

PERSONALIA

Vladimir Maksimovich Tuchkevich (on his seventieth birthday)

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Usp. Fiz. Nauk 115, 149-152 (January 1975)

Vladimir Maksimovich Tuchkevich celebrated his seventieth birthday on December 29, 1974. He was born into the family of a teacher in the village of Yanoutsy in Chernovtsy Oblast'. The Revolution found him in the Urals at Ufa. Here, though only 14 years old, he entered the Red Army as a volunteer. In 1924, after his discharge from the army, Tuchkevich enrolled in the Physico-mathematical Division of Kiev State University. Those studying with him here included A. P. Aleksandrov, N. P. Pisarenko, and others who would later become associated with the Physico-technical Institute at Leningrad. They all gathered in the Modern Physics Club organized by the Kiev physicist L. I. Kordysh, a Corresponding Member of the USSR Academy of Sciences. The activities of this club strongly influenced the molding of Tuchkevich's scientific interests.

Tuchkevich graduated from the university in 1928 and immediately went to work at the Ukrainian Metrological Institute; at the same time, on social principles, he took a job in the Physics Laboratory of the Kiev X-ray Institute of the Ukrainian People's Commissariat of Public Health. It was here that he began his research in X-ray physics and on the mechanism of electrical conductivity in solid dielectrics.

The First All-Union Congress of Physicists, which has come to be a well-known landmark in the history of Soviet physics, met at Odessa in the fall of 1930. The best physical minds in the country were represented here; its guests included famous Western scientists (it is sufficient to mention the names of Pauli, Sommerfeld, and Simon). The Kiev physicists, including Tuchkevich, delivered a series of papers. Tuchkevich reported his work on the effects of x-rays on electrical conductivity in dielectrics—a problem that had for many years interested A. F. Ioffe, who was present at that session and was attracted by the subject matter being studied at Kiev, since similar work was continuing at the institute that he headed. Ioffe, whose scientific and organizational activities were at their height, "noted and praised" all of these papers. He invited Aleksandro, D. N. Nasledov, Tuchkevich, and V. P. Sharavskii to come to the Physico-technical Institute (FTI) to continue them. At the time, however, Tuchkevich was unable to accept this flattering invitation, since he had signed for a three-year graduate fellowship that had started at Kiev and was to continue at Khar'kov. In that city, Tuchkevich headed an x-ray laboratory at the All-Ukraine Roentgenological Institute. He was engaged in the development of an objective method for dosing x-rays for therapeutic purposes. This led him to a study of photocells, which he continued into the early 1930's in its purely physical aspects. At the beginning of the 1930's Khar'kov had become one of the major centers of Soviet physics. Tuchkevich, who was not on the staff of the Ukrainian Physico-technical Institute, worked in K. D. Sinel'nikov's laboratory, participating enthusiastically in the sessions of the Khar'kov "Phystech"



seminars and building scientific bonds with his colleagues in Leningrad.

He moved to Leningrad early in 1935 to accept the duties of Chief of the Physics Laboratory at the Roentgen Institute and began to work at the FTI practically at once, again as a volunteer.

Tuchkevich began his research work at the FTI in the fall of 1936 in Ioffe's laboratory, to which the latter had invited him. The whole of Tuchkevich's subsequent activity is inseparably linked to the A. F. Ioffe Physico-technical Institute.

For nearly half a century, Tuchkevich's scientific interests centered on a single extremely broad and important field: that of semiconductor physics and its offshoots into electronics and power engineering. In essence, Tuchkevich was diverted only twice from this fundamental work.¹⁾ This first happened during the Second World War. He transferred his attention to defense work at its very outbreak. With Aleksandrov, B. A. Gaev, I. V. Kurchatov, and various other colleagues of the institute, he developed a degaussing system for ships to protect them from magnetic mines. His activity involved solution of a whole series of engineering, mathematical, and organizational problems, including the construction of a special station for determination of the magnetic fields of ships. Tuchkevich

was awarded a First Degree USSR State Prize in 1942, together with Aleksandrov, Gaev, Kurchatov, V. R. Regel', and P. G. Stepanov, for the work on protection of ships from mines. We stress that not a single ship protected by the Leningrad FTI system was blown up by a magnetic mine, either during the war or after it.

