Planck's Constant

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The objective of this lab is to measure Planck's Constant, 4.136×10^{-15} eV s, by using a Planck's Constant Apparatus. The procedure listed in [1] uses a different method to finding h, so a simpler and faster method for the procedure is discussed below.

I. PROCEDURE

First, the device must be calibrated by following steps $1-3$ in [1] under the "Operation" section.

Once the device is calibrated, it is time to find the stopping voltage. This is done by following the steps below.

1. Remove the cover from the photocell and insert the 365.0 nm filter.
2. Turn the range selector knob to "10^{-11} A".
3. Turn the Acc. Voltage Control knob until the analog ammeter (the current) dial is on zero. **DO NOT** turn the full scale dial, if you do you will have to restart data collection. (Why?)
4. Read off the voltage from the digital voltmeter.

Repeat the steps above for each of the filters(404.7 nm, 435.8 nm, 546.1 nm, 577.0 nm).

II. DATA ANALYSIS

The data from this lab should be placed in a data table that looks like the following:

Filter (nm)	Voltage (V) ±0.001 V
365.0	1.664
404.7	1.353
435.8	1.108
546.1	0.573
577.0	0.439

Then as mentioned in Dr. Smiths write up, you will be fitting this data to the following equation:

$$\mathrm{K}_{\mathrm{max}} = hf - \phi \tag{1}$$

Where $\mathrm{K}_{\mathrm{max}}$ is the kinetic energy of the stopping energy, h is Planck's Constant, and ϕ is the work function.

If you look closely, Eq.1 looks awfully similar to

$$y = mx + b \tag{2}$$

Thus, you will be plotting a straight line of $\mathrm{K}_{\mathrm{max}}$ vs. frequency. The plot should look like the following figure.

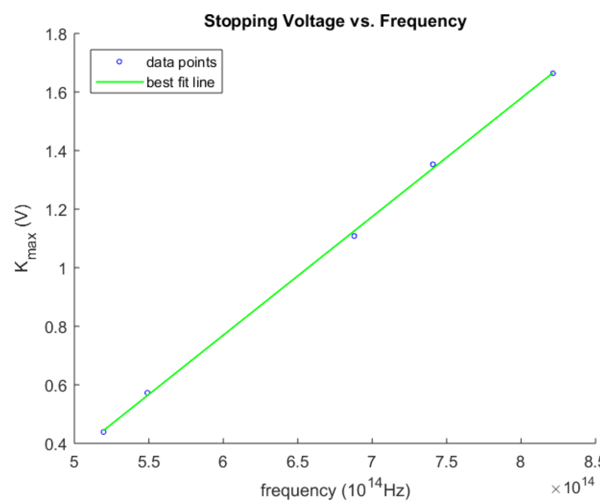

FIG. 1. As shown in the figure above, the blue dots are the data points and the green line is the best fit.

From the plot, the value for h is simply the slope.

[1] Instruction Manual for Planck's Constant Apparatus

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