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Research Article

SUBSTITUTING COMPUTER SIMULATIONS BASED VIRTUAL APPARATUS FOR PHOTOEMISSION PHENOMENON WITH DIFFERENT CATHODE MATERIAL IN PHYSICS LABORATORY

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ABSTRACT

In this paper I am going to present developed java simulation based photoemission experiment and their concept which will be able to explain how the photoemission phenomenon with different cathode material experiment works and also explain the results. For this I have been used java technology to develop this application. This phenomenon was a critical pioneer to the formulation of quantum mechanics as it was one of the first to show the wave-particle duality of light. We will examine this effect with simulation based method.

Keywords: *Photoemission, Computer Simulations, Java Technology*

INTRODUCTION

In 1887, Hertz was the first to discover that a metallic surface, when illuminated by light of sufficient frequency, may emit electrical energy (Harnell and Livingood *et al.*, 1933). This photoemission phenomenon' was unexplained until Einstein coupled this experimental inquisitiveness with Planck's idea that radiation comes in tiny packets, or quanta (MIT Lab Guide, 2007). He projected that the energy of the evicted electrons is proportional to the energy of the incident light with a constant compensate that is unique to the metal, referred to as the work function (Einstein *et al.*, 1905). This phenomenon was a critical pioneer to the formulation of quantum mechanics as it was one of the first to show the wave-particle duality of light. We will examine this effect, test the theorized linear relation. Today's lab involves a simulation of the photoemission phenomenon. We will be examining various metals for the point at which they begin to lean-to electrons, based on a specific threshold frequency- the precise point when the photons have an adequate amount of energy to knock the electrons movable. This energy is called the work function (W) for the metal. Different metals hold on to their electrons more strappingly or inadequately due to atomic configuration, so the work function for an assortment of metals varies. The formula for scheming W is as follows:

$$h\nu = Ek + W$$

$$h\nu = 0 + W$$

Where

h is Planck's constant

ν is the frequency of the light

Ek is the kinetic energy of the ejected electron

W is the work function

The kinetic energy of the electron refers to its real movement once upon a time driven out. Ek can effectively be uncared for if we just arrive at the amount of energy to release the electron but not get it moving (Ek in these circumstances will essentially have a value of zero). We will be trying to attain the lowest possible speed for the electrons we throw out from the virtual metal surface. W can be obtained by scheming frequency and using Planck's constant. The work function will be in joules, so in order to compare to published lists of work function values which are in electron volts, your final value will require conversion into this unit.

MATERIALS AND METHODS

Design: The "equipment" we have used to carry out looks like this (Figure 1):

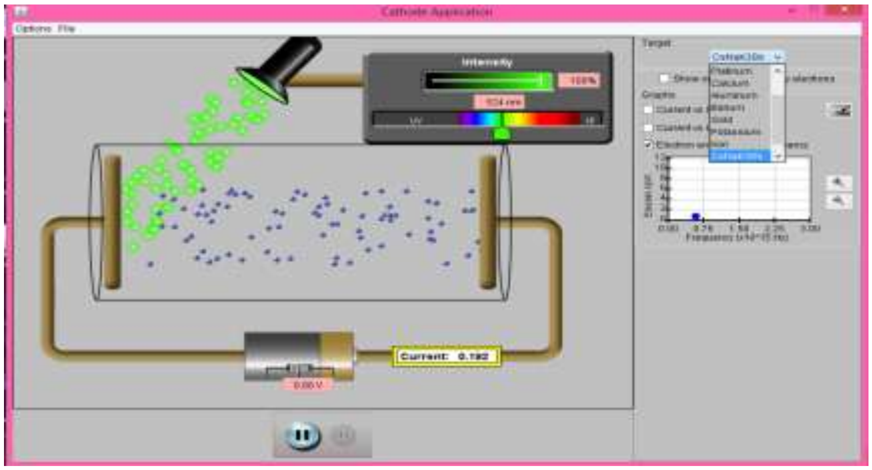

Figure 1: Screen shot of simulated for photoemission tool

General description of the features of the simulation

Intensity pointer (attached to beam control) enables to change the intensity of the external source of energy from 0% to 100%.

- Wavelengths pointer (attached also to beam control) enables to change the wavelengths of the external rays, thus the energy of the emitted photons by the light source, from Infrared (IR; extremely right) to Ultraviolet (UV extremely left).
- Target pointer (the very top-right side) enables to change the type of cathode metal (electrode) from which the electrons are driven out for example: Aluminium, Barium, CsNaK3Sb, Magnesium, Gold, Copper....
- Battery pointer (attached to the battery, lower part of the diagram) enables to change the potential supplied to the circuit from -8.0V to +8.0V. Note that the varying potential difference enables to apply stopping (retarding) potential.
- Graph Pointer enables to select analysis of electron energy verses light frequency.

Data and Analysis

Photosensitive metals: we can able to find the threshold wavelengths and frequencies for each of following photosensitive metals in the simulation. Also we can calculate the energy of the incident radiation for each photon incident upon the metals at that frequency.

Table 1: Different Photosensitive (Target) Metals

Sr. No.	Different Photosensitive (Target) Metals
1	Aluminium
2	Calcium
3	Copper
4	Gold
5	Iron
6	Magnesium
7	Platinum
8	Sodium
9	Zinc
10	Barium
11	CsNaK3Sb
12	Potassium

RESULTS

Under graphs as shown in Figure 2, we have three options for checking that is current vs. battery voltage, current vs. light intensity, Electron Energy vs. Light Frequency respectively. Current vs. battery voltage with help of this graph we can calculate stopping potential value for the material given in table 1, Electron Energy vs. Light Frequency graph to determine threshold frequency and work function for each sample.

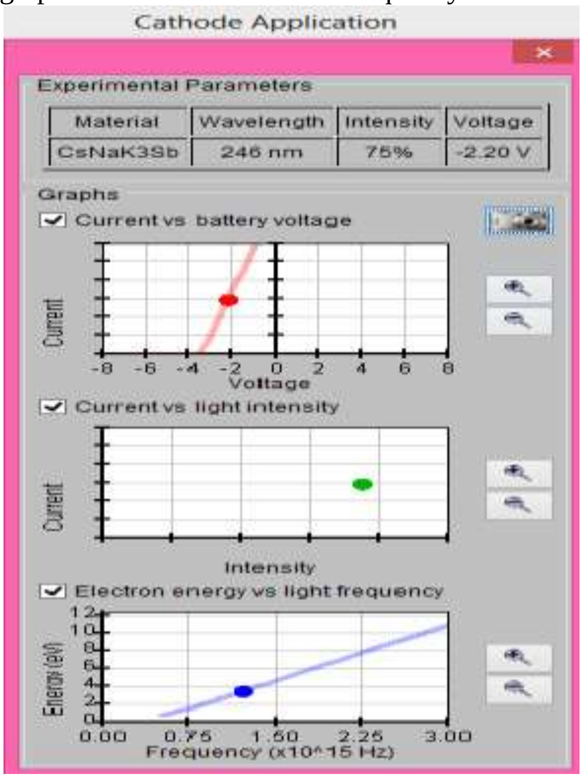

Figure 2: Screen shot for different types of graphs and their results

Conclusions

In this study, we explained computer simulations and it is in be the positioned of real equipment, and gave greater facility at manipulating real components. The properly designed computer simulations are useful tool for different rang of experimental environment and it can encourage student to gain knowledge and learning. The virtual equipment is more productive than real equipment. We show that computers are not just helpful for the reason that they are omnipresent and convenient in environments with otherwise limited resources.

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