Tuchkevich set aside his prewar subject matter a second time to engage in the FTI's assigned task of solving the uranium problem. In 1947, he headed one of the subdivisions of the research being done on isotope separation. His work later served as the basis for his Doctorate thesis, which he defended in 1955 (L. A. Artsimovich served as one of the official opponents of this dissertation).

Tuchkevich obtained fundamentally important results in fields other than the physics of semiconductors and devices based on them. His research embraced problems of measurement technique, the technology of semiconductor materials, and semiconductor metallurgy. Later it also became concerned with pure hardware problems: germanium and silicon diodes and triodes, which were first developed in our country in the Laboratory headed by Tuchkevich, were tested there in electronic circuits and in the first solid-state receiver models.

This last project took form after Bardeen and Brattain's discovery of the transistor effect. As we know, this discovery aroused universal interest: an extraordinary future had opened up for electronics, and the technical revolution that the semiconductor devices brought with them into radioengineering, electronics, and power engineering may prove to be important on a scale commensurate with that of the liberation of atomic energy.

In 1949, Tuchkevich organized and headed a sector (in Prof. D. N. Nasledov's laboratory) that plunged immediately into its work. Special note should be taken of the fact that he had immediately recognized the promise of precisely the radioengineering aspect of the new trend. His views did not at once gain support in the institute, and he had to put forth no small effort to defend his position. That he had been right was demonstrated during the very first year after the start of the work: in 1950-1953, Tuchkevich's sector, working under his direct supervision, expanded its research on the generation and recombination of electrons and holes in germanium doped with various impurities, studied the positions of impurity levels, discovered interesting properties of gold-doped diodes, and investigated the behavior of electrons and holes in systems with several electron-hole transitions.

These studies led to the development of principles for the manufacture of germanium planar diodes and transistors, as well as photocells and photodiodes. Solar-energy converters were developed later in a study of the properties of silicon.

All of these researches were based on material that had also been acquired in the laboratory. Thus, the entire cycle of production of the devices was closed, except for acquisition of the starting raw materials. The complex technological problems involved in making the devices were solved simultaneously, and this contributed greatly to speed in setting up series production at the factories.

Thanks to the efforts of Tuchkevich at the FTI, B. M.

Vul at the Academy of Sciences Physics Institute, and S. G. Kalashnikov at the Institute of Radio Engineering, the staffs that they directed laid the foundations of a modern Soviet semiconductor industry.

Since the mid-1950's, Tuchkevich's laboratory (which had grown out of the sector that he directed in 1958) has chosen as one of the basic directions of its activity the development of semiconductor power-engineering devices—germanium and silicon rectifiers, the demand for which is so strong in various branches of industry and transportation. Along with its studies of the electrical properties of doped silicon single crystals and investigation of the diffusion processes that take place in them, Tuchkevich's laboratory began in the early 1960's to develop research on the properties of multilayer silicon structures with several p-n junctions. All of this led to the development of heavy-duty diffusion-type controllable rectifiers (thyristors) with exceptionally high technical specifications, and soon thereafter to uncontrolled and controlled avalanche rectifiers.

In 1966, the entire cycle of these important studies was recognized in the award of a Lenin Prize to Tuchkevich and his FTI colleagues—I. V. Grekhov, V. B. Shuman, and V. E. Chelnokov.

Tuchkevich's laboratory has done highly important work toward the development of semiconductor converters for transmission of high-voltage direct-current electric power. The devices and their operating principles were tested on experimental transmission lines from Kashira to Moscow and from Volgograd to the Donets coal basin, which operate on high-voltage semiconductor converters developed and built at the FTI in collaboration with the Institute of Direct Current and the "Elektrovypryamitel'" ("Rectifier") plant.

It must be stressed that the creation of this new trend—semiconductor power engineering (the first work with germanium in this field had been started in 1953) would have been impossible without study of the properties of large-area electron-hole junctions and the behavior of electrons and holes in germanium and silicon crystals with several p-n junctions. The long series of physical studies in this field has also made it possible to develop new types of electrical equipment (avalanche rectifiers, photothyristors, etc.) and to improve the parameters of those developed earlier.

In the early 1960's Tuchkevich actively supported and worked on the comprehensive development of the research that his laboratory had begun on hetero junctions in semiconductors. This research enabled our country to advance on a new path in the physics and engineering of semiconductors. It led to the development of a large new class of semiconductor and quantum-electronics devices, in whose development, as in the case of the thyristors, the FTI moved ahead of the leading foreign research centers and companies. In 1972, Zh. I. Alferov, V. M. Andreev, D. Z. Garbuzov, V. I. Korol'kov, and D. N. Tret'yakov were awarded a Lenin Prize for the work on hetero junctions—in a rare case in which such high recognition and esteem have been accorded to two fundamental studies coming out of the same laboratory in comparatively close succession.

