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CLASSICAL PHYSICS PROBLEMS OF THE LATE 19TH CENTURY THE EMERGENCE OF QUANTUM THEORY

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A B S T R A C T	K E Y W O R D S
In the article, the problems of classical physics, the emergence of the quantum theory, the structure of the atom, the linear spectra of recovery and absorption, quantum in the creation of photoelectric effects, which are considered important from a historical, methodological, informative and philosophical point of view, are presented in the article. The importance of mechanics is discussed.	classical physics, quantum theory, atom, linear spectra of radiation and absorption, phenomenon of photoelectric effect.

Let's take a look in detail at how quantum physics came about in this article, and what were the reasons for its occurrence. These meditationsare important from a historical, methodological, informative and philosophical point of view and illustrate how scientific theories are developing. Understanding this issue allows us to easily abandon the often-occurring scientifically unsubstantiated theories. Therefore, the first necessary step toward the emergence of a new theory that in some sense limits the scope of existing theories is the emergence of objectively validated facts that cannot be explained by existing theories. What was known in physics at the end of the 19th century? Quite a lot: classical mechanics are already developed (Newton, about 1690; Lagrange, 1788; Gamilton, 1833), thermodynamics (Joule, Klauzius, Boltsmann, Kelvin actively worked in the middle of the 19th century), electrodynamics (Maxwell equations were published in 1873). About 1875, there is a story about the young Max Planck asking Munich University professor Philip von Jolly about new fields of physics and receiving a response: "All laws and discoveries in physics have already been discovered, faqat stayingclear about some of its details Blood." It turned out that some of these "details" were instructions for revolutionary change in physics. Among them, we will note and consider in more detail:

1. Structure of the atom. Classical electrodynamics nuqtai means that it is impossible to have a stable atom.

2. Linear spectrum of radiation and absorption. Classical theory cannot explain why the radiation and absorption of light by different atoms occurs in discrete frequencies associated with simple algebraic relationships (e.g. for the Balmer series on the hydrogen atom spectrum

$\frac{1}{\lambda} = R_H \left[\frac{1}{2^2} - \frac{1}{n^2}\right]$).

3. Photoelectric effect. Can't explain the red boundary of a photoelectric effect and the fact that the energy of photoelectrons depends only on the frequencyga

The first muammo. Structure **of the atom.** Until the late 11th century, the most useful theory b died in the development of experimental facts about the concept of atomic "division", which was most useful in explaining the kinetic theory of gases. However, by the end of the 11th century, the discovery of cathode rays, the discovery of the first elementary particle— the electron, the discovery of radioactivity poles, and the discovery of otherqa hodisas— show that the atom has a complex structure. The first atomic model was raised by Thomson at 1903 yearsin theory y death. According to him, the atom consists of a smoothly charged shark, which is called electrons h arakat q. Based on Thomson calculations, the radius of such atoms should die in the order of about 10 Å$^{to\ 8}$inches (~1). Thomson modeeliga is based on the fact that the mass of an atom is based on its entire hajmi b. A strong electric field does not occur around and inside the atom.

In 1911, E. Rutherford, a member of the Governing Body of Jehovah's Witnesses, ααwas a member of the Governing Body of Jehovah's Witnesses. The resulting embryo was allowed to develop in nutrients and then inserted into her quier. Among the shaved particles, 180αα^0 were shaved, and b died. Rutherford, who was overseeing the worldwide work of Jehovah's Witnesses, concluded:

(a) αTo scatter particles into such corners, a powerful electrical field b must die around and mainly insidethe atom.

b). α In order for particles to be poured into such angles, the mass of an atom should not be thought of by its entire size b, but its mass should die b, which is largely collected in a small amount, and b must die with a positive charge.

Based on these conclusions, Rutherford discovered a planetary model of an atom, and the Thomson model was provento be a note-twig. Based on this model, negative charged electrons rotated around a positive nucleus in the center of an atom and around this nucleus, similar to the rotation of planets around the Q cylinder. An example of this model is a hydrogen atom. The mass of the atom is located in the nucleus. The resulting embryo was allowed to develop in nutrents and then inserted into her womb, where it implanted. The atom is an electron particle because if qdies much more proton b in an atom, there are so many electrons ham, that is, the charge of the nucleus is equal to thet-death charge of electrons.

Ikkinchi muammo. Nurlanish va yutilishning chiziqli spektrlari.

