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HISTORY DEVELOPMENT OF NUCLEAR PHYSICS

Abstract. In this work we write a historical review about nuclear physics. The first time, radioactive radiation was recorded using a photographic plate. Radioactive radiation is divided into three parts. The beginning of research on radioactivity in Russia was associated with the name of an outstanding scientist.

Introduction

Nuclear physics was born in the late 19th century, when the French physicist Henri Becquerel in 1896 discovered a new phenomenon, later called radioactivity. In the preceding 1895, the physicist Rentren, conducting experiments with electric discharges in a vacuum, found that in the place where fast electrons hit the glass of the discharge tube, in addition to the Faint greenish glow observed by Plucker in 1859, some invisible radiation appears that can penetrate through thick layers of various substances and cause the illumination of the photographic plate. This penetrating radiation was called "x-rays" by the x-ray itself, and later it was called x-ray radiation. At about the same time, Henri Becquerel was studying fluorescence, the faint glow of certain materials that occurs when they are irradiated by a strong light source. After learning about the discovery of x-Rays, Becquerel decided to check whether x-rays also occur when fluorescence, which is very similar to the greenish glow of flex in the discharge tube. To this end, Becquerel took one of the most highly fluorescent substances uranium salt, put it on a black paper-wrapped photographic plate and exposed it all to the sun's rays. [1] Under the influence of solar radiation, the uranium salt strongly fluoresced. Therefore, after some time developing a photographic plate and finding a dark spot on it in the place where the uranium salt lay, Becquerel decided that the initial assumption was correct, i.e. that x-ray radiation occurs simultaneously with fluorescence. After preparing one of the following experiments, Becquerel placed a photographic plate wrapped in black paper, along with uranium salt, in the Cabinet.

The record was shown just in case. [1] And what was Becquerel's surprise when the uranium salt itself, without any fluorescence, emits some radiation similar in its properties to x-ray. Subsequently, Becquerel conducted a control experiment, replacing the uranium salt with metallic uranium. The appearance of a spot on the photographic plate in this case clearly indicated that the radiation was coming from the uranium itself, and the fluorescence of the salt had nothing to do with it. [1] Far-reaching conclusions followed from this discovery. Once something flies out of the uranium atoms, it means that the atoms themselves inevitably change, and if so, then the atoms have some internal structure and some pieces can break off from them. Looking ahead, we note that the new phenomenon discovered by Becquerel was later called radioactivity at the suggestion of Marie Curie, and the radiation that occurs at the same time is called radioactive radiation. [1] it is Worth noting that the radioactivity was discovered by accident. By chance, Becquerel chose the uranium salt from a large number of fluorescent substances for his experiments. By chance, due to bad weather, one of the plates prepared for the experiments remained ungraduated. By chance, this record was shown, although it should not have been done. Thus, as a result of coincidental events, the greatest discovery of modern times was made, the consequences of which significantly changed the living conditions of all mankind. Of course, it seems that sooner or later radioactivity would still be detected, but still this example makes us think about the role of chance in the development of science. Moreover, as we will see later, many other major discoveries were also made by accident. On the other hand, it is not accidental that such discoveries were made not by random people, but by large scientists who, with all their previous activities, were prepared to detect an unexpected phenomenon, not to pass by and give it a proper assessment. [1]

The first devices for recording radioactive radiation

As noted above, for the first time, radioactive radiation was recorded using a photographic plate. This method of registering particles is sometimes still used today, in particular, for dissymmetric measurements. However, it soon became clear that radioactive radiation can not only illuminate the photo emulsion, but also have other effects on the substance. For example, when alpha particles hit certain substances, there are flashes of light, although very weak, but still visible to the naked eye in complete darkness. For surveillance of such outbreaks, or as they are commonly called, scintillation, sir William Crookes invented a simple device [1,2,4].

First studies of radioactive radiation

It was quickly discovered that passing through a magnetic field, radioactive radiation is divided into three parts - one part of the radiation is deflected in one direction, the other - in the other, and the third part, without deviating goes straight. These three parts of the radioactive radiation were designated by the first three letters of the Greek alphabet-α, β, γ. In 1899, Rutherford Determined from the direction of deflection in the magnetic field that α-particles carry a positive charge, and β - particles carry a negative charge. And in 1900, Villard established that the third type of radiation, called gamma radiation, does not deviate in a magnetic field and is electrically neutral. In addition, a high penetrating power of this radiation was found: to reduce its intensity by half, a plate of lead with a thickness of about 1.25 cm was required. This far exceeded the penetrating power of x-rays, although the two types of radiation had much in common. Using gamma rays, it was also possible to see through closed objects and get photographic images of what was inside. [1,3] Further, with respect to the charge to mass ratio, it was found that β-particles are identical to previously discovered electrons. At the same time, the charge to mass ratio of α-particles turned out to be several thousand times less than that of electrons, and even two times less than that of hydrogen atoms. This circumstance led the author of the measurements Rutherford and his collaborator Soddy to the idea that α - particles are twice ionized helium atoms. As for gamma radiation, it is thousands or even millions of times less than that of visible light photons. [3]

Development of nuclear physics in Russia

The beginning of research on radioactivity in our country is associated with the name of an outstanding scientist, academician V. I. Vernadsky, who predicted a great future for nuclear energy in the 19th century. In 1911, Vernadsky initiated the creation of a Radiological laboratory, numerous expeditions and commissions. In this laboratory, V. G. khlyupin received the first preparations of domestic radium. In 1922, on the basis of the laboratory, Vernadsky created the radium Institute, which still exists today. In the 1920s, radiochemists of the radium Institute studied the chemistry of various radioactive substances, conducted research on the Geochemistry of radioactive elements, and developed methods for determining the age of rocks using nuclear methods. They identified the features of the distribution of uranium and thorium on the territory of our country, which later allowed us to organize their industrial production. Further studies of radioactivity were also carried out in Leningrad (A. F. Ioffe, I. V. Kurchatov, G. A. Gamov, etc.) and Kharkiv (A. M. Leipunsky, K. Sinelnikov, and A. V. khamov). Walter, L. Landau, and others) at physics and engineering institutes. [1] So, by the middle of the 19th century, the theory of the atom was basically built. [1,3,4]

Conclusion

At the end of the nineteenth century, while Becquerel was involved in a somewhat well-known luminous process at the time, it suddenly encountered a completely new phenomenon - radioactivity. She gave the researcher a gift, allowing him to look at the new, unexplored world of subatomic physics. Researchers who worked in this field in the 20th century discovered a completely different world, with its own laws, even different from the world's standard described by classical physics.

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PROFESSIONAL CAREER DEVELOPMENT OF SECURITY KNOWLEDGE IN THE NUCLEAR INDUSTRY

Abstract

A research on the Professional Career Development of Security Knowledge in the Nuclear Industry has been done. This was done by considering the motivational key factors that contribute to the establishment of the