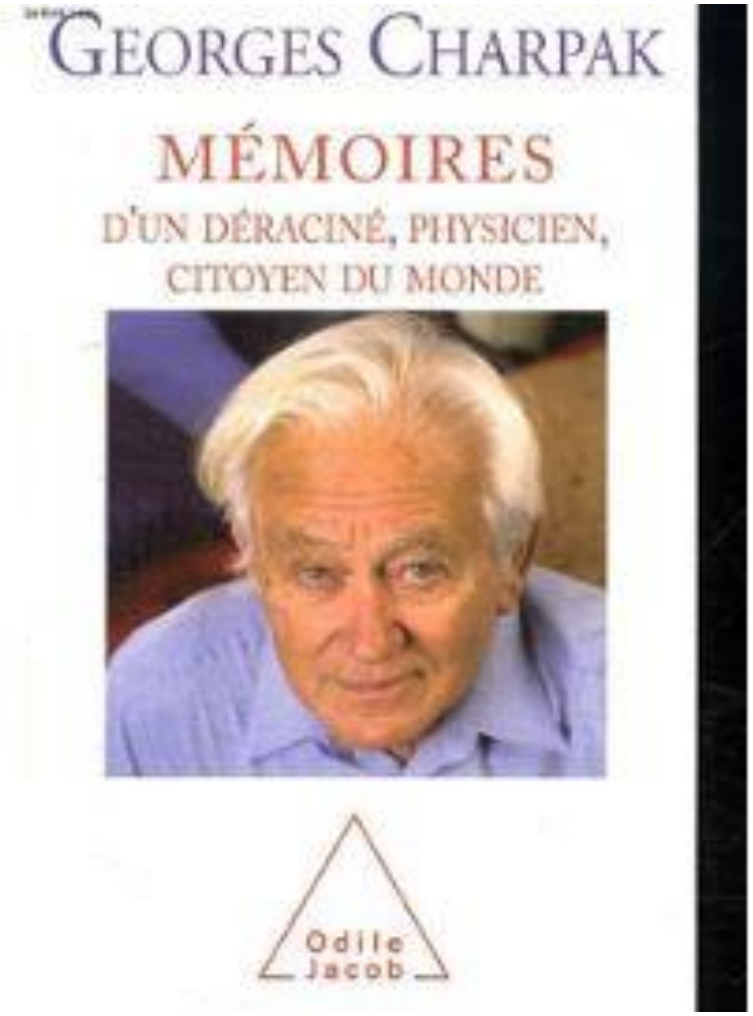
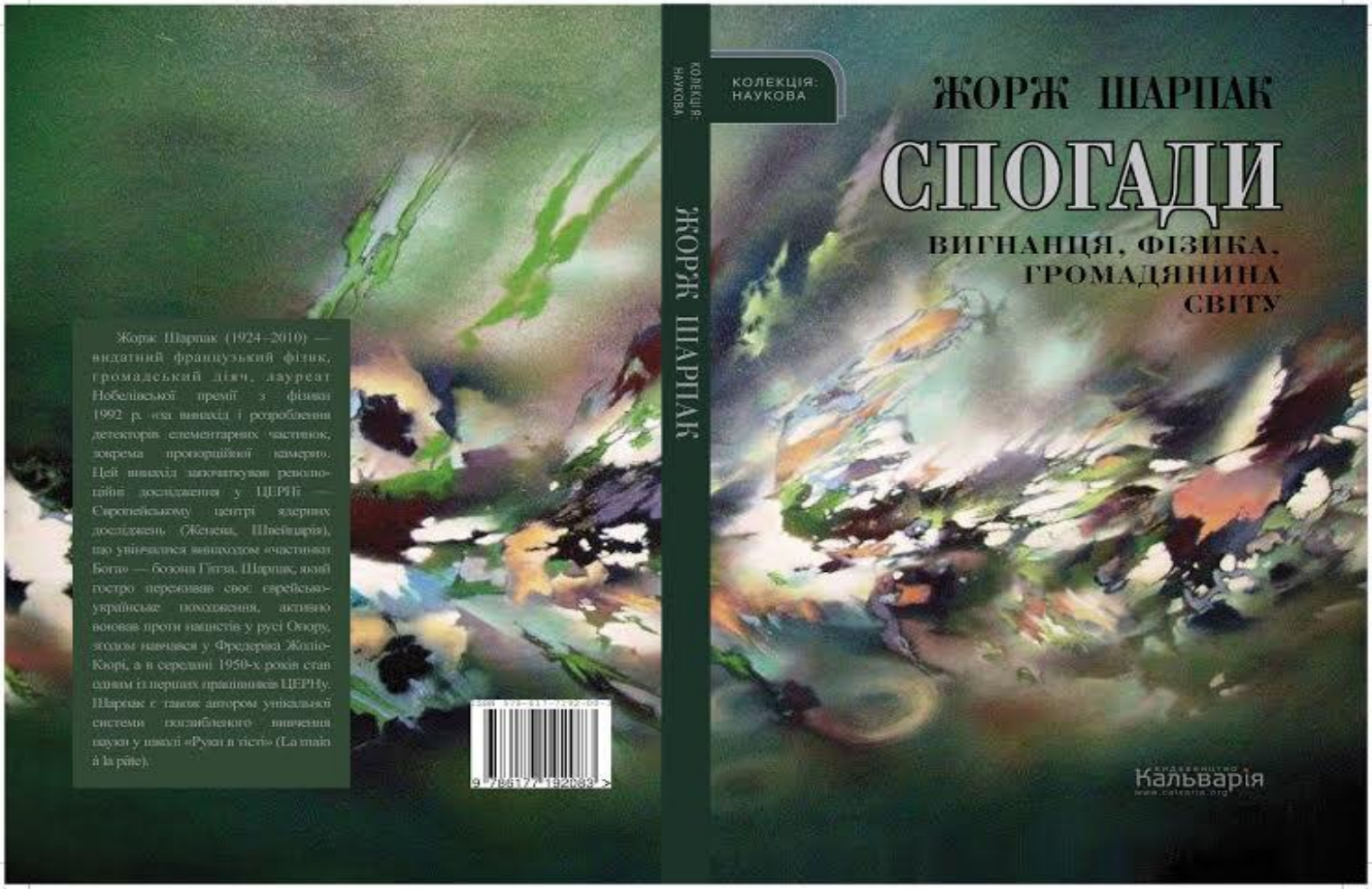