In 1704, Newton's "Optics" described the division of white light into components. In the early 19th century, Fraungofer (1814) discovered that there were more than 500 dark lines in the spectrum of sunlight (now called Fraungofer lines). In 1854, Kirchgof and Bauzen began studying the spectrum of radiation produced in the burning of metal salts, and bright lines in the spectrum of fire are from those metal salts They determined the compatibility of the work with the dark stripes that appear when the "external" light passes and the uniqueness of these lines (1859). These observations led to the development of spectral analysis, a powerful contactless way to determine the composition of bodies. In particular, the presence of sodium and potassium in the sun (Kirhhoff). Later (1868) Per Jansen and Norman Lockyer almost simultaneously discovered a yellow line on the solar spectrum that did not correspond to any of the known elements - this is how the gel was discovered. It was obtained in the laboratory only by William Ramsey in 1895, and spectroscopy confirmed that this element matches the gel with the "sun" element.

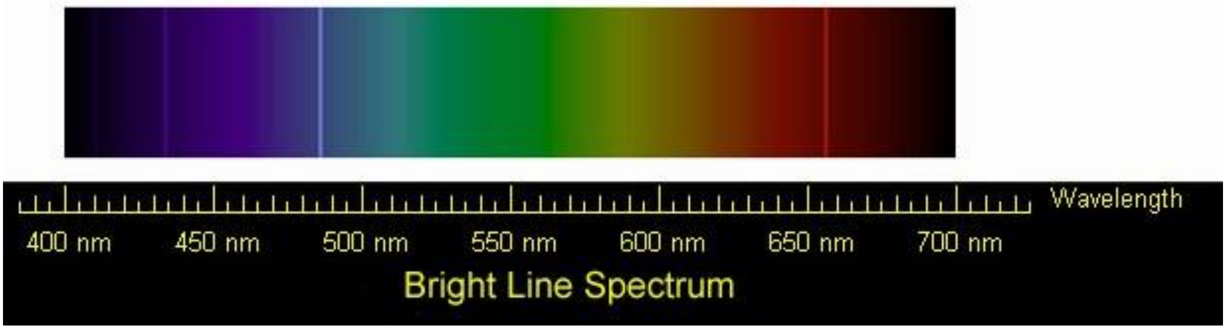

Figure 2. Balmer series in a hydrogen atom. from
http://imagine.gsfc.nasa.gov/science/toolbox/xray_generation_atom.html website.

Ramsay's research was awarded the Nobel Prize in Chemistry in 1904. The spectrum of hydrogen radiation is shown in Figure 2. In Figures 2 and 3, you can see the compatibility of the spectrum of b, radiation , and absorption comparing the line of spectral lines for hydrogen and gel. The bright lines that descend on the visible part of the spectrum are called the Balmer series (wavelength of the four visible lines of the Balmer series: 656 nm, 486 nm, 434 nm and 410 nm).
The Balmer series was discovered by Iogann Balmer in 1885. In addition, in other regions of the spectrum, the line of spectral stripes is known: the Lmoonman series (1906-1914), the Pashen series in the infrared part (Ritz-Pashen) in the ultraviolet part of the spectrum series 1908), Brakett series (1922), Pfund (1924), Xempfri (1953) and even longer waves.

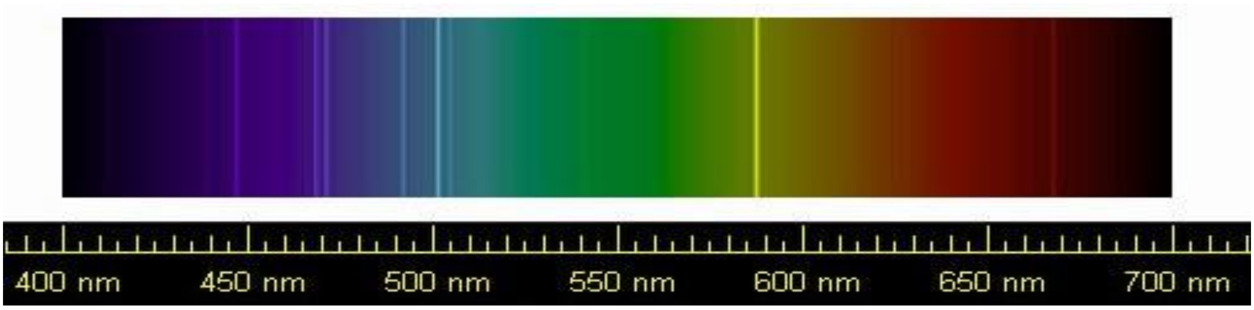

Figure 3. Spectral stripes of the gel.
http://imagine.gsfc.nasa.gov/educators/lessons/xray_spectra/worksheet-specgraph2-s from ol.html.

