Testing The Law

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Physics 3P92

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Abstract

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Contents

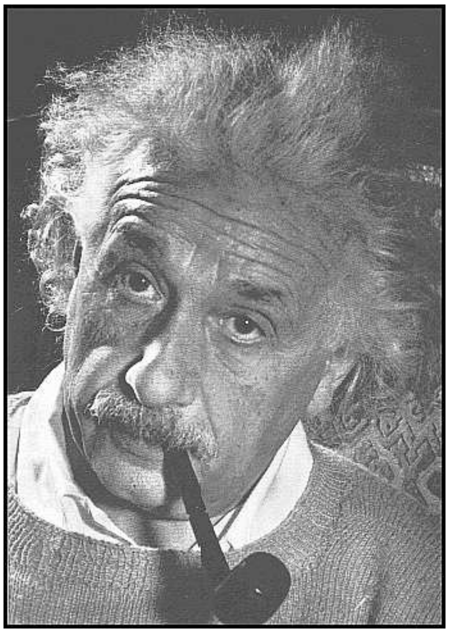

Figure 1: This is the caption for the picture.

1 Introduction

The purpose of this experiment is to determine xxx xxxxx xxxxx xxx xxxx xxxx xxxxx xxxxx xxxx xxxxx xxxx xxxxxxxxx xxx xxxxx xxxxx xxx xxxx xxxx xxxxx xxxxx xxxx xxxxx xxxx xxxxxxxxx

xxx xxxxx xxxxx xxx xxxx xxxx xxxxx xxxxx xxxx xxxxx xxxx xxxxxxxxx xxx xxxxx xxxxx xxx xxxx xxxx xxxxx xxxxx xxxx xxxxx xxxx xxxxxxxxx xxx xxxxx xxxxx xxx xxxx xxxx [1] xxxx xxxxx xxxx xxxxxxxxx xxx xxxxx xxxxx xxx xxxx xxxx xxxxx xxxxx xxxx xxxxx xxxx xxxxxxxxx This is the way to insert a figure or simply leave some white space for a figure that is to be pasted in later, like a photo or a hand-drawn sketch. As seen in Figure 1, everything is clear. xxx xxxxx xxxxx xxx xxxx xxxx xxxxx xxxxx xxxx xxxxx xxxx xxxxxxxxx xxx xxxxx xxxxx xxx xxxx xxxx xxxxx xxxxx xxxx xxxxx xxxx xxxxxxxxx xxx xxxxx xxxxx xxx xxxx xxxx xxxxx xxxxx xxxx xxxxx xxxx xxxxxxxxx

xxx xxxxx xxxxx xxx xxxx xxxx xxxxx xxxxx xxxx xxxxx xxxx xxxxxxxxx xxx xxxxx xxxxx xxx xxxx xxxx xxxxx xxxxx xxxx xxxxx xxxx xxxxxxxxx Text before the footnote.[1] Text after the footnote. xxxx xxxxx xxxx xxxxx xxxxx xxxx xxxxxxxxx xxx xxxxx xxxxx xxx xxxx xxxx xxxxx xxxxx xxxx xxxxx xxxx xxxxxxxxx

[1] Here's the text of the footnote.

2 Experimental procedure

The experimental procedure described in the lab manual [2, pp. 13–17] was followed exactly. We found that the following changes were necessary to make the circuit work:

- xxx xxxxx xxxxx xxx xxxx xxxx xxxxx xxxxx xxxx xxxxx xxxx xxxxxxxxx xxx xxxxx xxxxx xxx xxxx xxxx xxxxx xxxxx xxxx xxxxx xxxx xxxxxxxxx
- xxx xxxxx xxxxx xxx xxxx xxxx xxxxx xxxxx xxxx xxxxx xxxx xxxxxxxxx xxx xxxxx xxxxx xxx xxxx xxxx xxxxx xxxxx xxxx xxxxx xxxx xxxxxxxxx The modified circuit diagram is presented in Figure 2.

