LEONID ALEKSANDROVICH KUBETSKIĬ

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LEONID ALEKSANDROVICH KUBETSKIĬ, well known scientist and inventor, dies on 22 September 1959 after a long illness.

His death was preceded by some three months by the 25th anniversary of his production of the first working model of a new photoelectric device — the photoelectric multiplier (FÉU), which was constructed in accordance with his invention.[1]

One cannot overestimate the significance of this invention and of its practical realization to the development of science and engineering at the present time, when photomultipliers are so extensively used and have become the indispensable research tool in nuclear physics, optics and astronomy, biology, medicine, agriculture, or chemistry and metallurgy, and are finding greater and greater technical application in the automatization of the control of manufacturing processes, in prospecting for useful minerals, etc. It must also be borne in mind that the method of secondary-electron amplification (multiplication) has in itself made possible direct registration of individual molecular, atomic, and nuclear particles (electron multipliers), and has found important applications in vacuum tubes.

Kubetskiĭ's invention, and particularly its practical realization, initiated a new stage in research on all phenomena connected or capable of being connected with the emission and absorption of light, placing in the hands of the researchers an electronic instrument of unsurpassed and in principle unsurpassable sensitivity, accuracy, and speed.

The full significance of photomultipliers was appreciated not immediately, but became evident only after it was shown[2] that in nuclear physics no other receiver can yield so much detailed information on the investigated processes as the photomultiplier. This new stage of development began in 1948, i.e., 14 years after the creation of the first photomultiplier.

But even in the first years, the potential possibilities of secondary-electron amplification (or the method of secondary-electron conversion, as Kubetskiĭ called it) attracted persistent attention by most perspicacious specialists. Great and constant attention to the work of Kubetskiĭ at the initial period (and up to his untimely death) was paid by Academician A. A. Chernyshev. The well known developer of the first electronic television system, Dr. V. K. Zvorykin, after becoming acquainted with Kubetskiĭ's work during his visits in the U.S.S.R. (1933 and 1934), also

valued its significance greatly. This is evidenced not only by the fact that in 1935 the RCA company produced the first American photomultipliers (which did not differ at all in construction and in control of the electron beam from the first "Kubetskiĭ tubes"), but by his direct participation in subsequent years in the development[3] of new designs of multiplying systems and dynode materials.

Leonid Aleksandrovich Kubetskiĭ was born on July 25, 1906 in Pushkin, Leningrad oblast' (formerly Tsarskoe Selo). The bent for scientific and technical creativity appeared already in his school years, and furthermore in the two subjects which were most attractive to the youth of those days, electricity (in the broad sense of the word) and aviation. He chose the former. It is known, for example, that he constructed an original and daring private telephone system, consisting of two sets (his own and that of a friend living two or three kilometers away) and of the wires of an overhead telegraph line passing by the two houses. This line worked in good order until some beautiful day the leads were discovered by a lineman. This episode can not be classed merely as a schoolboy's senseless prank, since it disclosed both a technical purposefulness and other traits that should be possessed by an inventor: the ability to find his own way, persistence, and accomplishment of purpose.

After finishing school with distinction, Kubetskiĭ entered the first year of the Leningrad State University, from which he transferred in 1925 to the Polytechnic Institute. During this period he made several inventions in the field of electrical engineering (new ways of converting direct current into alternating current, transformation of direct current), formulated in suitable claims, some of which were awarded inventor's certificates. While studying, Kubetskiĭ supported himself as an electric wireman.

Kubetskiĭ began his scientific work proper in 1928, under the leadership of Academician V. F. Mitkevich, and naturally, in the field of Electrical Engineering. He was attracted, however, by the latest branch of communication engineering, now called electronics, which (for the explorer of novelties) was full of an uncounted number of undiscovered, unclear, and therefore particularly attractive opportunities. It is enough to recall that hardly any of the numerous modern electronic devices existed in 1928, with the exception of amplifier and generator vacuum tubes and mercury rectifiers, while the simple potassium-hydride photocell or glow-discharge neon tube were still the product of high laboratory skill.

