

E.P. Cherenkova

Pavel Alekseevich Cherenkov conducted his historical studies of the blue glow in 1933-1940. Let me clarify some of its details.

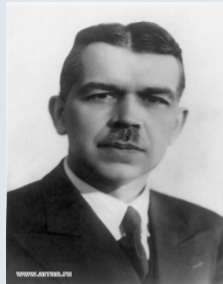
About the nascency of the theme

Research began when completing a candidate dissertation. Its leader was Academician Sergei Ivanovich Vavilov. What semantic connotation can you see in the words from the Russian scientific literature: "Vavilov immediately determined the importance of the topic and proposed the topic of the dissertation to Cherenkov" [1] ?

It is known that the topic of the work of Cherenkov "Investigation of electrons moving in matter with the superluminal speed" surfaced as a result of an unexpected discovery in his experiments on his candidate dissertation (or Ph.D.-1). In the course of experiments with γ -luminescence of solutions of uranyl salts, graduate student Cherenkov realized that there was a weak blue background, which, apparently, should be corrected. However, in previous works by Vavilov, when liquids were excited by ultraviolet radiation, a blue glow was also observed if the liquids were not sufficiently purified [2]. Sergei Ivanovich did not want to agree with the graduate student, suggesting that his observations depended on the fact that the liquids contained foreign impurities or that the dishes had not been washed thoroughly.



About the struggle for the cleanliness of dishes, L.V. Levshin, son of Vavilov's colleague V.L. Levshina, wrote: "Vavilov was convinced of the negligence of his ward, which one, despite of all the recommended measures, pure solvents continued to glow.



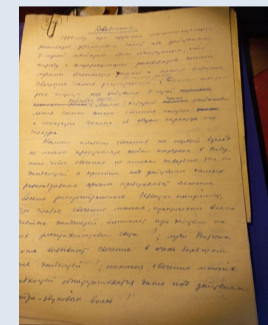
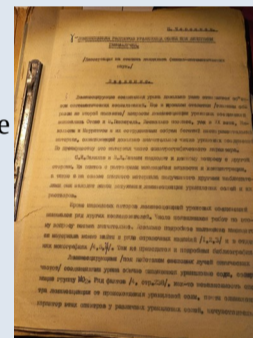
Vavilov became irritated and told Cherenkov that there would be no progress until he learnt to purify solvent properly [3]. Cherenkov, in spite of Vavilov's strict admonitions, did not want to give up his observations. He was convinced that he was right about the existence of the additional light. To resist the academician required firmness of mind and the character of a scientific experimenter.

In order to include the measurement of corrections for the additional radiation in the work on the luminescence, it was necessary for Vavilov to be convinced that the observed light was not due to the presence of foreign impurities in liquids, but had any another cause. Pavel Alekseevich later wrote that the full set of data obtained in his experiments made it possible to establish that the luminescence of a solvent and other pure liquids has an amazing constancy and universality [4] and, therefore, it exists as an independent physical phenomenon. When Sergei Ivanovich, although not immediately, but nevertheless convinced of the correctness of the student, he told the graduate student that the blue glow should be given the special attention later.

But the study of an luminescence began during Cherenkov's candidates work. Although it was devoted to the study of luminescence, its content already included a section "Visible gamma-luminescence of liquids" where he discussed the universal property of liquids discovered by him - the ability to glow under the action of γ -rays, which differs from the observations of S.I. Vavilov and L.A. Tumerman [2]. In the dissertation, for example, the discovered degree of polarization of the luminescence, the effect of temperature and the presence of solutions on its intensity, the spectrum and brightness were noted. This study became part of the first, candidat-Ph.D. thesis, because it was necessary to determine the corrections for the γ -glow.

About the Research Methodology

In the same work [1], it is reported that Vavilov proposed to Cherenkov not only the topic, but also the methodology of his doctoral dissertation. Let us clarify whether the method of observing a blue radiation was an innovation for Cherenkov in the study of the new glow he discovered. It was not brought in specifically for this work, but the natural use of the former - the one that was already used in his first - candidateral thesis, continued. Namely, the method of photometry by quenching with the help of an optical wedge, with which S.I. Vavilov and E.M. Brumberg worked with weak glows [5, 6]. The method was proposed by Vavilov in that earlier work - still at the stage of Cherenkov's postgraduate research, and it was well studied by the postgraduate student in his initial experiments.



Pages of dissertations by P.A. Cherenkov - candidate and doctoral

About the Authorship of the Experimental Discovery

It was said above that Cherenkov began the study of the blue glow as early at his postgraduate work on luminescence and then determined some of its properties. In the ongoing experiments, the human eye served as the most important instrument of observation. But it is a very complex tool.

Its peculiarity lies in the fact that, as Cherenkov writes, "... for one and the same person, the threshold value of energy, for an eye fully adapted to darkness, remains constant for quite a long time" [7]. At the same time, different places of the retina of the eye have different sensitivity to light [5]. But if the sensitivity of the retina of one person is different in its different places, then it becomes obvious that the sensitivity of the eye of different people is also not the same. Therefore, for the reliability of the results, they must be homogeneous, i.e. they must be carried out by the same person.

I note that for the objectification of observations in the research scheme, a certain condition was laid down. At the same time, since photometry by quenching is partly subjective, the important results of the experiments were verified by involving other persons in the observation. Such a check was precisely a part of the methodology, but not a revision of the possible errors of the author of the observations.

The character of Cherenkov as an experimenter dictated the reliability of the results. The clear organization of the experiment, the exactingness in conducting its initial studies were noted by N.L. Grigorov (at that time a laboratory assistant, later - Doctor of Physical and Mathematical Sciences): "Pavel Alekseevich prepared everything necessary for the upcoming measurements (he did not trust anyone with this preparation)" [8, 9]. Strictness and exactingness to accuracy in experiments, meticulous scrupulousness, were noted by many of his colleagues academicians A.M. Baldin and V.I. Gol'danskii, Doctors of Physical and Mathematical Sciences E.I. Tamm, I.V. Chuvilo, Yu.M. Ado [10]. These natural properties of Cherenkov's character became one of the reasons for his scientific success.

In conclusion, I would say that the Pavel Alekseevich highly appreciated the role of the Sergei Ivanovich Vavilov in his development as a scientist. This is a postgraduate science guide, science talks filled with a wealth of knowledge, thoughts and experience.

This is Vavilov's initial understanding of the need to study a new glow, his initiative to publish his work in major foreign journals.

Outside of Russia, the S.I. Vavilov figure does not look as big as it actually was in science. S.I. Vavilov was the founder of the Russian school of physical optics. The main topic of his scientific interests was luminescence. The results of his work in this area became the foundation of the modern theory of luminescence. Vavilov had an excellent organizational talent, headed the Academy of Sciences in 1945-1950. He was the initiator of the development of progressive scientific directions. At LPI, he organized a wide range of topics, closely followed the work, and came to LPI every day. Versatilely talented, he published, for example, works on philosophy, art history, popularization works. I note that, it must be added that SIV was a very benevolent, extremely efficient, disinterested and honest person. Everyone who knew him felt more charm of his personality. To all this, it must be added that seven Nobel laureates at the LPI are also the merit of Sergei Ivanovich.



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4. P.A. Cherenkov. Nucl. Instrum. Methods A 248 (1986) 3.

5. E.M. Brumberg, S.I. Vavilov. Izv. AN VII OMEN (7) (1933) 919.

6. E.M. Brumberg, S.I. Vavilov. Dokl.Ac.Nauk 3 (6) (1934) 405.

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