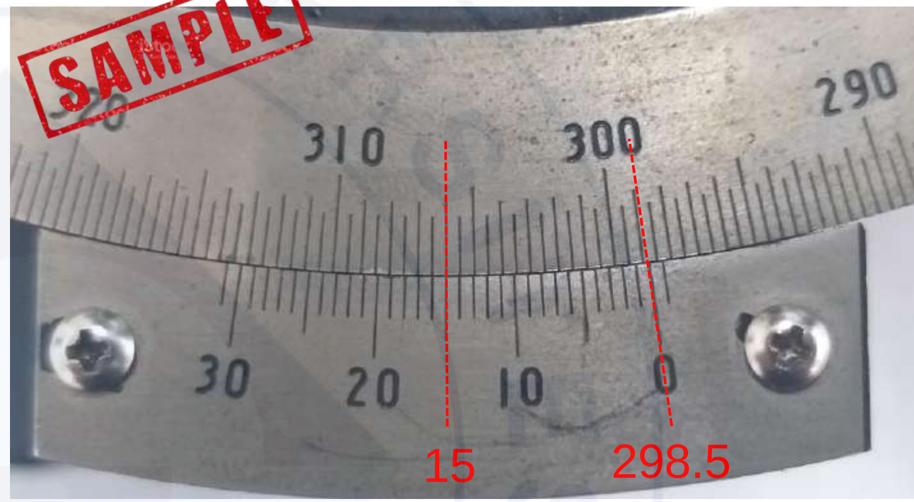
WHITE LIGHT REFLECTION – demonstration 0 ° – 0 ° match





58.5(12)°
30 0.5°
12 x
x=0.20° (2 SF)
58.70° (2 SF after decimal point)

298.5(15)°
30 0.5°
15 x
x=0.25° (2 SF)
298.75° -> 360.00° – 298.75°
= 61.25° (2 SF after decimal point)

(58.70°+61.25°)/2= 59.98° = α

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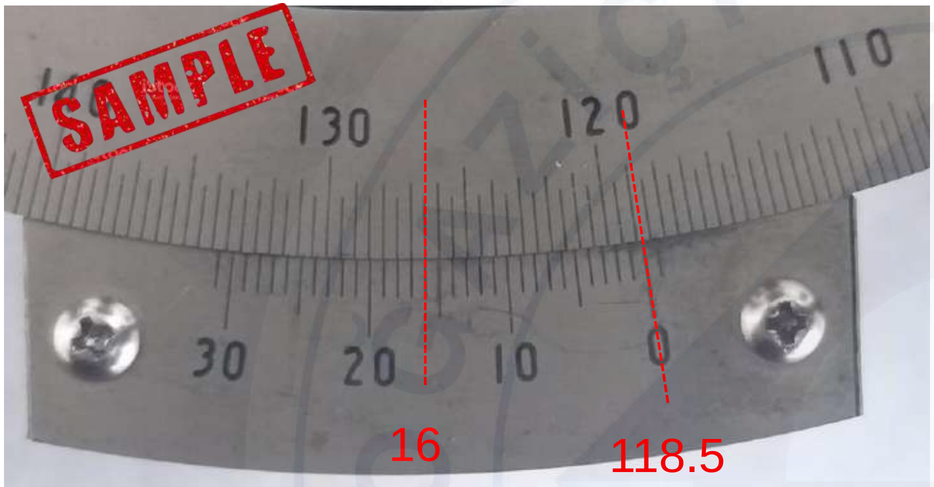
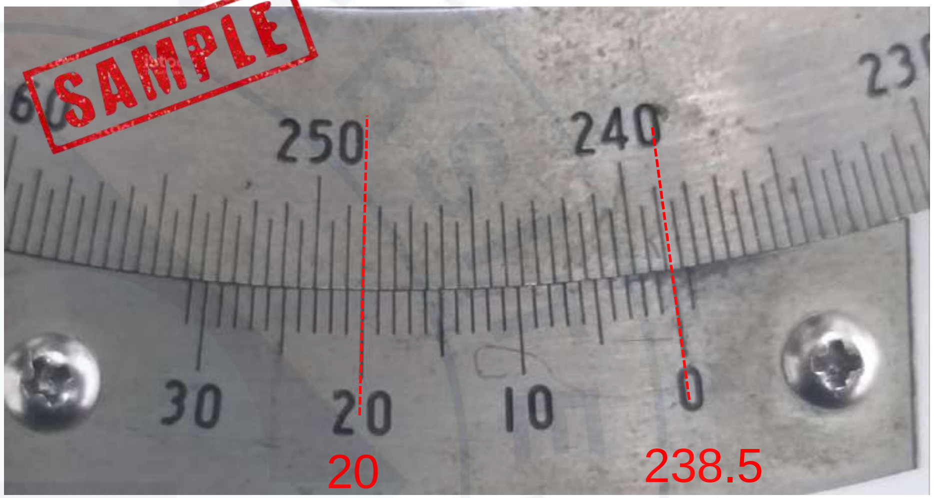
WHITE LIGHT REFLECTION – demonstration 0 ° – 180 ° match





