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**ACADEMICIAN OF THE NATIONAL  
ACADEMY OF SCIENCES OF UKRAINE  
MARAT TEREITYOVYCH SHPAK**  
To the 100th anniversary of his birth



This year, the outstanding Ukrainian scientist, a recognized expert in the fields of solid-state physics, quantum electronics, and molecular crystal spectroscopy, a twice laureate of the State Prize of Ukraine, an Honored Worker of Science and Technology, and Academician Marat Terentiyovych Shpak would have been 100 years old.

The entire scientific activity of M.T. Shpak was connected with the Institute of Physics of the NAS of Ukraine, where he advanced from a graduate student to the director of the Institute, which he headed for 17 years (1970–1987). During this period, several key scientific and organizational initiatives were un-

dertaken at the Institute, significantly enhancing the efficiency of fundamental research and expediting the implementation of applied developments. The capital construction of a new technological and laboratory building for the Special Construction-Technological Department was organized and carried out. Among the applied developments of the Institute at that time, the main place was occupied by various devices and technical tools for scientific and special technologies, elements and products of infrared technology, cryogenic and cryosurgical equipment, lasers with tunable generation frequency, *etc.*

Thermal radiation detectors, developed at the Institute and manufactured at the Special Construction-Technological Department, were successfully applied and operated in research equipment and various complexes on interplanetary automatic stations of the Mars and Venus types, as well as on the meteorological satellites of the Meteor series.

In the field of IR instrument, the Institute of Physics successfully implemented a number of joint scientific and technical programs with such leading organizations of the former USSR in the field of space technology at that time as the Institute of Space Research of the Academy of Sciences of the USSR, the S.I. Vavilov State Optical Institute, the scientific and production associations “Geophysics” and “Astrophysics”, and others. The Institute’s achievements in this field were awarded two State Prizes of Ukraine (in 1984 and 1986).

The results and achievements of the Institute of Physics in the field of the development and implementation of multi-purpose cryosurgical instruments into medical practice (the State Prize of Ukraine in 1977) and unique cryostat systems with adjustable temperature in an interval of 4.2–300 K, which were

supplied to scientific centers of Ukraine and other republics of the former USSR, as well as to the Comecon countries, are widely known.

Large-scale comprehensive research in the field of quantum electronics was carried out at the Institute of Physics, and a complex of lasers of various types with tunable generation frequencies was created for scientific purposes (the State Prize of Ukraine in 1974).

During the directorship of M.T. Shpak, the Institute's employees were awarded the State Prize of the former USSR, nine State Prizes of Ukraine, the Lenin Komsomol Prize, and two Republican Komsomol Prizes named after M. Ostrovsky. Three discoveries made by the Institute's employees in previous years were registered. The total number of employees increased from 415 to 650, with the number of doctors of sciences increasing from 10 to 37 and the number of candidates of sciences from 45 to 158. About 40 monographs were published. The production of liquid helium increased more than threefold. In 1979, for achievements in the field of fundamental research, training of scientific personnel, and in honor of the 50th anniversary of its foundation, the Institute of Physics was awarded the Order of the Red Banner of Labor.

In order to accelerate the practical implementation of the results of fundamental holographic research, a laboratory of applied holography was organized at the Institute of Physics in 1980 (together with the Ministry of Culture of the Ukrainian SSR); its activity was carried out in creative cooperation with the State Historical Museum of Ukraine and within the UNESCO program "Culture and Future". As a result, based on the technology developed at the Institute, a large number of high-quality holograms of historical relics and unique cultural heritage objects of Ukrainian culture were made. They were repeatedly and widely demonstrated at many exhibitions in various cities of Ukraine, as well as abroad (Great Britain, Austria, Argentina, Cuba, France, Poland, Finland, and others), and received high international recognition.

In the field of fundamental holographic research, under the guidance of M.T. Shpak, the physical basis of correlation-statistical methods for correcting laser radiation and forming desired macroscopic characteristics of laser beams was developed, which is important for problems in optical interferometry, fiber-

optic communication lines, image processing, *etc.* Nowadays, those studies are successfully continued and, in the context of new tasks in holography, have prospects for further development.

The period of intensive scientific development at the Institute in the 1960s and 1970s was to some extent a result of the efforts made by Marat Terentiyovych's predecessors in this position, as well as the intellectual and scientific contribution of the previous generation of scientists, including such prominent scientists and organizers of science, founders of scientific schools and research directions as P.G. Borzyak, O.S. Davydov, N.M. Morgulis, and A.F. Prykhot'ko.