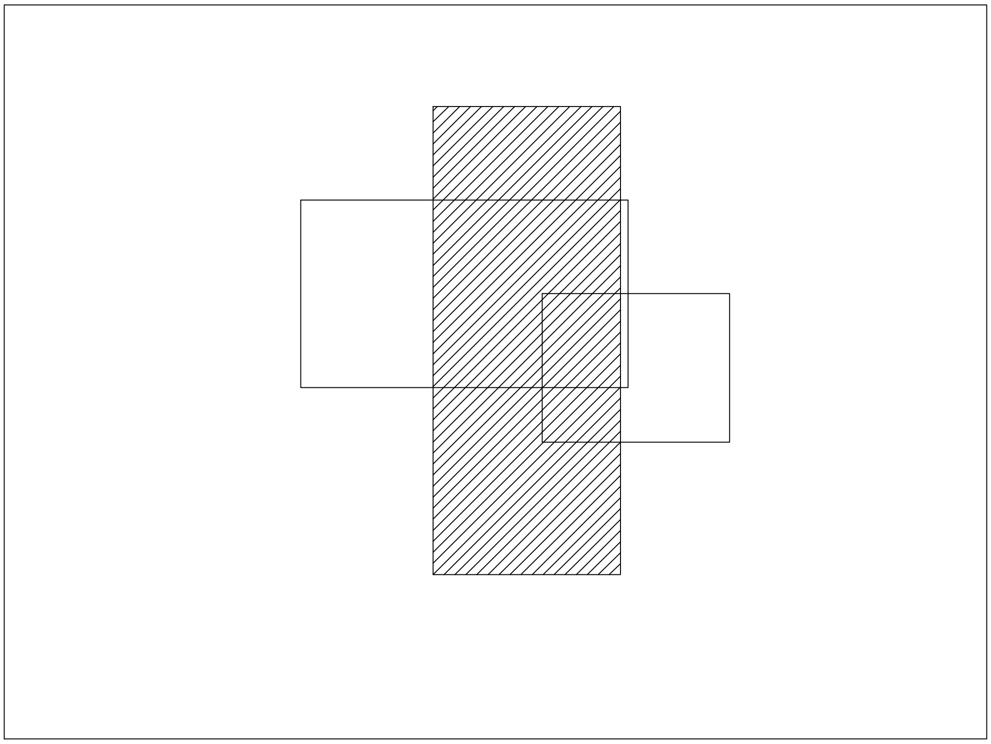

Figure 2: The modified circuit diagram was drawn with `edgr` and saved as a PostScript file.

- xxx xxxxx xxxxx xxx xxxx xxxx xxxxx xxxxx xxxx xxxxx xxxx xxxxxxxxx xxx xxxxx xxxxx xxx xxxx xxxx xxxxx xxxxx xxxx xxxxx xxxx xxxxxxxxx

3 Results

xxx xxxxx xxxxx xxx xxxx xxxx xxxxx xxxxx xxxx xxxxx xxxx xxxxxxxxx xxx xxxxx xxxxx xxx xxxx xxxx xxxxx xxxxx xxxx xxxxx xxxx xxxxxxxxx xxx xxxxx xxxxx xxx xxxx xxxx xxxxx xxxxx xxxx xxxxx xxxx xxxxxxxxx xxx xxxxx xxxxx xxx xxxx xxxx as shown in Equation 1

$$P = IV = I^2R = \frac{V^2}{R} \quad , \tag{1}$$

where V is voltage (V), I is current (A), and xxxxx xxxxx xxxx xxxxx xxxx xxxxxxxxx

xxx xxxxx xxxxx xxx xxxx xxxx xxxxx xxxxx xxxx xxxxx xxxx xxxxxxxxx xxx xxxxx xxxxx xxx xxxx xxxx xxxxx xxxxx xxxx xxxxx xxxx xxxxxxxxx Multi–line equations are also possible (see Equation 2)

$$\begin{aligned} P &= IV \\ &= I^2R \end{aligned} \tag{2}$$

where some lines may be left unnumbered. xxx xxxxx xxxxx xxx xxxx xxxx xxxxx xxxxx xxxx xxxxx xxxx xxxxxxxxx xxx xxxxx xxxxx xxx xxxx xxxx xxxxx xxxxx xxxx xxxxx xxxx xxxxxxxxx

The summary of the experimental results is presented in Table 1 xxxx xxx xxxx xxxx

Table 1: This is the caption for the summary table, usually placed at the top, not at bottom as for figures.

P, W	V, V	I, A
0.0 ± 0.01	0.0 ± 0.01	0.0 ± 0.01
0.1	0.2	0.3
0.1	0.2	0.3
0.1	0.2	0.3
0.1	0.2	0.3
0.1	0.2	0.3

xxxxx xxxxx xxxx xxxxx xxxx xxx xxxx xxxx xxxxx xxxxx xxxx xxxxx xxxx xxx xxxx xxxx xxxxx xxxxx xxxx xxxxx

xxx xxxxx xxxxx xxx xxxx data points with error bars, and the curve fitted to the data using Equation 1 are shown in Figure 3 and the text after the figure. The raw data is presented in Appendix A. xxxx xxxxx xxxxx xxxx xxxxx xxxx xxxxxxxxx

The graph of Figure 3 was generated using `physica` (see the macro file shown in Appendix B). The data points are shown as well as the curve representing the least–squares fit to the data. `physica` reports the value of the slope of the graph to be -21452 ± 801, which is equal to $h\nu/k$. Thus from the graph one can determine everything.