118.5(16)°
30 0.5°
16 x
x=0.27° (2 SF)
118.77° (2 SF after decimal point)

238.5(20)°
30 0.5°
20 x
x=0.33° (2 SF)
238.83° (2 SF after decimal point)

(238.83°-118.77°)/2= 60.03° = α

WHITE LIGHT REFLECTION

Fill the empty spaces accordingly.

White light reflection:

Angle (left) θ_{left} = ...

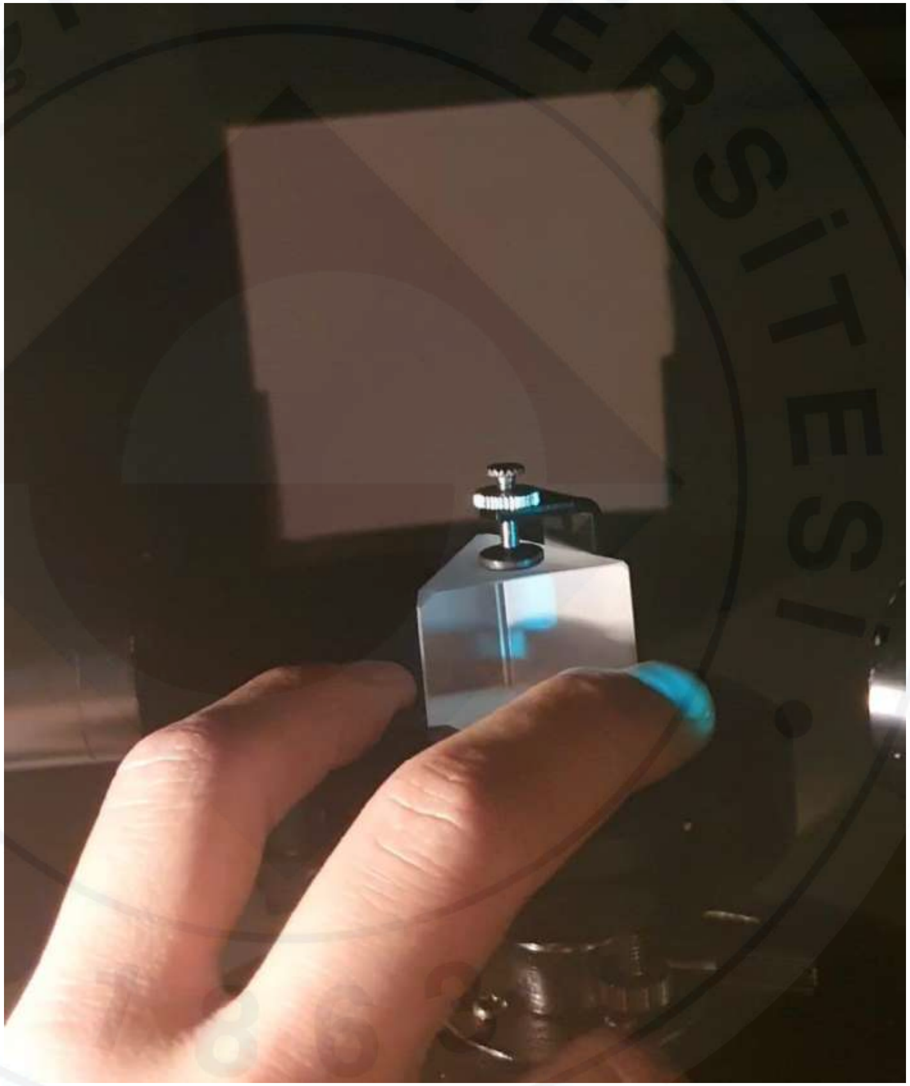
Angle (right) θ_{right} = ...