M.T. Shpak was born on April 13, 1926, in the Sumy region into a family of civil servants. He began his studies at school in the fall of 1933 and finished them with a Certificate of Merit in 1943 in the city of Balakhna (the Gorkii region, Russia), where he was evacuated at the beginning of the war. In 1944, after entering the Gorkii Civil Engineering Institute and successfully completing the first year, he was transferred to the Kyiv Civil Engineering Institute, but almost immediately was drafted into the Red Army. He served in the radio engineering and communications units of the Baltic Navy. In 1946, after demobilization, he came to Chernivtsi, where his parents lived at that time, and entered the Faculty of Physics and Mathematics of Chernivtsi University. After graduation, he was retained at the Department of Experimental Physics and worked as an assistant during 1951–1952.

In 1952, M.T. Shpak entered the postgraduate course at the Institute of Physics of the Academy of Sciences of the Ukrainian SSR in Kyiv, where he began working in the 6th department under the supervision of Academician A.F. Prykhot'ko.

In 1956, M.T. Shpak defended his candidate's thesis "Spectral studies in a series of polycyclic hydrocarbons", and in 1965, his doctoral thesis "Experimental study of the luminescence of molecular crystals". He was a junior researcher in 1956–1958, the scientific secretary of the institute in 1958–1962, and a senior researcher in 1962–1965. From 1965 to 1970, M.T. Shpak performed the duties of the first deputy director of the Institute. In 1966, he headed the Department of Photoactivity and remained in this position until 1993.

The scientific, managerial, and public activity of M.T. Shpak gained high recognition from the state

and the scientific community. In 1968, M.T. Shpak was awarded the academic title of Professor, and in 1986, the title Honored Scientist of the Ukrainian SSR. In 1969, he was elected a corresponding member of the Academy of Sciences of the Ukrainian SSR in the specialty "Optics and Spectroscopy", and in 1990, he was elected a full member of the Academy of Sciences of the Ukrainian SSR in the specialty "Experimental Physics". M.T. Shpak was twice awarded the State Prize of the Ukrainian SSR. In 1976, M.T. Shpak was awarded the Order of the Red Banner of Labor.

The fundamental research of M.T. Shpak and his numerous disciples made a significant contribution to the development of such scientific areas as solid-state physics, low-temperature condensed-state spectroscopy, quantum electronics, laser spectroscopy, nonlinear optics, and holography. One of the significant achievements in solid-state physics was the cycle of pioneering works by M.T. Shpak devoted to the study of the luminescence of molecular crystals, carried out in the early 1960s. He was the first to discover the excitonic luminescence of molecular crystals, which allowed a detailed mechanism to be proposed for both pure crystals and those containing various kinds of impurities and defects, and allowed the role of excitons in the processes of energy transfer and radiation to be elucidated. Those studies made it possible to establish the nature of the spectra that were previously mistakenly associated with transitions between the intrinsic energy states of crystals. The authority of Marat Terentiyovych and the importance of his scientific results in the field of the physics of excitons in molecular crystals became generally recognized by the scientific community, both in Ukraine and abroad.

In the mid-1960s, M.T. Shpak began to actively work in the fields of quantum electronics and laser spectroscopy. Under his leadership, comprehensive pioneering studies of the nonlinear optical characteristics of solutions were carried out for a wide class of organic dyes, which made it possible to develop the physical foundations of radiation frequency control and create a series of lasers with tunable frequency. In 1974, for the corresponding cycle of works, M.T. Shpak, together with a group of other scientists from the Institute of Physics of the Academy of Sciences of the Ukrainian SSR, was awarded the State Prize of the Ukrainian SSR. In 1986, M.T. Shpak

became a laureate of the State Prize of the Ukrainian SSR for the second time for the research and development of the methods and equipment for non-destructive defectoscopy and their application in microelectronics and space technology.

A number of other important results in the field of quantum electronics were obtained in the Department of Photoactivity headed by Marat Terentiyovych. Light generation by dye-activated liquid crystals was obtained for the first time, a laser with distributed feedback based on an impurity liquid crystal was created, and the temperature tuning of its generation frequency was performed. A number of new nonlinear optical phenomena were discovered and studied: superluminescence of solutions of organic dyes, stimulated Raman scattering with negative absorption, radiative transitions from high excited states of complex organic molecules, *etc.*

In the early 1970s, on the initiative of M.T. Shpak, the studies of the physical properties of ring gas lasers with nonlinearly absorbing media were started at the Department of Photoactivity of the Institute of Physics. On the basis of those studies, highly frequency-stable lasers with unique parameters were developed and created. Lasers of this series were repeatedly awarded diplomas and gold medals of the VDNH of the USSR and recommended by the State Standard as secondary frequency standards (the State Prize of Ukraine in 1998 and the Lenin Komsomol Prize in 1972).

In 1986, on the basis of a scientific group under the supervision of Dr. Sc. in Physics and Mathematics M.V. Danilyko at the Department of Photoactivity, a laboratory of laser spectroscopy was founded. Later, in 2006, owing to the extensive development of research in this area, two new scientific divisions were created: the Department of Coherent and Quantum Optics under the supervision of Academician L.P. Yatsenko and the Department of Laser Spectroscopy under the supervision of the Corresponding Member of the National Academy of Sciences of Ukraine A.M. Negriyko.

The results of M.T. Shpak's fundamental research were published in more than 300 works and three monographs:

- E.A. Tikhonov, M.T. Shpak. Nonlinear Optical Phenomena in Organic Compounds (Naukova Dumka, Kyiv, 1979). 383 pp.;

• N.I. Ostapenko, V.I. Sugakov, M.T. Shpak. Spectroscopy of Defects in Organic Crystals (Naukova Dumka, Kyiv, 1988), 184 pp.;

• N.I. Ostapenko, V.I. Sugakov, M.T. Shpak. Spectroscopy of Defects in Organic Crystals (Kluwer Acad. Publishers, Dordrecht, 1993), 210 pp.

M.T. Shpak had trained a large group of highly qualified specialists in modern physics. Among his students and disciples, there are about 10 doctors and more than 30 candidates in physics and mathematics. Many of them successfully work at scientific institutions and universities in Ukraine and other countries.

M.T. Shpak successfully combined scientific work with managerial and public activity. For many years, he was the chairman of the Scientific Council of the Academy of Sciences of the Ukrainian SSR on the problem “Quantum Electronics”, a member of the Scientific Council of the Academy of Sciences of the USSR on “Luminescence and its Development and Application in the National Economy”, a member of the Presidium of the Republican Board of the Znan-nya (Knowledge) Union, and served as the deputy editor-in-chief of the “Ukrainian Physical Journal”, *etc.* With his idea and constant support, the Republican school-seminar “Spectroscopy of Molecules and Crystals” was founded, which later became international. For many years, M.T. Shpak headed the organizing committee of this school, which is still held every two years. From 1973 to 2025, 26 such forums were held in various towns of Ukraine.

Marat Terentiyovych was a great optimist; he loved to joke, knew many interesting stories, and skillfully told them. A broad erudition and a subtle sense of humor allowed him to be an unsurpassed leader in any company and under any circumstances.

We – the colleagues, disciples, and friends of Marat Terentiyovych – will always remember him as a won-

derful, benevolent person, an extraordinary personality, who organically combined great intelligence and encyclopedic knowledge with high moral and ethical qualities.

M.T. Shpak was a widely educated and knowledgeable person, a talented scientific leader. He was interested in the cultural and historical heritage of Ukraine, knew well the history and architecture of Kyiv, and was familiar with the latest novelties in literature. For the 50th anniversary of the foundation of the Institute of Physics, on his initiative and with his energetic support, an original monumental and decorative mural “Illuminated with Light” was made on the inner side of the dome of the main building of the Institute. This is a kind of a group portrait of giant, world-class figures in science, which depicts the history of the formation and development of physics from antiquity to the present. The mural was made by the People’s Artist of Ukraine, a member of the Academy of Arts of Ukraine M.A. Storozhenko. A valuable practical contribution to the implementation of this unique artistic project was made by Dr.Sc. in Physics and Mathematics O.A. Goncharov; owing to his efforts and energy, many problems of both organizational and creative origins were solved on the thorny path from idea to implementation. This magnificent work of art has become the pride of the Institute of Physics and its integral part.

We are proud of both the scientific achievements of our predecessors and the modern achievements of the Institute of Physics.

*M.V. BONDAR, T.A. GAVRYLKO,  
D. DOROHAI, M.D. CURMEI,  
V.I. MELNYK, A.M. NEGRIYKO,  
N.I. OSTAPENKO, S.M. RYABCHENKO,  
T.M. SMIRNOVA*