

# lab #2

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## 1 Measured Data

We first attempted to get the focal length of the two lenses. While doing this we recorded two positions of each instrument each with a uncertainty of .1cm this gives the average an uncertainty of  $\delta = .1/\sqrt{2}$ .

We measured the position of the source as  $ave(14.55cm, 18.45cm) = 16.5cm \pm \delta$ .

Next we set up our experiment to measure the focal lengths of the two lenses. Below are the average distances (uncertainty  $\delta$ ) to the mirror and the range of screen positions that focused  $P_l$  to  $P_h$ . We will not consider the uncertainty from the instrument's measurements for these last two as the uncertainty we had in where they focused is much higher as shown below (order of mm vs cm).

	lense	$P_l$	$P_h$	$P$	$\delta P$
L1	37.55	149.45	159.25	154.35	4.9
	42.9	97.625	101.375	99.5	1.875
L2	37.55	148.25	158.55	153.4	5.15
	42.05	98.35	102.95	100.65	2.3

We then measured the distance to a virtual image. To do this we calibrated the focus of a camera so that it focused in the range (59.675, 66.025). Which gives us a focus at  $62.85 \pm 3.175$ . We then positioned the lense at various positions and measured the distance to the virtual image formed by lense one. The range in these measurements is denoted  $C_l$  to  $C_h$ . Note that L has the previously described uncertainty  $\delta$ .

L	$C_l$	$C_h$	C	$\delta C$
17.45	59.575	65.525	62.55	2.975
22.45	53.575	61.775	57.675	4.1
27.45	40.875	48.975	44.925	4.05

Finally we positioned lense one near the source then lense two and finally the screen. We set the positions of the lenses then experimentally determined the distance where the image on the screen came into focus. All of the set measurements come with uncertainty  $\delta$  the experimental value has experimentally determined uncertainty.

$L_1$	$L_2$	$S_l$	$S_h$	S	$\delta S$
32.3	52.3	71.8	72.55	72.175	0.375
23.05	58.9	86.95	87.85	87.4	0.45