The Franck-Hertz Experiment

Michael Richmond

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Abstract

We reproduced the classic Franck-Hertz experiment by accelerating electrons across varying voltages through gaseous mercury and measuring the electrons which have enough kinetic energy to pass through a retarding potential. Our results show the periodic variations one expects, based on the quantum nature of the energy required to raise mercury atoms out of the ground state. However, we measure an potential difference between successive peaks of 5.3 ± 0.1 Volts, which does not agree within the experimental uncertainty with the known 4.9 Volt difference between energy levels in mercury.

Introduction

This historic experiment measures many things, some better than others.

Theory

Very few people can see an electron, never mind measure it's charge, but we will here. Here's some equations for your amusement, even with labels.

At the terminal velocity, the acceleration is zero, and Newton's second law gives

$$0 = 6\pi r \eta v_g + \frac{4}{3}\pi r^3 \rho_{air} g - \frac{4}{3}\pi r^3 \rho_{oil} g \qquad (1)$$

where v_g is the speed of the drop moving downward.

Equation 1 can be solved for the radius of the drop;

$$r = \sqrt{\frac{9\eta v_g}{2(\rho_{oil} - \rho_{air})g}} \qquad (2)$$

Experiment

You can describe the equipment and what you did here.

For what its worth, I don't care if you rename all these sections something else.

Analysis

Here's a way to get a bunch of parameters to print out with the equal signs lined up neatly.

$$\begin{aligned} \rho_{oil} &= 872 \;\; kg/m^3 \\ \eta &= 1.85x10^{-5} \;\; Ns/m^2 \\ \rho_{air} &= 1.2 \;\; kg/m^3 \end{aligned}$$

And you can certainly insert a Figure

and then cite it in the text: See Figure **??** for my preferred activity.

References

`http://www.xkcd.com/242/`