Prism Angle α = $\dfrac{|\theta_{right} + \theta_{left}|}{2}$ .... $\dfrac{|\theta_{right} - \theta_{left}|}{2}$

0° -0° match   0° -180° match

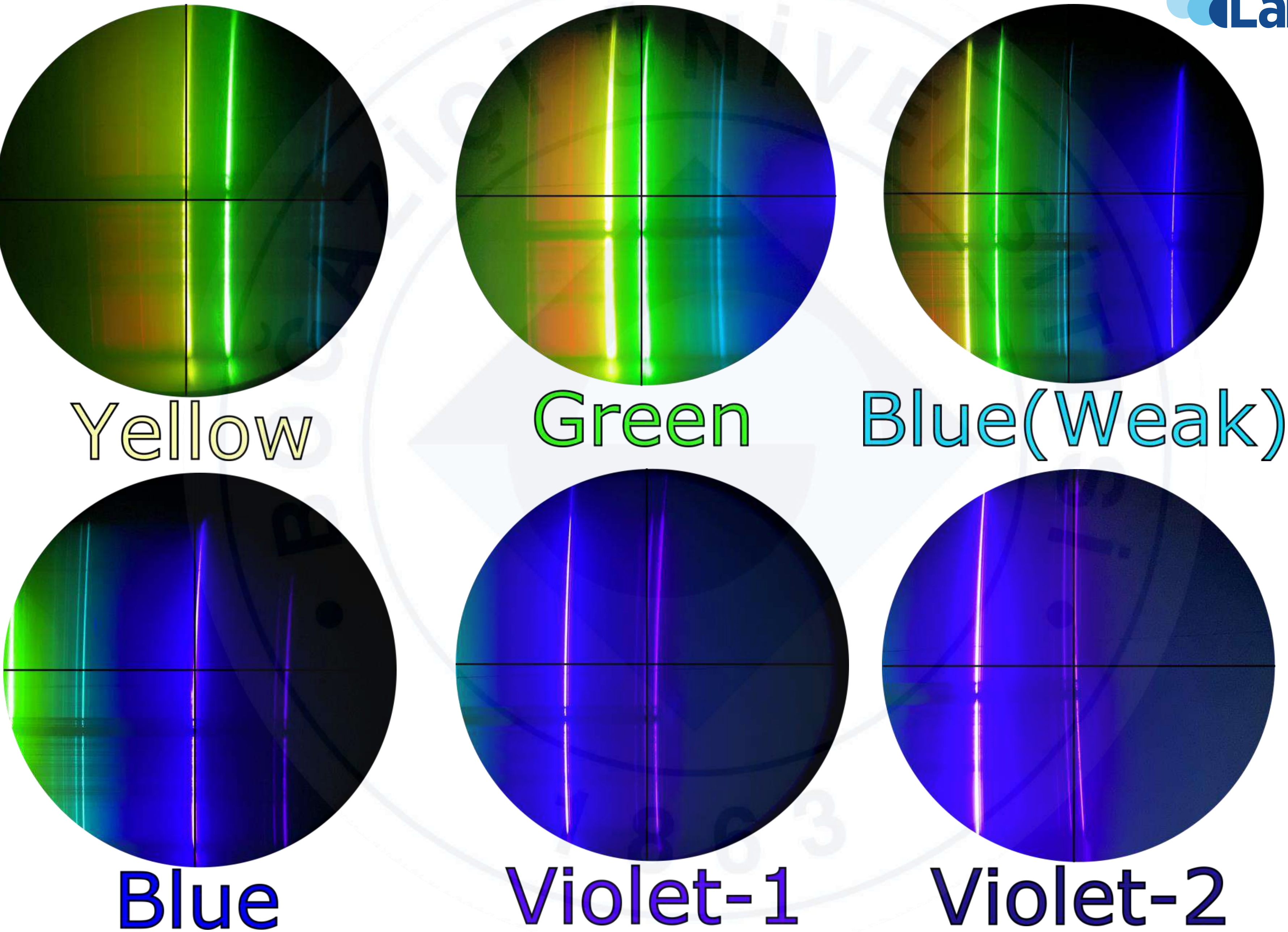
MERCURY LAMP

- Find the minimum angle of deviation with respect to incoming light



PRISM SPECTROMETER

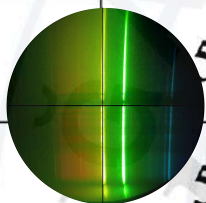
MERCURY LAMP



MERCURY LAMP - demonstration

Measurements for the Mercury spectrum:

Keep this unit throughout the experiment



COLOR	λ (A°)	θ	D_{min} (*show your calculations*)
Yellow-1 Average	5790	308.5(27)°	30 0.5° ?=27*0.5/30 (2 SF) 27 ?° D_{min}=308.95°= 51.05°
Yellow-2	5769		
Green	5460		
Blue (weak)	4916		
Blue	4358		
Violet-1	4077		
Violet-2	4046		

PRISM SPECTROMETER

MERCURY LAMP

Fill the empty spaces accordingly.

