
UKRAINIAN PHYSICISTS SEARCH FOR THE ANSWERS TO THE PRESENT-DAY CHALLENGES (to the Jubilee Conference of the Ukrainian Physical Society – 2011)

The Ukrainian Physical Society (UPS) became one of the first public scientific associations that arose on the tide of democratic changes at the beginning of the 1990s following the initiatives “from below” rather than executing the instructions “from above”. On February 18, 2011, a jubilee conference UPS–2011 was held in the main lecture-hall of the Faculty of Physics at the Taras Shevchenko National University of Kyiv. The conference was devoted to the 20th anniversary of the UPS, the 40th anniversary of the European Physical Society (EPS), and the centenary of the superconductivity phenomenon discovery.

More than 100 physicists – lecturers, students, and scientists – from various cities of Ukraine took part in the conference. One of the outstanding physicists in the 20th century, Academician V.G. Bar'yakhtar, who was the first President of the UPS at the beginning of 1990s, attended the conference as a guest of honor and an active participant. Among the conference attendees, there were the Vice-President of the National Academy of Sciences of Ukraine, Academician V.G. Naumovets, the Vice-Chancellor of the Taras Shevchenko National University of Kyiv V.I. Grygoruk, the Deans of the Faculties of Physics and Radiophysics of this University, as well as many other guests. The President of the EPS, Prof. M. Kolvas (Poland) also arrived at the conference (Fig. 1), which added an international character to the meeting of Ukrainian physicists. Before the conference opening, the President of the EPS was received at the Presidium of the National Academy of Sciences of Ukraine, where he had an important talk with the Chief Academic Secretary, Academician A.G. Zagorodny and the Academician Secretary of the Division of Physics and Astronomy, Academician V.M. Loktev concerning the development of mutual contacts.

In his opening statement, the present President of the UPS V.G. Litovchenko emphasized that, for last two

decades, the UPS has been carrying out an important work aimed at executing its constitutional tasks – the propagation of physical knowledge and the development of physical researches in Ukraine. Under the initiative and with the assistance of UPS, a number of authoritative international and domestic scientific forums were held, including the representative congress “Physics in Ukraine”, which became a unique platform for the dialogue among the representatives from various branches of physical science.

The UPS activity aimed at strengthening the international authority of Ukrainian physics resulted in a recognition of leading national scientific editions in physics – “Ukrainian Journal of Physics”, “Journal of Condensed Matter Physics”, and “Journal of Physical Researches” – by the EPS. On the UPS initiative, the EPS executive committee held its meeting in Kyiv, which enabled the leading physicists of the continent to see with their own eyes the work of leading Ukrainian scientific and higher education institutions of physical specialization and to get convinced that the physical science in Ukraine has long traditions and a considerable potential for its further development.

An important direction of UPS activity is the improvement of the physical education level. It was after the appeal of the Society (the Memorandum on the state natural science education in Ukraine, as well as a series of UPS publications in the central press) that the previous Minister of Education and Science of Ukraine I.O. Vakarchuk held an All-Ukrainian conference on the problems of physics teaching. As a result, the number of lessons for studying physics in the senior school was increased. Unfortunately, after the governing body of the Ministry had been changed, those positive steps were substantially nullified.

The participants of the session – the first President of the UPS V.G. Bar'yakhtar, the first chairman of Co-



Fig. 1. Presidium of the Jubilee Conference: Acad. L.A. Bulavin, Acad. V.G. Bar'yakhtar, Corr. Mem. V.G. Litovchenko, Prof. M. Kolvas, Acad. Ya.S. Yatskiv, Acad. A.G. Naumovets, Corr. Mem. S.M. Ryabchenko, Prof. V.V. Il'chenko



Fig. 2. Members of the Ukrainian youth group of the UPS program Young Minds. From left to right: V. Sontsev, Yu. Naseka, M. Kolvas, A. Luchenko, V. Naseka

ordination Board O.V. Slobodyanyuk, the President of the UPS in the late 1990s S.M. Ryabchenko – recalled important events in the society history. In the early years of its activity, the UPS, having established working contacts with the American Physical Society, managed to involve considerable means for grants, for the acquisition of scientific literature, office equipment, and so forth. Such an activity helped the Ukrainian science to survive under the hard crisis in the 1990s. At that time, the UPS organized the publication and the prop-

agation of the bulletin “The Physical Courier”. Some later, the EPS became the major international partner of the UPS. Useful links with Ukrainian scientific public organizations were also established, in particular, with the Ukrainian Astronomical Association (the President is Academician Ya.S. Yatskiv), which the UPS is sincerely grateful to for the permanent support.

In his report, Professor M. Kolvas told about the current state and the prospects of the EPS. In recent years, the EPS has been concentrating its activity on the support and the popularization of reproductive power engineering, physics of high-energy plasma, laser physics; the introduction of the Bologna system of education; the support of short messages in the express publication edition “Europhysics News” concerning the most interesting papers published in journals recognized by the EPS, in particular, in the Ukrainian ones. The EPS also initiates novel forms of support for young talents in the framework of the project Young Minds and so on (Fig. 2).

The scientific part of the session was composed of the reports on the challenging problems of modern physics. Academician V.G. Bar'yakhtar, Academician M.F. Shulga, and A.G. Shepelev illuminated various aspects of the outstanding scientific anniversary: the centenary of the superconductivity discovery and the 75th anniversary of the discovery of superconductivity of the second kind at the Ukrainian Physico-Technical Institute (UPTI, Kharkiv). M.F. Shulga recalled the little-known events that took place at that time, at the

end of the 1920s and the beginning of the 1930s, when Kharkiv was not only the capital of Ukraine but also one of the physical centers of Europe, where the leading physicists of the continent came to not only to make reports, but also to work (in particular, Paul Ehrenfest and Paul Dirac were the members of the academic board at the UPTI, and serious negotiations were carried on with the both concerning their management of the department of theoretical physics, which ultimately was headed by L.D. Landau). The worker of the National Science Center “Kharkiv Institute of Physics and Technology” A.G. Shepelev – the son of G.D. Shepelev, who was an assistant of the discoverer of superconductivity-2 L.V. Shubnikov (the latter had burnt in the fires of Stalin’s repressions) – presented a wide scientific retrospective view on the 1930s, on the events that were a background for the first works on superconductivity-2. The reporter presented unique archival documents; in particular, these were a copy of the personal decision by the People’s commissar of internal affairs of the USSR N.I. Yezhov and the Public Prosecutor of the USSR A.Ya. Vyshynskii dated by July 25, 1937, on the condemnation of the founder of cryogenic physics in Ukraine, the physicist with international recognition L.V. Shubnikov to death; the certificate of rehabilitation of the scientist dated from 1957; and the certificate dated from 1938 on awarding G.D. Shepelev the Ph.D. degree in physics and mathematics for his work “Magnetic properties of superconducting alloys” (unfortunately, the talented scientist, being young, was killed at the front in 1942). A.G. Shepelev also touched upon the modern aspects of the physics of superconductivity of the second kind, in particular, in connection with a necessity to create high magnetic fields in modern accelerators of elementary particles with ultrahigh energies.

M.V. Strikha made a report “Physics of graphene: its state and prospects”. Though graphene was obtained only in 2004, the appearance of a new cross-disciplinary science, “physics of graphene”, which is located at the boundary between solid state physics, high-energy physics, physical chemistry, and engineering, is already told about. Thousands of published articles have already been devoted to graphene, and the number of citations of the pioneer work by A. Geim and K. Novoselov, where a report was made concerning the graphene production and the results of first measurements for this new substance, has exceeded 3300 by the end of November, 2010. The Nobel Prize in physics awarded in 2010 to the authors of this work gave a new impetus to the physics of graphene.

It is important to notice that the Ukrainian theorists V.P. Gusinin and S.G. Sharapov (the Bogolyubov Institute for Theoretical Physics, National Academy of Sciences of Ukraine, Kyiv) played a considerable role in the creation of fundamentals for the physics of graphene. They theoretically predicted such unusual properties of graphene as the extraordinary integer quantum Hall effect, the phase shift of quantum magnetic oscillations (in particular, Shubnikov–de Haas oscillations), and the concentration dependence of the cyclotron mass.

Another branch, where the contributions by Ukrainian scientists always were and remain sound, is the physics of nonequilibrium electrons and holes. F.T. Vas’ko (V.E. Lashkaryov Institute of Semiconductor Physics, National Academy of Sciences of Ukraine, Kyiv) became the inspirer and the central figure of this activity. He, together with his collaborators, carried out a series of quasiclassical calculations for the transfer phenomena in intrinsic and doped graphene, which are connected with the heating of charge carriers by a constant electric field, as well as by the photoexcitation of the electron–hole plasma. The results obtained can have important applications in optoelectronics.

At last, the reporter made a review of experimental and theoretical works, which have been carried out under the direction of V.G. Litovchenko (V.E. Lashkaryov Institute of Semiconductor Physics, National Academy of Sciences of Ukraine, Kyiv) since the end of the 1980s. On the basis of those works, a new direction, the formation (engineering) of carbon graphene-like semiconductors with variable energy gap width, has been proposed. It is based on the fundamental mechanism of band parameter changes in semiconducting substances with carbon in their content (the combined sp^2 – sp^3 hybridization is inherent only to carbon).

The President of UPS V.G. Litovchenko made a report “Solar power engineering: achievements and prospects”. He gave a wide review concerning the state of the problem in the world and dwelled upon the developments of Ukrainian scientists. Those include solar cells with combined barriers, systems with facet concentrators of solar energy, the developments in photosensitive composites with the quantized energy spectrum (nano-pored Si with a transparent ITO layer and a Schottky barrier), systems with combined (passivation and antireflection) coatings. Today, the works in the photovoltaic branch are important more than ever, because the global warming puts an urgent task before the mankind: to change to power engineering on the basis of new restorable energy sources, which would not bring about the chemical and thermal contamination of the environment.

Several reports of historical and organizational character were also heard.

According to the results of discussions, a Resolution was adopted, where the achievements of UPS attained throughout its 20-year history were marked. At the same time, the Resolution expressed the alarm of the physicists by the current state of teaching physics in the secondary school and high education institutions, as well as the general state of science and education in the country. The Resolution contains the appeal to the public authorities to make science and education the real rather than declarative priorities, because the future of Ukraine de-

pends on them. The Resolution was sent to the Heads of the Ministry of Education and Science and the National Academy of Sciences of Ukraine, as well as to the regional UPS organizations.

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