After these many years of work, Tuchkevich is rightly regarded as the founder of Soviet semiconductor power engineering—a new industrial branch that has grown out of the research and development done in his laboratory.

The building of a series of large plants to manufacture semiconductor devices and the development of the corresponding research in the branch institutes took place under his day-to-day supervision and were due in many respects to new scientific and technical ideas that he advanced. Most of the managers of these organizations were his students or students of his students.

Tuchkevich works in the area of physics in which the results obtained in the research process could, in principle, be announced as the end of the corresponding (as they say, purely academic) stage of the investigation, without necessarily providing for subsequent practical application. But Tuchkevich's technical "bent", organizational talent, and understanding of the specifics and needs of production have provided a link to industry for the projects that he guided and continues to guide.

Practically immediately after completing his university studies, Tuchkevich began not only his scientific career, but teaching activity as well—first at Kiev and Khar'kov, and later also at Leningrad, in the Physico-mechanical Faculty of the Kalinin Polytechnic Institute (in the General Physics Department, which was headed at the time by Ioffe). As early as in the 1930's, he had written and published two books on optics and electronics on the basis of this activity (one of them jointly with Nasledov). He gave up his professorship at the LPI in 1960, but not his ties to that institute of higher learning. Just recently, the base of an optoelectronics department of the Ul'yanov-Lenin Leningrad Electrical Engineering Institute was created in the LPI at his initiative; the new development was supported and cosponsored by departments of the Kalinin Polytechnic Institute.

Tuchkevich has a knack for selecting talented young people and interesting them in the work, preparing them quickly for independent study, and promoting their advancement. It is no accident that the Semiconductor Devices Laboratory that he heads at the FTI has become a veritable forge for cadre of the highest qualification, or that many of his students have become famous and are directing research in new fields.

For many years, Tuchkevich has been associated with the work of our leading physics journals. He has been deputy to the Editor-in-Chief (A. F. Ioffe) of the *Zhurnal Tekhnicheskoi Fiziki* [Sov. Phys.-Tech. Phys.] and *Fizika Tverdogo Tela* [Sov. Phys.-Solid State], and now heads the editorial staff of the former.

Along with his many-sided activities, Academician Tuchkevich has done much work far beyond the confines of his laboratory. First of all, he has been head of the A. F. Ioffe Physico-technical Institute for seven years now. In this high position he has exhibited the superior qualities of a Soviet scientific organizer of coordinated research. Both the research that is traditional for the FTI and new trends, e.g., those embarked upon at the initiative of B. P. Konstantinov, enjoy his active support. A number of FTI laboratories are working on projects suggested by him and are coordinated by him personally. A new initiative or a fresh idea invariably receives his enthusiastic backing.

The USSR Academy of Sciences elected Tuchkevich a Corresponding Member in 1968 and a full member in 1970. He is currently a member of the Presidium of the USSR Academy of Sciences and the Presidium's Plenipotentiary for Leningrad, so that large groups of scientists working in the Leningrad academic institutes have come into his sphere of influence. He is Chairman of the Scientific Council on Semiconductor Converter Technique of the Committee on Science and Engineering of the USSR Council of Ministers.

Since 1970, Tuchkevich has been a member of the Leningrad Metropolitan and then of the Oblast' Committee of the Soviet Communist Party.

Tuchkevich's work is held in high esteem by the Soviet government. He has been awarded the Orders of Lenin and of the Red Banner of Labor and numerous medals, and holds the titles of State (1942) and Lenin (1966) Prize Laureate and Honored Scientific and Technical Worker of the RSFSR.

In the name of his associates at the Physico-technical Institute, his colleagues in the Academy, and his numerous students, we send Vladimir Maksimovich Tuchkevich hearty congratulations on his banner seventieth birthday and wish him sturdy good health and further productive work for the benefit of our Motherland.

¹⁾Tuchkevich's first publication was devoted to a method that he developed for checking the accuracy of clockwork mechanisms (1928). This paper came out of his work at the Ukrainian Metrological Institute at Kiev.

Translated by R. W. Bowers