In 1929 Kubetskiĭ began his research on electronic vacuum devices at the Leningrad Physico-Technical Institute.[1] His first product was the development, in the same year, of a gas-discharge device with incandescent cathode and grid control,[4] which thus preceded somewhat the first reports of the American thyratrons.[5] In the same years he advanced many other suggestions, some in the form of inventor's claims. These include a "cascade secondary-electron device,"[1] a "cathode television transmitter,"[6] and an "optical microphone."[7] It must be noted, that the second of these suggestions represents the prototype of a television transmitter tube, described in 1934 by Farnsworth,[8] while the first gave rise to research on secondary-electron devices not only in the U.S.S.R. but in the entire world.

In many subsequent claims (1932–1934) Kubetskiĭ anticipated many multiplier-system designs developed later on both in the U.S.S.R. and abroad. Kubetskiĭ himself, however, remained true to his own photoelectronic multiplier (the Kubetskiĭ magnetic tube), and in 1935–1936 began to pay more and more attention to problems of practical application of multipliers.

This bent towards to utilitarianism is one of the reasons, although not the principal one, why the development of secondary-electron devices has slowed down in our country after its brilliant start. The main reason was that at that time practice did not demand of the photoelectric technology any of the specific and unique capabilities that are inherent in photomultipliers. With the exception of astronomy and spectroscopy, there was no need anywhere to measure or record exceedingly small light fluxes, since nowhere, including the television of those years, was there need for the speed of action afforded by the photomultiplier. Therefore attempts to employ the photomultiplier in such devices as photoelectric relays, sound-recording apparatus for motion pictures, or replacement of vacuum tubes in radio receivers did not go beyond showing the principal possibility of the corresponding applications. All these problems were solved more simply and more reliably with the aid of ordinary photocells and amplifying devices. This has contributed in a certain degree to a loss of interest in the entire problem as a whole. The American experience is also evidence of such a pause in the development of photomultipliers. In spite of the fact that regular production of photoelectronic multipliers began in the U.S.A. in 1935–1938, only a few general-purpose types were available up to 1947 or 1948, differing little from each other (RCA 931A, 1P21, 1P28); nothing is known regarding commercial production of photomultipliers in other countries. The breakthrough occurred only after it became necessary (for problems in nuclear physics) to make use of the essential feature of the photomultiplier, namely its low sensitivity threshold and high speed. As a result, whereas in the first fourteen years the number of photomultiplier types used to any significant extent could be counted on one's fingers, it has exceeded 150 in the next twelve years and continues to grow.

Kubetskiĭ's further work in the field of secondary-electron emission was aimed principally at the application of photomultipliers for measuring purposes. At the end of the thirties he proposed a null measurement method, which he called the "integral-balance" method, which made it possible to reduce the threshold of sensitivity of photomultipliers by several orders of magnitude, by reducing the noise due to fluctuations in the dark background. This method enabled him (1939) to detect for the first time the infrared radiation from the night sky.[9] He also proposed methods for super-contrast transformation of spectra and images, a super-contrast fine-structure analysis, and others.

Unfortunately, Kubetskiĭ's health, never too robust, failed greatly in the last years, particularly after a major operation which he underwent in 1948. This made it impossible for him to employ the full measure of his creative powers and did not permit him to complete many of the planned investigations.

The merits of Kubetskiĭ as a pioneer in secondary-electron emission were highly valued by the scientific community and by the government. He was awarded the Stalin prize for work in his field (in 1950).

Another award which Kubetskiĭ gained, one available only to creative workers, was to see the blossoming of new branches of scientific research and technology, the foundations for which he laid many years ago when, as a young man, he invented and demonstrated the practical feasibility of one of the most remarkable electronic devices, the photoelectric multiplier.

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[1] Inventor's Certificate No. 24040, Priority 1930.

[2] H. Kallman, Natur. Technik, July 1947.

[3] Zvorykin, Morton, and Molter, Proc. IRE **24**, 351 (1936).

[4] Inventor's Certificate No. 26762, Priority 1929.

[5] A. W. Hull, Gen. Electric Review **32**, 213 and 390 (1929).

[6] Inventor's Certificate No. 85196/5773, Priority 1931.

[7] Inventor's Certificate No. 21273, Priority 1931.

[8] P. T. Farnsworth, J. Frankl. Inst. **218**, 411 (1934).

[9] See, for example, I. A. Khvostikov, Usp. Fiz. Nauk **33**, No. 4, 572 (1947).

Translated by J. G. Adashko