3.1 Sample Calculation for Power

The following calculation shows how the power was obtained. Note that this value is proportional to power, but it not the value for power itself.

$$P \propto V^2$$

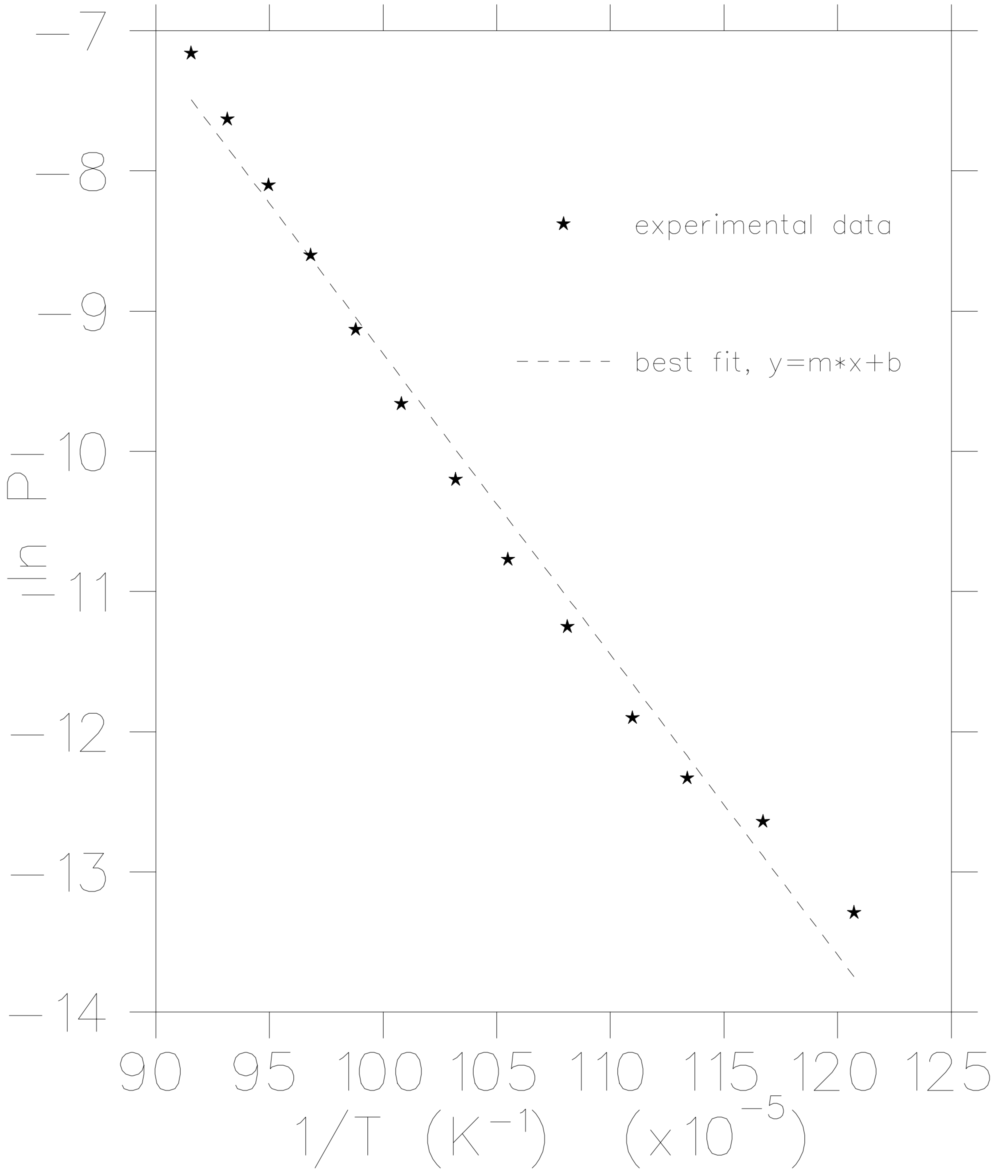

Figure 3: This plot was drawn using **physica** and saved as a PostScript file.

$$
\begin{aligned}
&\propto \ (0.0017V - 0.0004V)^2 \\
&\propto \ 1.69 \times 10^{-6} V^2
\end{aligned}
$$

