BIRZEIT UNIVERSITY

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Department of Physics دائرة الفيزياء

Phys111 Report

Experiment #5: Focal Length of a Convex Lens

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(1) Abstract:

- **Aim of the experiment:**

To find the value of the focal length of a convex lens.

- **The main result is:**
  - The focal length of the convex lens is $f = 2.040 \pm 0.004$ cm

(2) Data:

	1.	**2.**	**3.**	**4.**	**5.**	**6.**
$u\ (cm)$	12.00 cm	10.00 cm	8.00 cm	6.00 cm	4.00 cm	3.00 cm
$v\ (cm)$	2.40 cm	2.50 cm	2.67 cm	3.00 cm	4.00 cm	6.00 cm
$1/u$ **(cm^{-1})**	0.08 cm^{-1}	0.10 cm^{-1}	0.12 cm^{-1}	0.17 cm^{-1}	0.25 cm^{-1}	0.33 cm^{-1}
$1/v$ **(cm^{-1})**	0.42 cm^{-1}	0.40 cm^{-1}	0.37 cm^{-1}	0.33 cm^{-1}	0.25 cm^{-1}	0.17 cm^{-1}

$\Delta u \approx 0.01$ cm	$\Delta v \approx 0.01$ cm	$f_{true} \approx 2.00$ cm

(3) Calculations:

$\bar{u}$ = 7.167 cm	$\bar{v}$ = 3.428 cm	$\overline{\left(\frac{1}{u}\right)}$ = 0.175 cm^{-1}	$\overline{\left(\frac{1}{v}\right)}$ = 0.323 cm^{-1}

$f_1 = 1/\, x_{intercept}$= $\frac{1}{0.49}$ = 2.04 cm	$f_2 = 1/\, y_{intercept}$= $\frac{1}{0.49}$ = 2.04 cm
$\bar{f} = \frac{f1+f2}{2}$ = $\frac{2.04+2.04}{2}$ = $\frac{4.08}{2}$ = **2.040 cm**	
$\Delta\bar{f}$ = $f^2 x(\frac{\Delta u}{u\text{^}2} + \frac{\Delta v}{v\text{^}2})$ = $(2.04)^2$ x $(\frac{0.01}{(7.167)\text{^}2} + \frac{0.01}{(3.428)\text{^}2})$ = 4.1616 x(1.947x10^{-4} + 8.508 x 10^{-4})	
= 4.1616 x 1.0455 x10^{-3} = 0.0043509528 ➔ **0.004 cm**	

(4) Results:

- The focal length of the convex lens is $f = 2.040 \pm 0.004$ cm

(5) Conclusions:

$\bar{f} \pm \Delta\bar{f}$ = 2.040 ± 0.004 cm

After I did the readings and calculations ,I need to make the Discrepancy Test to check if the result is accepted or not :

***Discrepancy Test = |true value – exp. Value| ≤ 2 × error**

=| 2 – 2.040| ?≤ 2 x 0.004 ➔➔➔ 0.04 ≤ 0.008

The result is not accepted. (The true value of f = 2 cm).

There are some systematic errors that made the result unacceptable such as:

The object is not placed at a distance of 0 cm and this will affect the result on (v, u, and f).

It is also possible that the measured image was not the correct and clear reflection of the object, and thus the result would be different.

as well, when I draw the slope carve, maybe I take the wrong x- and y-intercept which may affect the final result.

Malek Zeghari, 1230358. exp5:

$\frac{1}{V}$ VS $\frac{1}{\mu}$