DU CENTRE MICROÉLECTRONIQUE DE
ECOLE DES MINES DE SAINT-ETIENNE


GEORGES CHARPAK
MÉMOIRES
D'UN DÉRACINÉ, PHYSICIEN,
CITOYEN DU MONDE
Odile
Jacob


Жорж Шарпак (1924–2010) — видатний французький фізик, громадський діяч, лауреат Нобелівської премії з фізики 1992 р. «за винахід і розроблення детекторів елементарних частинок, зокрема пропорційної камери». Цей винахід започаткував революційні дослідження у ЦЕРНі — Європейському центрі ядерних досліджень (Женева, Швейцарія), що увінчалися відкриттям «частинки Бога» — бозона Гіггза. Шарпак, який гостро переживав своє єврейсько-українське походження, активно воював проти нацистів у русі Опору, згодом навчався у Фредерика Жоліо-Кюрі, а в середині 1950-х років став одним із перших працівників ЦЕРНу. Шарпак є також автором унікальної системи популярного вивчення науки у книзі «Руки в тісті» (La main à la pâte).
КОЛЕКЦІЯ: НАУКОВА
ЖОРЖ ШАРПАК
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ЖОРЖ ШАРПАК
СПОГАДИ
ВИГНАНЦЯ, ФІЗИКА, ГРОМАДЯНИНА СВІТУ
видавництво Кальварія
www.calvaria.org

CERN – step into the future

CERN stands for a marvelous place, where an honest-to-god revolution is under way. CERN was incepted by several farsighted European politicians aided by a few dozen famous scientists from the USA and Europe.

These people did not want to accept the decadence of European science after World War II. Their effort bore fruit in the shape of an epochal invention of a new way to conduct scientific studies on our globalized planet. They brought together thousands of young talented European physicists scattered over hundreds of effete research centers and universities. They succeeded in getting funds for the construction of facilities unseen before in terms of size and expense, and unfeasible for separate countries.

Those particle accelerators were the place where scientists learned to work in multinational teams bringing together thousands of engineers and physicists from all over world. Quite a few talents came in handy for creating the devices that earlier seemed to belong in the realm of science fiction.

Thus appeared absolutely new life conditions which allowed the physics elite actively participate in the creation of the new center: theorists and experimentalists, still in the light of glory after their discoveries, flocked to get a unique chance of obtaining resources for a few years, maybe even their whole life. It was a possibility to strengthen universities – since physicists who managed local groups that did high energies studies could involve postgraduate students in their research and teach remotely. Governments of a number of countries made a decision to form a few teams consisting of hundreds physicists and station them in CERN, so that they could apply their talents participating in research activities.

Essentially, CERN has allowed Europe to climb up to the level of highly developed countries and even leave them behind in some ways. Europe has become the host of a scientific gem of the 20th century, where the most famous discoveries were made: the Standard Model. The construction of the new accelerator LHC, whose capacity equaled that of the rest of the world, was a gamble that gave people hope in the future.