4 Discussion and Conclusions

The results obtained in this experiment are quite accurate. The graph presented in Figure 3 xxx xxxxx xxxxx xxx xxxx xxxx xxxxx xxxxx xxxx xxxxx xxxx xxxxxxxxx xxx xxxxx xxxxx xxx xxxx xxxx xxxxx xxxxx xxxx xxxxx xxxx xxxxxxxxx xxx xxxxx xxxxx xxx xxxx xxxx xxxxx xxxxx xxxx xxxxx xxxx xxxxxxxxx xxx xxxxx xxxxx xxx xxxx xxxx xxxxx xxxxx xxxx xxxxx xxxx xxxxxxxxx

Possible sources of error xxx xxxxx xxxxx xxx xxxx xxxx xxxxx xxxxx xxxx xxxxx xxxx xxxxxxxxx xxx xxxxx xxxxx xxx xxxx xxxx xxxxx xxxxx xxxx xxxxx xxxx xxxxxxxxx xxx xxxxx xxxxx xxx xxxx xxxx xxxxx xxxxx xxxx xxxxx xxxx xxxxxxxxx xxx xxxxx xxxxx xxx xxxx xxxx xxxxx xxxxx xxxx xxxxx xxxx xxxxxxxxx

In conclusion, this experiment xxx xxxxx xxxxx xxx xxxx xxxx xxxxx xxxxx xxxx xxxxx xxxx xxxxxxxxx xxx xxxxx xxxxx xxx xxxx xxxx xxxxx xxxxx xxxx xxxxx xxxx xxxxxxxxx xxx xxxxx xxxxx xxx xxxx xxxx xxxxx xxxxx xxxx xxxxx xxxx xxxxxxxxx xxx xxxxx xxxxx xxx xxxx xxxx xxxxx xxxxx xxxx xxxxx xxxx xxxxxxxxx

References

[1] A. Green. *Reviews of Scientific Instruments*, **55**:123–134, 1982.

[2] E. Sternin. *Experimental Physics II (Electronics)*, Laboratory Manual. Brock University, 1994.

A Raw data

Table 2: Resistance and Temperature of the Filament

$R(T)$, Ω	T, K	$1/T$, K^{-1}	$\ln P$
151.00$\pm$3.92	828.35$\pm$23.46	1.2072×10^{-3}	-13.29
157.12$\pm$3.71	856.88$\pm$22.25	1.1671×10^{-3}	-12.64
162.53$\pm$3.49	881.99$\pm$21.02	1.1338×10^{-3}	-12.33
166.67$\pm$3.33	901.14$\pm$20.13	1.1097×10^{-3}	-11.90
171.84$\pm$3.17	924.98$\pm$19.25	1.0811×10^{-3}	-11.25
176.84$\pm$3.04	947.96$\pm$18.53	1.0549×10^{-3}	-10.77
181.46$\pm$2.90	969.13$\pm$15.49	1.0319×10^{-3}	-10.20
186.49$\pm$2.79	992.09$\pm$17.18	1.0080×10^{-3}	-9.66
190.91$\pm$2.69	1012.21$\pm$16.65	9.8794×10^{-4}	-9.13
195.48$\pm$2.59	1032.95$\pm$16.45	9.6811×10^{-4}	-8.60
199.93$\pm$2.50	1053.08$\pm$15.65	9.4960×10^{-4}	-8.10
204.47$\pm$2.41	1073.56$\pm$15.19	9.3148×10^{-4}	-7.63
208.62$\pm$2.34	1092.22$\pm$14.83	9.1556×10^{-4}	-7.16

B A physica macro

This physica macro was used to generate the plot of Figure 3 as well as to fit xxx xxxxx xxxxx xxx xxxx xxxx xxxxx xxxxx xxxx xxxxx xxxx xxxxxxxxx xxx xxxxx xxxxx xxx xxxx xxxx xxxxx xxxxx xxxx xxxxx xxxx xxxxxxxxx

```
! exp_3.pcm
clear

! read in the data
read\format\noerror exp_3.dat (*) x,y,dy

! plot the data
label\x ‘Voltage, V’
label\y ‘Power, W’
set colour 1 1
set pchar -4
graph x,y,dy

! fit and plot the curve
scalar\vary A,T,w,phi
! initial values for parameters
A=2.3
w=6.5
phi=0
T=10.

fit y=A*cos(w*x+phi)*exp(-x**2/T)
fit\update f
set colour 2 2
set pchar 0
graph\noaxes x,f
```