



Volodymyr G. Litovchenko

**UKRAINIAN PHYSICAL SOCIETY :
current status, activities and perspectives**

1990 - 2011

Who we are?

The Ukrainian Physical Society (UPS) is a scientific public non-profit organization of educators, industrial and research workers and students of physics and related fields in Ukraine.

The aim of the Society

is to satisfy and defend physicists` creative interests, contribute to creation of conditions for their efficient work, development of physical education and science as well as bringing scientific, technological and methodological advances into practice.

The Society promotes physical research, development of new technologies and dissemination of physical knowledge.

STRUCTURE

UPS currently consists of 40 regional and local groups (all over Ukraine, in all major educational and research physical institutions of Ukraine), and the current number of individual UPS members is 425.



HISTORY

UPS was **founded in 1990** and was also one of the tools in struggle for democracy in Former Soviet Union (FSU) and for independence of Ukraine.

1990-1993 - Agreements on the co-operation with Phys. Soc. of Poland, Moldova and Baltic Countries.

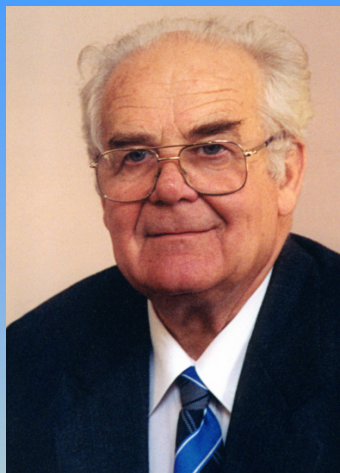
1992, April - Agreement with American Physical Society (APS).

1994, March - the UPS was nominated as a National Member Society of the EPS.

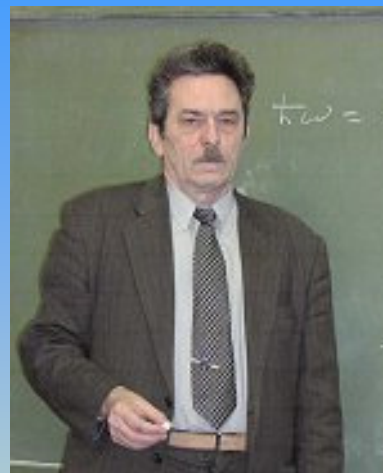
UPS Presidents



**Viktor G.
Bar'yakhtar
(1990-1995)**



**Ivan S. Gorban'
(1995-1998)**



**Sergiy M.
Ryabchenko
(1998-2001)**



**Ivan O.
Vakarchuk
(2001-2004)**

The First Chairman of the UPS Coordination Board Bureau

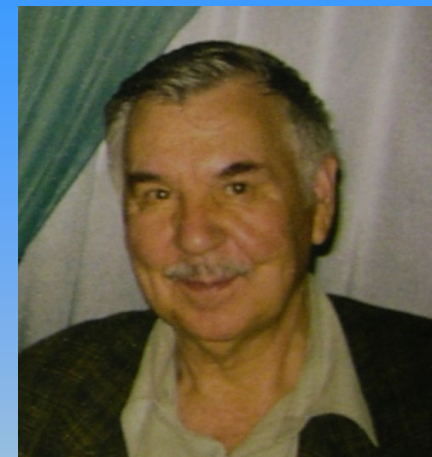


Oleksandr V. Slobodyanyuk

The present President

Prof. Volodymyr G. Litovchenko

**D. Sc., head of the Division for Surface Physics and
Microelectronics of Institute for Semiconductor Physics of
the National Academy of Sciences of Ukraine**



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Prof. Valeriy M. Yashchuk

Taras Shevchenko National University of Kyiv, Kyiv

UPS ACTIVITIES

- **Dissemination of the information** on its activity (mostly through the UPS website www.ups.kiev.ua and by E-mail)
- Dissemination of the **physical knowledge** and maintaining the **scientific outlook** through **mass media** and **popular scientific journals**
- Holding on Ukrainian **Conferences, Symposia, Meetings, Workshops** on a regular basis
- Helping **young Ukrainian physicists** in obtaining **international grants** to participate in European physical conferences
- Participation in the **EPS ‘Young Minds’** project
- Initiation of the independent **public professional expertise** of projects, programs and great plants already in service, which are in the territory of Ukraine, and providing such expertise on the request of public and government organizations
- Searching progressive forms of activity

UPS publishing activity

The UPS is one of the founders of the **Journal of Physical Studies** (Lviv).

The UPS is represented in the editorial boards of the following journals:

- 1) **Ukrainian Journal of Physics** (Kyiv);
- 2) **Semiconductor physics, quantum electronics & optoelectronics** (Kyiv);
- 3) **Metal Physics and Novel Technologies** (Kyiv);
- 4) **Advances in Metal Physics** (Kyiv);
- 5) **Powder Metallurgy and Metal Ceramics** (Kyiv);
- 6) **Low Temperature Physics** (Kharkov);
- 7) **Condensed Matter Physics** (Lviv);
- 8) **Sensor Electronics and Microsystem Technologies** (Odessa);
- 9) **World of Physics** (magazine for youth, Lviv);
- 10) **Country of Knowledge** (magazine for youth, Kyiv).

Some important achievements of Ukrainian physicists

- ✓ Discovery of superconductivity II (L. Shubnikov, Kharkiv, 1937)
- ✓ Exciton condensation on surface droplets and stimulated surface laser luminescence (D. Korbutyak, V. Litovchenko, Kyiv, 1962)
- ✓ Giant magnetoresistance effect in ferromagnetic crystals (S. Ryabchenko, Kyiv, 1975)
- ✓ Discovery of semiconductor properties in graphene-like ultrathin carbon structures (V. Gavrilenko, V. Litovchenko, Kyiv, 1987)
- ✓ Bose condensation of excitons in crystals with strong polar bonding (I. Gorban, Kyiv, 1992)
- ✓ Development of economical technology of formation of nanosized structures based on the principles of self-organization (I. Indutnyi *et al.*, Kyiv, 2005)

Beginning of graphene studies in Ukraine

(Institute for Semiconductor Physics, Kyiv (a);
Physico-Technical Institute, Kharkiv (b))

CHARACTERISTIC FEATURES OF THE ELECTRONIC STRUCTURE OF CARBON FILMS

by V. Gavrilenko, N. Klyui, V. Litovchenko (a)
V. Strelnitskii (b)

Phys. Stat. Sol. (b), **1988**, Vol. 145, P. 209-217

MODIFIED GRAPHENE-LIKE FILMS AS A NEW CLASS OF SEMICONDUCTORS WITH A VARIABLE ENERGY GAP

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It has been theoretically predicted and experimentally proved that the deformation of thin graphite-like carbon films is accompanied by the appearance of an energy gap at the K -point, the gap being proportional to a strain. A metal–semiconductor phase transition in a thin graphite (or multilayered graphene) film has been revealed. This phenomenon can be promising for the development of semiconducting materials.

gap equivalent to room temperature in terms of energy units) [6]. Another probable approach consists in the hydrogenation of the graphene surface and the formation of the so-called graphane, in which the energy gap does exist [7]. There also exist other approaches associated with the replacement of hydrogen by fluorine, introduc-

Ukr. J. Phys. 2011. Vol. 56, No. 2

<http://ujp.bitp.kiev.ua>

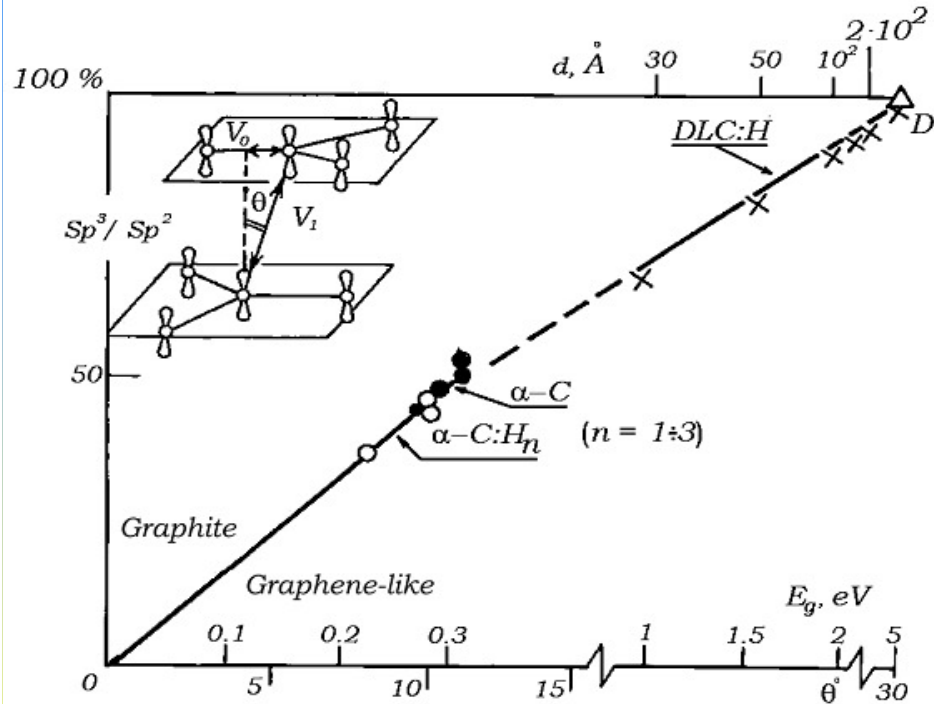


Fig. 1. Dependence of deformation-induced energy gap width E_g on the angle θ and the ratio sp^3/sp^2 for various carbon modifications (d is the size of sp^3 cluster, see work [19])

tude equals

$$E_g = \frac{V_0^2 \sin^2 \theta}{2V_1 + \Delta}, \quad (1)$$

where

$$\Delta = 2V_1 (\cos \theta \cos(\pi \cos \theta + kd \sin \theta) - 1) +$$

$$+ 2V_0 \frac{a^2}{d^2} \sin \theta (\pi \sin \theta + kd \cos \theta),$$

$k^2 = k_x^2 + k_y^2$, the graphene lattice constant $a = 0.246$ nm, the distance between graphene planes in thin graphite $d = 0.4$ nm, and $V_0 = 2.39$ eV and $V_1 = 0.4$ eV are the matrix elements of interatomic σ - and π -bonds, respectively.

As was demonstrated in work [19], the angle θ in thin graphite (or, according to modern terminology, in *multi-*

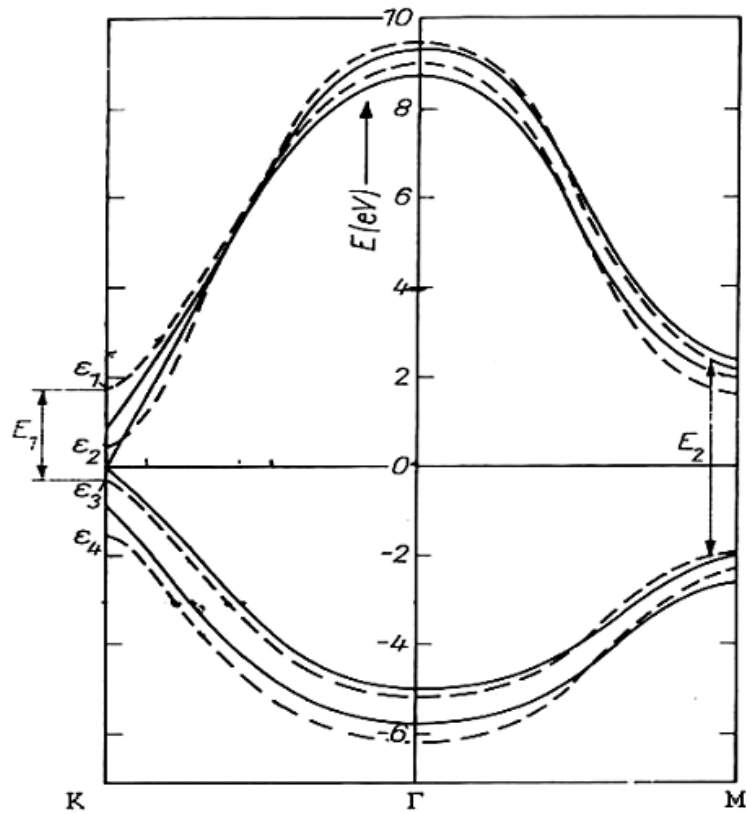


Fig. 2. Band structure in thin graphite-like carbon (solid curves) and in carbon with induced deformations, and an energy gap induced by deformations at the K -point (dashed curves) [14, 15]

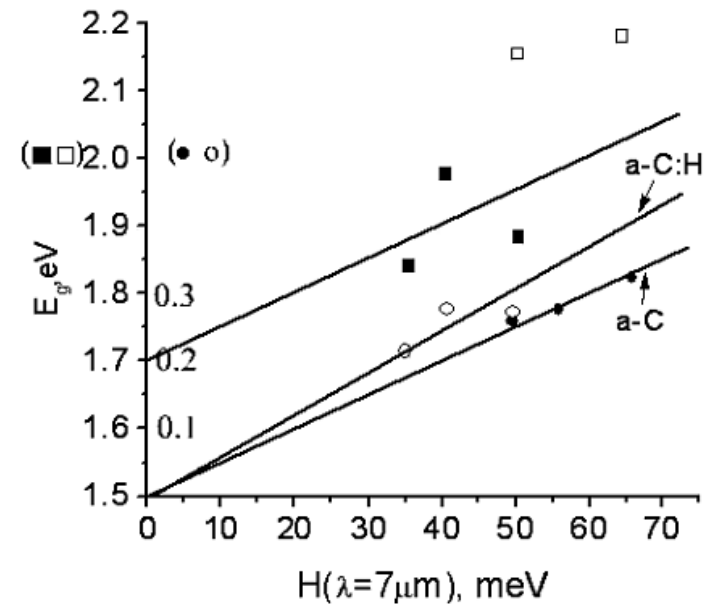


Fig. 3. Dependences of energy gaps in thin graphene films on the line broadening (the deficiency degree). The upper line corresponds to $E_{g1} = \epsilon_1 - \epsilon_3$, the lower ones to $E_{g2} = \epsilon_2 - \epsilon_3$ (see Fig. 1)

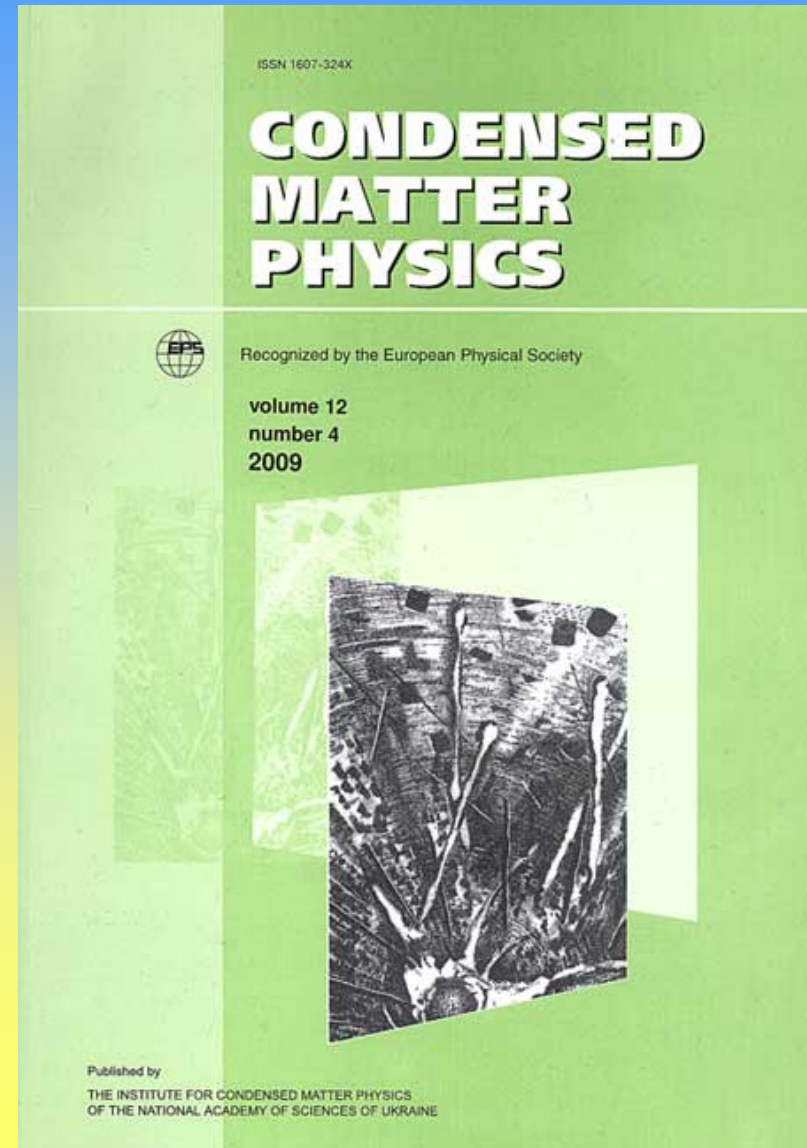
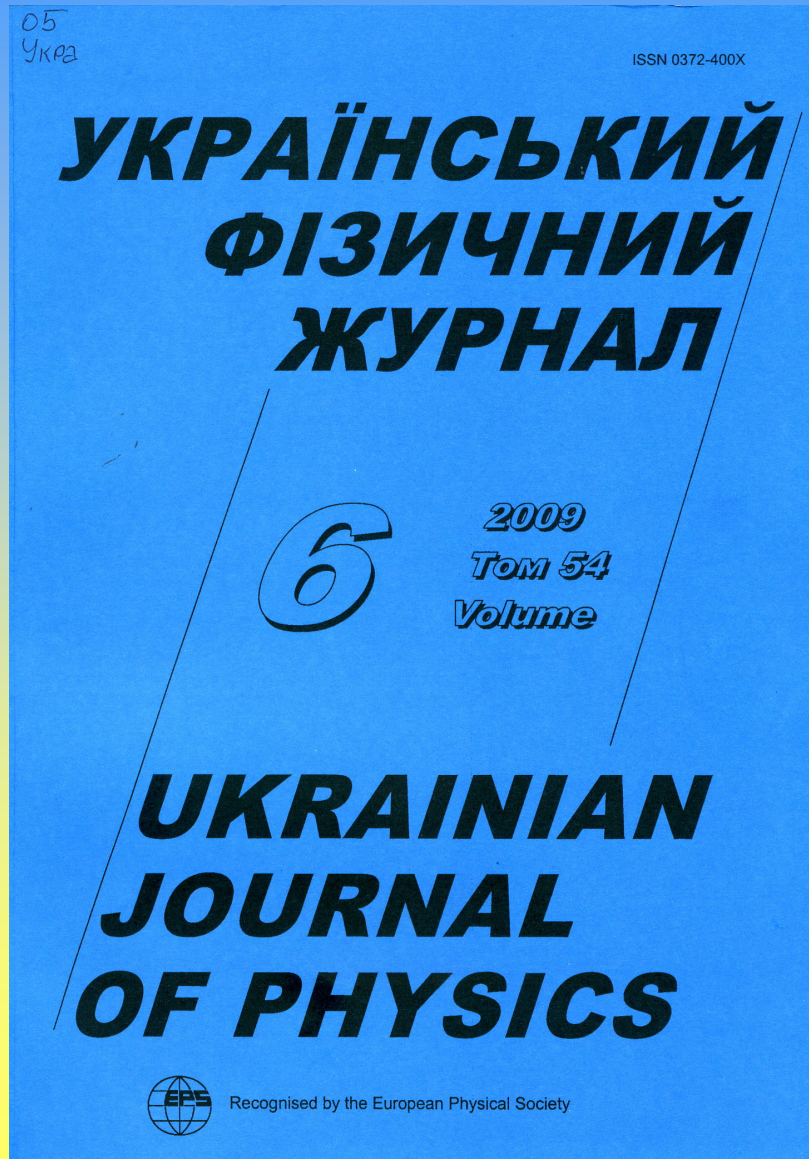
4. Conclusions

Our experimental results are in good agreement with theoretical predictions (Eq. (1)). The estimates obtained for deformations invoked in graphite-like films and resulting in the corresponding splittings fall within a reasonable interval of low strains. At the same time, for higher deformations, the theory describes well the results obtained for amorphous carbon. We note that the description of those results by relation (2) meets substantial difficulties [1].

Hence, we may assert that a thin semimetallic graphite layer transforms into a semiconductor already at low elastic strains, when structural defects are introduced, or at the doping. The physical nature of such phase transition has been determined: it is related to the bond distortion owing to the mixed hybridization $sp^2 - sp^3$, the phenomenon being possible only for carbon capable of the polyhybrid bonding. The discovered metal-semiconductor phase transition in a thin graphite (or multilayered graphene) film is promising for the materials science of semiconductors.

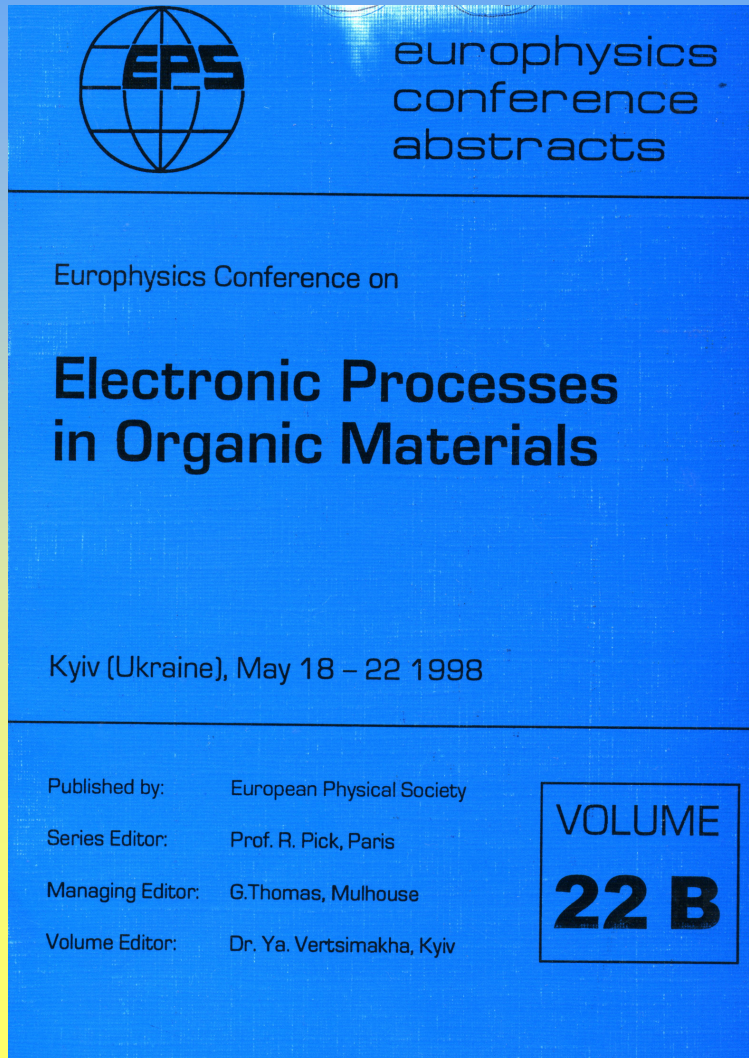
It should be marked that it is multilayered graphene (thin graphite) grown up, e.g., on the basis of SiC that is regarded today more and more often as a promising substance for technological applications, in contrast to monoatomic graphene. This fact is associated with a considerably higher quality of individual graphene planes in the bulk of thin graphite – and, as a consequence, with a very high mobility of charge carriers (up to $10^6 \text{ cm}^2/(\text{V} \cdot \text{s})$) – in comparison with the worse structure quality of monoatomic graphene on a substrate – and, as a consequence, with the corresponding mobility of charge carriers that is one to two orders of magnitude lower [11].


**‘Ukrainian Journal of Physics’ and ‘Condensed Matter Physics’
have been accepted as EPS Recognised Journals**



► Europhysics conferences in Ukraine.

✓ The First EPS Conference in Ukraine



 europhysics
conference
abstracts

Europhysics Conference on

**Electronic Processes
in Organic Materials**

Kyiv (Ukraine), May 18 – 22 1998

Published by: European Physical Society

Series Editor: Prof. R. Pick, Paris

Managing Editor: G. Thomas, Mulhouse

Volume Editor: Dr. Ya. Vertsimakha, Kyiv

**VOLUME
22 B**

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✓ All-Ukrainian Congress “Physics in Ukraine”, Odessa, October 2005

with participation of the EPS President Martin C. E. Huber



EPS Executive Committee meeting in Kyiv

On **23 - 24 June 2006** a meeting of the **EPS Executive Committee** including the '**Journée de Réflexion**' was held in Kyiv.

Among the participants were the members of EPS EC, representatives of the Western European Physical Societies, delegates from UPS and Physical Societies of neighbouring countries of Ukraine, representatives of the Council of President of Ukraine, National Academy of Sciences and Ministry for Education and Science of Ukraine.

Discussed were the ways of strengthening and widening relations between EPS and UPS, development of fundamental and applied physics and physical periodic press in Ukraine, the state and problems of education in physics, other items concerning the future of physics in Ukraine as well as the problems of other Eastern European Physical Societies.

Europhysics News 2006, Vol. 37, No. 5

EPS session in Ukraine (June 2006)

The joint session of the Executive Committee of EPS and Ukrainian Physical Society (UPS) was held during 22-25 June 2006 in Kiev. It was also attended by representatives of the National Academy of Sciences of Ukraine (NASU), the Ministry of Science and Education (MSE), Universities and other organizations.

It is important to note that this meeting was initiated by the EPS (now it unites 30 national physics associations from Europe) with the aim to strengthen contacts of the physics communities of Europe and Ukraine.

Physics is important in many areas in society and the economy, for example playing an essential role in technological progress in electronics, computer sciences, communications, etc. The World year of Physics in 2005 highlighted many of these achievements and looked not only at past successes in physics, but at future challenges. The joint session considered possible actions to continue the promotion of physics.

In the opening ceremony, introductions were given by the president of EPS, O. Poulsen, the counsellor of President of Ukraine, I.R. Yukhnoski, the Vice-president of NASU, A.G. Naumovets, the head of the division of physics of NASU, V.M. Loktev, and the president of UPS, V.G. Litovchenko.

The Executive Committee of the EPS during its session discussed at length the plans by the EU to establish a European Institute of Technology. One of the main issues is whether the EIT will be one institution with clear localization or a confederation of the institutions placed in different countries. In order to better integrate Ukrainian scientists, the Ukrainian physicists present supported the second

view and proposed to involve Ukrainian institutions in this activity.

Summary of the other main presentations made by the participants.

President EPS, Prof. O. Poulsen

Physics is undergoing great changes. On a European scale, there is much pressure to change how we do science, with for example the creation of the ERC centralising funds for frontier research.

Another challenge for physics comes from the Bologna process to coordinate curricula, harmonise degrees and promote mobility. One of the problems with this process however is that physics does not really have a 1st cycle leading to a degree with employment opportunities.

In the countries represented here today, their different cultural heritage, their phase of economic development, and the needs of their society have an impact on all elements of scientific research. One of the most basic needs is the development of a strong research infrastructure.

The EPS sees Ukraine as part of Europe and we look forward to receiving input on the problems related to physics education and research in order to develop adequate policies for the integration and promotion of physics in this area.

Prof. Shopa, editor of the UPS journal World of Physics

The UPS journal "World of Physics" was created in 1997 and is a collaboration of the UPS, the Academy of Sciences, the Shevchenko Scientific Society, and the Ministry of Education and Science. The journal covers items of general interest, scientific features, and book reviews. As there are few publications in the Ukrainian language, it is important to support them.

Prof. V. Yashchuk (Nat. Kiev.Uni.), Head of Executive Council of UPS

The UPS was founded in 1990. It played an important role in the struggle for independence and democracy in the Ukraine. It currently has 620 members in 41 regional and local groups. Its main activities include the organisation of conferences, dissemination of information to its members and to the public, and the provision of expert advice on projects and installations.

The main problems faced by physics and physicists in the Ukraine include the improvement of salary and working conditions for physicists in Europe. The current salary for a professor is approximately 300€/month. Equipment needs to be modernised as well.

Prof. A. Zagorodnii, Editor of Ukr. Phys. Zh and Dr. O. Shopa, "The state and problems of Ukrainian physics publications—and potential solutions"

Scientists in Ukrainian research institutes publish approximately 4000 papers/yr in journals all over the world. EPS support for publication in Ukraine is very important and EPS recognition of some of the new journals would be helpful.

M. Stepko, representative of Education Ministry and ex-president of UPS, Prof V. Baryakhtar "On the state of physics education in the Ukraine — where are changes needed"

In the Ukraine, physics education in university is targeted towards the deliverance of Masters and PhD degrees. There are currently 1150 physics students in Kiev. Degrees in more practical and applied aspects of physics are being studied. University education in the Ukraine has been adapted to conform to the ECTS requirements to improve student and teacher mobility. Interdisciplinary studies are being promoted as well.

The Ukraine too is confronted with the problems of the Bologna process, and the lack of a real 1st level university degree in physics.

There is a problem in finding employment for graduates. Physics studies are not attractive if there are no jobs, and funding for the faculties is related to the number of students. The laboratories cannot hire the



◀ President of EPS, O. Poulsen and president of UPS V.G. Litovchenko, during the joint session.

graduates, and there is no work in the industrial sector either.

Pre-university physics education depends on the high school and whether the student will study science at university. For these high schools concentrating on physics, students have 5 hours of physics per week. The main problem is equipment, and the Ukraine currently has a programme with Germany to provide equipment.

During the cold war, it was easier to find students and funding for physics education. However, this has changed and assuring the next generation of physicists is a big problem. Access to good textbooks and an adequate supply is needed.

S. Ryabchenko

The number of members is relatively low because the UPS had few activities in the recent past. There has been much brain drain in Ukraine. One solution is the “shuttle scientist”, who works 1-2 years abroad, and returns to the Ukraine afterwards, and



▲ President of EPS, O. Poulsen and vice-president of EPS, M. Huber during the session.

keeps good contacts and collaborations in other countries. The Ukraine has also received much international support (e.g. APS, the Soros Foundation, EPS ...). These actions have helped to stabilise science in the country. Physics plays a leading role: 39% of all scientific papers in

the Ukraine are in physics. International assistance is still required. The EPS could advocate that levels of intellectual and scientific activity be taken into account of integration/development of FSU. The EPS could reduce the membership fees for scientists in FSU countries. The EPS could look at new ways to combat the brain drain, and work with the FSU countries on the implementation of the Bologna process.

Oleksandr Slobodyanyuk

The UPS is a bottom-up initiative, and one of the first manifestations of civil society in the Ukraine. It is unprecedented as a non-profit, non-governmental association. Its creation introduced elementary notions of democracy and opened the eyes of other people and served as a model for other professional societies. One of the main roles of the UPS has been to act as a clearing house for funds from international aid programmes. ■

✓ **The VII Congress of UPS, Kyiv, 23 June 2009**

КИЇВСЬКИЙ НАЦІОНАЛЬНИЙ УНІВЕРСИТЕТ імені ТАРАСА ШЕВЧЕНКА
ФІЗИЧНИЙ ФАКУЛЬТЕТ



ВІТАСМО ДЕЛЕГАТІВ ТА ГОСТЕЙ VII З'ЇЗДУ
УКРАЇНСЬКОГО ФІЗИЧНОГО ТОВАРИСТВА



The congress has adopted a resolution on formation of the Commission of the UPS
Coordination Bureau on education and relations with the EPS.

✓ **Jubilee Conference of the Ukrainian Physical Society,
Kyiv, 18 February 2011**
with participation of EPS President Maciej Kolwas





THANK YOU FOR ATTENTION!