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# THE FRANK-HERTZ EXPERIMENT.EINSTEIN THEORY

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***Abstract.****In this article we investigate the problem of modeling laboratory work in quantum physics under the name "Study of the photoelectric effect." The dependence of the light intensity and frequency on the anode voltage is investigated. There is a known voltage value between the anode and the photocathode, where the photocurrent is zero. The process of formation of the photoelectric effect at a given voltage as a result of a change in the parameter U was analyzed from the point of view of modeling.*

***Key words:*** *information technology, quantum physics, modeling.*

As we know that in higher education, laboratory practice is one of the most important forms of training, which allows students to work independently. Laboratory studies in quantum physics should be seen as an experimental exhibition, and not as an auxiliary tool to improve this course. The purpose of laboratory studies is to give students practical knowledge of the theoretical foundations of the subject being studied, a thorough study of the latest experimental methods in the field of science, and instrumentalization of the knowledge gained. turn them into educational and scientific research, and then as a means of solving real experimental and practical problems, in other words, to establish a connection between theory and practice.

On the other hand, laboratory classes require that the student be creative and proactive, independent in decision-making, deep knowledge and understanding of the educational material. Students will be able to better learn the material that is taught during laboratory work, as many calculations and formulas that seem abstract will be refined throughout the course. Students will reveal the secrets of many physical details that they could never have imagined, and this will help them develop the ability to solve complex problems.

In modern conditions it is necessary to get real experience in computer modeling of physical processes and phenomena studied in the laboratories of

quantum physics. If it is impossible to study the phenomenon for any reason or for training reasons, it is advisable to use computer simulation (for example, problems of quantum mechanics in the field of motion, cosmic problems, symmetry, elementary particle physics, etc.).

Let us consider several aspects of the use of computer models in laboratory practice. Methods of performing laboratory work in a virtual workshop include acquaintance with the physical nature of the phenomenon being studied, familiarity with the operation of the experimental device, setting specific research goals and tasks for the future, description of experiments and processing of experimental data by calculation of relative and absolute errors. Each laboratory has all the traditional elements: methodical and reference work, experimental part, processing of experimental data, educational and control tests. For example, in quantum physics, the “Studying the Photoelectric Effect” laboratory investigates the dependence of the camera power on the voltage at the anode at various intensities and frequencies of light, as well as the Einstein equation.

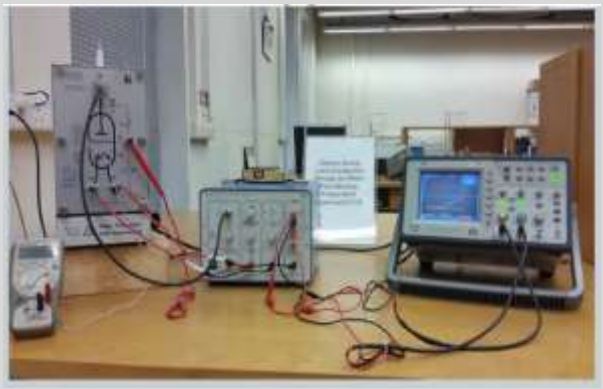

Fig. 1. Photoelectric Effect Modeling Scheme

The computer model that we studied (Fig. 1) is designed to study the law of the photoelectric effect. The test window is displayed on the left, and the current voltage characteristic of the photo is shown in the right window. The external photoelectric effect is the process by which electrons are emitted from the metal itself under the influence of light. A qualitative study of this phenomenon allows us to draw a number of interesting conclusions. To form this bond, the cathode must be irradiated with monochromatic light, which is almost impossible to perform in a demonstration experiment. Therefore, the essence of this phenomenon can be transmitted to students only with the help of computer modeling.

First of all, it is necessary to draw students' attention to the experimental scheme for generating the photoelectric effect, especially to the shape of the tube tube. The

complexity of the shape of the flask is explained by the fact that the photoelectric effect can be observed not only with visible cathode light, but also with ultraviolet light. It is known that glass does not easily absorb ultraviolet light, so the side window is made of quartz. In this case, the photoelectric effect can be created by illuminating the cathode at a distance of 10 meters or by ultraviolet radiation. Using the interactive capabilities of a computer model, you can select a number of important parameters: the wavelength and intensity of the incident light, the magnitude and difference between the anode and the photocathode, etc. This allows you to get the main quantitative dependencies that make up the basis of the photoelectric effect.

Thus, we can show the following laws of the photoelectric effect:

1. *The maximum speed of photoelectrons is determined by the frequency of this light and does not depend on its intensity, that is, the maximum kinetic energy of photoelectrons depends only on the frequency of light. By changing the radiation intensity P and the wavelength λ, one can observe a change in the photoelectron energy and show its independence from the radiation intensity. However, it should be noted that from the classical point of view, the photon voltage does not depend on the amplitude of the light intensity vector.*

2. *The red limit of the photoelectric effect for each substance, that is. the external photoelectric effect still has a minimum light frequency or maximum wavelength. By setting parameter A, you can specify the process of generating the photoelectric effect at a specific wavelength corresponding to the red limit.*

**CONCLUSION**

Thus, it was shown that there is a known voltage value between the anode and the photocathode, where the photocurrent is zero. The process of formation of the photoelectric effect at a given voltage as a result of a change in the parameter U was analyzed from the point of view of modeling.

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