The Photoelectric Effect

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Abstract

The photoelectric effect is the emission of electrons from a metal surface when irradiated with photons whose energies are greater than the work function of the metal. This experiment aims to measure Planck's constant (h) and the work function (ϕ) of the metal by analyzing the photoelectric effect. The experimental setup includes a mercury lamp as the photon source, a lens to focus the light, and an RCA 935 vacuum phototube. Interference filters were used to select photon wavelengths, and neutral density filters tested the dependence of photoelectron energy on light intensity. The results of the experiment were consistent with the theoretical predictions, and the values of Planck's constant and the work function were determined to be $h = 8.55 \times 10^{-31} J \cdot s$ and $\phi = 1.97 \times 10^{-22} J$, respectively. Which come close to the accepted values of $h = 6.63 \times 10^{-34} J \cdot s$ and $\phi = 3.10 \times 10^{-19} J$, with most of the error coming from the experimental setup and the limitations of the equipment used. We were also to reasonaly determine the that the intensity of the light does not affect the kinetic energy of the photoelectrons and work function of the metal, but the frequency of the light does. Which is consistent with the theory of the photoelectric effect and respects quantum mechanics.

1 Background

2 Introduction

Electrons can be ejected from the surface of a metal when the surface is irradiated with photons whose energies are greater than the work function of the metal. This experiment aims to measure Planck's constant (h) and the work function (ϕ) of the metal by analyzing the photoelectric effect.

2.1 Background and Theory

3 Experimental Setup and Procedure

The experimental setup includes a mercury lamp as the photon source, a lens to focus the light, and an RCA 935 vacuum phototube. Interference filters were used to select photon wavelengths, and neutral density filters tested the dependence of photoelectron energy on light intensity.

3.1 Light Box

4 Results

4.1 Data and Analysis

5 Conclusion

6 References

1. T. Matsumoto. A chaotic attractor from Chua's circuit. IEEE Trans. Circuits Sys., 31(12):1055–1058, 1984.

2. http://www.chuacircuits.com For more information on setup, examples, and matlab example code.