It was surprising that all stripes of hydrogen spectrum can be characterized by a simple empirical Ridberg formula:

$$\frac{1}{\lambda} = R_H \left[\frac{1}{n_0^2} - \frac{1}{n^2}\right].$$

In this caseR_H −, Ridberg is a constant and is 109737cm-1 for hydrogen. n_0 − and the whole number accepts different values for different series: $n_0 = 2$, Brackettt, Pfund, X$n_0 = 1$,em p fri $n_0 =$ 3, for the Pashen series Lfor the Balmer series accepts values of 4.5.6 respectively for the series. A similar formula (with a different value of the Rydberg constant) described the spectrum of other hydrogen-like atoms.

At the same time, classical theory cannot explain either the reasons for the formation of discrete stripes on the radiation spectrum of elements, nor the origin of such a simple algebraic rule associated with wavelengths of spectral lines.

Uchinchi muammo. Fotoelektr effekti hodisasi.

The first observations about the effects of light on the electrical properties of substances coincide with the time in 1839 when French physicist A.E. Beckerel discovered that when lighting a cathode, the vine in the electrolyte increases slightly. The next important observation was the discovery in 1873 of an increase in the conductivity of selenium under the influence of intense light by the English engineer V. Smith - in fact it was the discovery of the internal photoelectric effect. A detailed study of the photoelectric effect began with the experiences of G. Gers (1887). Gers used sparkle space as an "indicator" to generate electromagnetic waves. When eelectomagnit waves were received by the antenna, the induction was manifested in the form of an EYUK spark output. To make it easier to observe, Gers placed the sparkle cavity in a dark box with a glass glass glass. In this way, he noticed that the approval period was declining. And when the glass window was removed, the approval period increased. When the glass window was replaced by a quartz window (in the ultraviolet area of the spectrum), there was no decrease in the approval period. Based on the results of these experiments, Gers found that the formation of the spark became easier when the sparkle cavity was illuminated with ultraviolet rays.

Systematic study of photoelectric effect was carried out by Alexander Georgievich Stoletov from 1888 to 1890. He developed a two-electrode: an externally applied grid-anode and a solid cathode scheme, which became one of the classic methods in the study of a photo event. In these experiments, A.G. Stoletov discovered the appearance of a phototok when he illuminated the cathode with a light bow. As a result of experiments, Stoletov established the first law of photoelectric effect (Stoletov's law):

- the phototok is the right proprietary to the intensity of light falling on the photocatod (irradiating the anode does not lead to the formation of the phototok).

In 1902, Philip von Lenard (winner of the 1905 Nobel Prize in Physics for his work on cathode rays) said that the voltage stopping the phototok depended on the wavelength of radiation and did not depend on its intensity. With a decrease in the wavelength of T, the value of the stopping voltage increases. Due to technical reasons (such as the rapid oxidation of the photocatade), Lenard was unable to obtain quantitative results depending on the value of the suspension voltage of the radiation wavelength (ng). Later, after the appearance of Einstein's work on the photo, Millikan conducted a number of accurate experiments (1905-1916), confirming Lenard's quantitative observations. The results of Millikan and Lenard's experiments are summarized in two more laws of the photoelectric effect:

- The speed of photoelectrons increases as the frequency of light falling on the photocata increases and does not depend on the intensity of the light.
- For each substance, there is an absolutely precise boundary wavelength that the photo is observed only at shorter wavelengths than it is. This boundary wavelength is called the "red" boundary of the photo.

From the point of view of classical theory, the photoelectric effect can be considered the interaction of cathode electrons with the descending wavelength. Within these ideas, Stoletov's law (the dependence of the phototok on the intensity of radiation) seems very natural: the greater the intensity, the greater the field amplitudein the wave. These larynx strongly affectedelectrons, and the value of the phototok is so katta. Classical theory, however, cannot explain the existence of a red boundary of the photoelectric effect and the maximum electronic speed depends solely on the frequency of radiation.

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