Show your calculations

CALCULATIONS:

COLOR	$1/\lambda^2$ ( )	$n = \frac{Sin[(\alpha + D_{min})/2]}{Sin(\alpha/2)}$	*n* (result)
Yellow-1 Average			
Yellow-2			
Green			
Blue (weak)			
Blue			
Violet-1			
Violet-2			

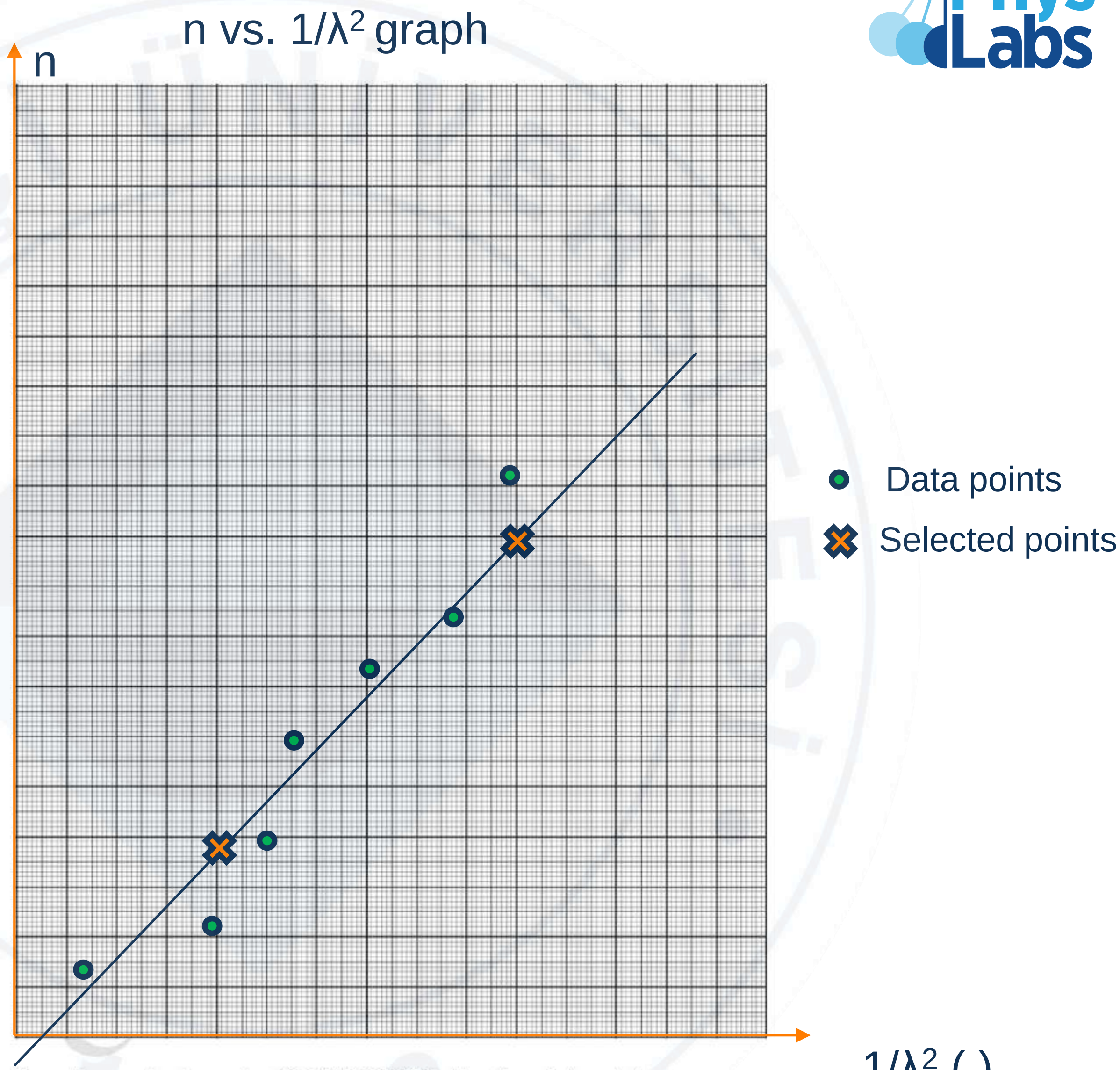
MERCURY LAMP

$$n = A + \frac{B}{\lambda^2}$$

A is y-intercept that is why you should start your x-axis from 0.

Scale your y-axis independently of your x-axis

- While drawing your line, try to even out your data points.



From the graph, choose two SLOPE POINTS other than data points,

SP_1 : (;)

SP_2 : (;)

MERCURY LAMP

Fill the empty spaces accordingly.

Notation	Calculations (show each step)	Result
A =	....	....
	....	
B =	....	....
	....	

Dimensional Analysis of *A*:

Dimensional Analysis of *B*: