



**Mykhailo Brodyn**

## ACADEMICIAN MYKHAILO SEMENOVYCH BRODYN (TO THE 80-TH ANNIVERSARY OF HIS BIRTHDAY)

On September 30, 2011, Mykhailo Semenovich Brodyn – the outstanding scientist in solid state physics, nonlinear optics, and quantum electronics, laureate of the Lenin and State Prizes of the USSR, the UkrSSR, and Ukraine, the Honored worker in science and engineering of Ukraine, Academician of the NAS of Ukraine, the Honorary director of the Institute of Physics of the NAS of Ukraine, the Head of the Nonlinear Optics Department at this institute, the Editor-in-Chief and the editorial board member of the Ukrainian Journal of Physics for many years – was 80 years of age.

M.S. Brodyn was born in the village of Sivka (the Voinyliv district of the Stanislav region – nowadays the Kalush district of the Ivano-Frankivsk region) in the peasant family. After leaving the secondary school with a silver medal at the town of Burshtyn in 1948, he entered the physics branch at the Faculty of Physics and Mathematics of I. Franko Lviv State University. After graduating from the university with distinction, M.S. Brodyn was recommended by the Academic council and directed to the postgraduate study for the further education. In November 1953, he became the postgraduate student at the Department of Crystal Physics of the Institute of Physics of the AS of the UkrSSR. His scientific adviser was Corresponding member (later, Academician) of the AS of the UkrSSR A.F. Prikhotko. All further scientific and labor activity of M.S. Brodyn has been connected with the Institute of Physics of the NAS of Ukraine, where he has come a way from a postgraduate student to Academician, the Director of the Institute, the outstanding scientist, whose name is widely known to experts in our country and abroad.

The first serious success in M.S. Brodyn's scientific activity achieved under the direction of his scientific adviser, Academician A.F. Prikhotko, was associated with the researches of the optical properties of molecular crystals. More specifically, the investigations dealt with the domain of exciton states, the existence of which had been experimentally confirmed for the first time at the Institute of Physics. Owing to M.S. Brodyn's experimental skill, high-precision low-temperature techniques had been developed, which allowed fine effects in light absorption and dispersion in the vicinity of exciton resonances to be revealed and their nature to be deter-

mined. He executed the pioneer researches that evidenced the importance of the effects of spatial dispersion of the dielectric permittivity for strong dipole-active exciton transitions. He studied the influence of the effects of band non-analyticity, the manifestations of polariton effects in the formation of the structure of luminescence and resonance Raman scattering spectra, the existence of surface excitons in anthracene crystals, and so forth. Those researches were carried out in collaboration with such outstanding theoreticians as Academicians S.I. Pekar and O.S. Davydov.

In 1966, for a cycle of works devoted to the study of excitons in crystals, M.S. Brodyn, among other scientists, was awarded the Lenin Prize, the highest and the most prestigious scientific award in the USSR at that time.

Later, the scope of scientific interests of M.S. Brodyn had determined the versatility of his research activity. In the mid-sixties, just after lasers had been invented and after a successful defense of his thesis for the doctoral degree at the age of 29, Mykhailo Semenovich started an active work in a new at that time direction of physics, quantum electronics and nonlinear optics. In 1965, there was created a laboratory at the Institute of Physics of the AS of the UkrSSR and, some later, the Department of Nonlinear Optics headed by M.S. Brodyn. Already in the first years of the functioning of the department, the eager activity of M.S. Brodyn and his collaborators in this branch of science was marked by such sound achievements as the creation of lasers based on homogeneous mixed  $A_2B_6$  semiconductors, which allowed the modification of the radiation spectrum in the whole visible and near ultra-violet spectral range to be controlled. Those works won recognition, and the participants were awarded the State Prize of the UkrSSR in 1974. Sound results were also obtained in studying the effects of exciton–exciton interaction, which favor the emergence of new channels for induced radiation emission in direct-band-gap semiconductors.

A substantial scientific contribution was made by M.S. Brodyn and his disciples to the study of fundamental problems in nonlinear optics and dynamic holography. In particular, a new form of the self-influence of light beams, namely, their self-deflection with an asym-

metric intensity profile at the propagation in solid-state nonlinear media, was revealed for the first time with his participation. On the basis of the researches devoted to the nonlinear refraction in wide-band-gap semiconductors, the criteria for recording scalar and vector dynamic holograms at the highest recording rate and with a high efficiency were determined. In 1982, for a cycle of fundamental works in the field of dynamic holography and nonlinear optics, M.S. Brodyn and other collaborators from the Institute of Physics were awarded the State Prize of the USSR.

In 1990, a new direction in scientific researches, laser photoacoustic spectroscopy of materials for electronic facilities, headed by M.S. Brodyn was started. A significant progress attained in this direction brought about a number of important scientific results and led to the creation of a unique diagnostic complex, the laser thermal-wave introscope. In 1994, for a cycle of works in this domain of science, M.S. Brodyn, as well as other participants, was awarded the State Prize of Ukraine in science and engineering.

In the recent years, M.S. Brodyn and his collaborators have been successfully carrying out the researches in nanophysics and nanoelectronics. Their efforts are concentrated on studying the spectral and nonlinear optical properties of nanostructures on the basis of semiconductors and precious metals. The following results can be distinguished among the most important ones obtained in this domain. A giant (by some orders of magnitude) increase of cubic nonlinearity was experimentally revealed for gold nanoparticles, which takes place owing to an enhancement of the local field in a vicinity of the surface plasma resonance and to the contribution made by hot electrons. The "giant" cubic nonlinearity was also discovered in porous films made up of titanium dioxide nanoparticles; this nonlinearity exceeds the corresponding value for the bulk material by six orders of magnitude. The crucial role in the formation of such a nonlinearity was shown to be played by the resonance excitation of defect states formed by oxygen vacancies, with the latter behaving as photo-stimulated active centers located on the nanoparticle surface.

M.S. Brodyn is the author of over 380 scientific works, including five monographies, which were published both in our country and abroad. He has created the authoritative school of scientists, who fruitfully work in the domains of nonlinear optics, laser physics, and solid state physics. Among his disciples, there is one Corresponding member of the NAS of Ukraine, 8 doctors of science, and more than 40 Ph.Ds. M.S. Brodyn is actively lecturing. He heads the Department of Quantum Elec-

tronics, Nonlinear Optics and Holography at the Scientific and Educational Center of the NAS of Ukraine. He was the Professor at the Department of Instrument-Making Industry at the National Technical University of Ukraine "Kyiv Polytechnic Institute". Mykhailo Semenovych also lectured at the Kyiv and Lviv National Universities. In 2000, for his fruitful activity in training the young scientists-physicists, the Academic council of the Lviv National University conferred M.S. Brodyn the rank of "Honorary Doctor of the I. Franko Lviv National University". He is also the Honorary Doctor of the Vasil Stefanyk Precarpathian National University and the Honorary Professor of the Taras Shevchenko Cherniv National University.

M.S. Brodyn directs much of his efforts to the science management. Since 1965 and till now, he has been a permanent Head of the Department of Nonlinear Optics, which had been created by Mykhailo Semenovych's initiative. From 1987 to 2006, M.S. Brodyn was the Director of the Institute of Physics of the NAS of Ukraine (now, he is the Honorary Director of the same institute) and, from 1989 to 1998, the Academician-Secretary of the Division of Physics and Astronomy of the NAS of Ukraine, a member of the Presidium of the NAS of Ukraine. Mykhailo Semenovych preserved and developed the best traditions of the Institute of Physics, one of the oldest physics-oriented scientific institutions in Ukraine. When he was the Director, researches in new scientific directions have been started at the institute, such as the physics of liquid crystals, the physics of biological systems, nanophysics. Today, works in the fields of laser physics and nonlinear optics, solid state physics, physical electronics, and surface science are carried out at the world level. The high level of investigations that are executed at the institute is corroborated by the grants obtained from various international scientific funds; by the number of those grants, the institute is among the leading institutions of the National Academy of Sciences of Ukraine. M.S. Brodyn is the head of the Scientific council of the NAS of Ukraine on quantum electronics, as well as a member of several other scientific councils of the NAS of Ukraine and the Russian Academy of Sciences. For a number of years, he had been the Editor-in-Chief of the Ukrainian Journal of Physics and the member of the editorial boards of well-known international journals, such as "Quantum Electronics", "Materials Science", "Semiconductors Physics, Quantum and Optoelectronics", and the "Ukrainian Journal of Physical Optics".

M.S. Brodyn's scientific and scientific-management activity has been widely recognized. Besides the State

Prizes indicated above, he was awarded the K.D. Sinelnikov prize of the NAS of Ukraine. In 1982, M.S. Brodyn was elected the full member (Academician) of the NAS of Ukraine in the speciality "Solid state physics, spectroscopy, and optoelectronics". In 1992, he was conferred the rank of the "Honored worker in science and engineering of Ukraine". M.S. Brodyn was awarded high government rewards: the medal "For Valorous Labor" (1970), the order "The Sign on Honor" (1981), the "October Revolution" order (1986), the orders "For merits" of the 3-rd (1999) and the 2-nd (2008) degree. He was also awarded the sign of the D.S. Rozhdestvenskiy Optical society, namely, the S.I. Vavilov medal (2000). In 2009, M.S. Brodyn was awarded the Honorary diploma of the Verkhovna Rada (the Supreme Council) of Ukraine.

M.S. Brodyn is a person of rare professional and intellectual qualities. He combines the exactingness in sci-

entific and management activity with the cordiality and the benevolence in his relations with colleagues and companions. He will always come to help, if anybody of them needs his assistance.

M.S. Brodyn meets his 80-th anniversary full of the creative power. He continues to work fruitfully for the development of the domestic science. The scientific community sincerely congratulate Mykhailo Semenovich on his anniversary and wish him the sound health and the inspiration for further creative achievements.

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#### Greeting adress:

Mikhail Brodyn,

on the occasion of your 80th birthday I am sending my warmest congratulations and best wishes for health and strength for the years to come.

I still have very good memories on our long lasting scientific cooperation in particular together with the late Sergey Shevel. I have always been impressed by your broad scientific background and excellence. I further have highest appreciation for your wise and competent leadership of the Institute of Physics of the National Academy of Sciences of the Ukraine. You have successfully led the institute through difficult times.

I am glad and honored to call you as one of my scientific and personal friends.

Best wishes



Prof. Dr. Ernst Göbel  
President  
Physikalisch-Technische Bundesanstalt  
Braunschweig and Berlin