Now it is clear why I consider getting into that laboratory and working there over 30 years a unique chance. During that time, I had a daily possibility to communicate with physicists, who I could never know otherwise; using virtually inexhaustible material resources every day, and choosing the topics of research without restrains. It even allowed me to turn to some aspects of biology and medicine.

While the process of globalization forces us to search solutions for global problems, the example of CERN, its success and laws help us find the ways of collaboration indispensable in any scientific area.

Science education

I dedicated a great part of my life to decoding the infinitely small, and afterwards, thanks to my age and honors, I found myself in the world that had been changing. Family, friends, motherland, our wonderful planet have become more visible, more tangible. After leaving the cocoon of pure physics – my Laboratory at CERN – I realised that world needs more attention. CERN is a huge aquarium inhabited by several thousands of scientists from all over the world, scientists without financial restrictions thanks to grants. And without political restrictions either – even during the worst days of Cold War, contacts between high-energy physicists were maintained. No visible use of these people's knowledge for military or economic purpose allowed politicians save the bridge between scientific elites of conflicting countries – the bridge, whose main goal has always been convincing our colleagues, who suffered from totalitarian regimes, in democratic ideals.

Since 1996, I dedicated great efforts to reforming the elementary science education. Thanks to Leon Lederman – my long-time friend, who in 1959 hired me to CERN, I got involved in this adventure with a whole group of academicians, school directors and thousands of activists. All together we have built a system which will outlive us and bridge the borders.

In 1992, not long before I was awarded with Nobel Prize, Lederman invited me to visit a ghetto school for black-skinned students in Chicago. There he managed a Laboratory which competed with CERN, while also trying to change the curriculum of 450 thousand pupils attending city elementary schools with a hands-on method. Later we dubbed this method Playdough.

It was obvious that the method worked wonders. Children aged 5 to 12 years were happy, sought knowledge, while teachers enjoyed the relationships with their classes and an impressive program. It was not only about children getting scientific knowledge but also about its particular distribution. Throughly thought-out experiment which involved children actively discovering the surrounding world played an important role, as well as special notebooks showing gradual research phases, and communication of children from small research groups with ordinary classes.

Certainly, the methods were not actually new; something like that could be found in France and aboard. However, Americans realized the generally miserable state of programs in their elementary education institutions and spent huge funds on improving the system over ten years. Notably, science education was seen as priority. That is why in some districts - mainly chosen for the incredible poverty in schools – they succeeded in setting up an effective strategy which contributed in the ambitious reformation on the national scale.

Coming back from Chicago, I decided to spread these reforms in France too. I recall neither the spread of rumors about the Minister's good attitude to our ideas throughout the Ministry, nor the build-up of contacts with local activists. However, I am confident that we succeeded in lobbing a mission of a large delegation from the Ministry to Chicago to look at what Lederman had achieved.

In 1993, Robert Jermyn visited me in CERN. He told me about the problems of science education in schools for engineers. He tried to solve them launching an educational program in just opened Mining school in Nant city. I could not tell him anything specific.

At that time, I had already met Jerry Payne, physics lecturer on the freshman year in Caltech (California Institute of Technology), the most prestigious engineering university in USA located in Pasadena. I was impressed with the teaching level – the program was based on skillfully planned experiments. But I was even more astonished when professor and a few his associates modernized the teaching in ordinary elementary schools attended by 12 thousands of pupils, 90% of them living below the poverty line.

All schools were involved. Educational materials and books received by teachers were of impressive quality, simplisity and convenience for teachers. Experiment, akin to Lederman's program, was funded from the National Scientific Foundation. Special role was played by the group led by Karen Worth from Cambridge, where Harvard University and Massachusetts Institute of Technology are situated; this group in Pasadena worked with written textbooks and experimental materials. I was amazed to note that it is easy to copy books and other materials, and USA can offer significant funds for this.

That is why the Mining school in Nant played important role in starting the Hands-on approach in the area of Laure-Atlantic. Its students and teachers were involved in the production and use of educational materials. They collaborated with teachers from Vaulx-en-Velin in developing new materials. It was about a general block which had to ensure quick success for the method, as it allowed increasing the number of classes where it could be used. Finding the funds for buying ready-made material is easier than finding teachers who are enthusiastic with the method and have time for it.

MINOR ACADEMY OF SCIENCES OF UKRAINE

Minor Academy of Sciences of Ukraine

is an educational system, that manages and coordinates scientific and research activity of school students, ensures conditions for their intellectual, creative development and career self-determination, contributes to the scientific potential of the country.

REGIONAL NETWORK OF MASU

Minor Academy of Sciences of Ukraine unites

27 territorial departments on regional level,

which coordinate the activity of district and city territorial departments and school student scientific societies

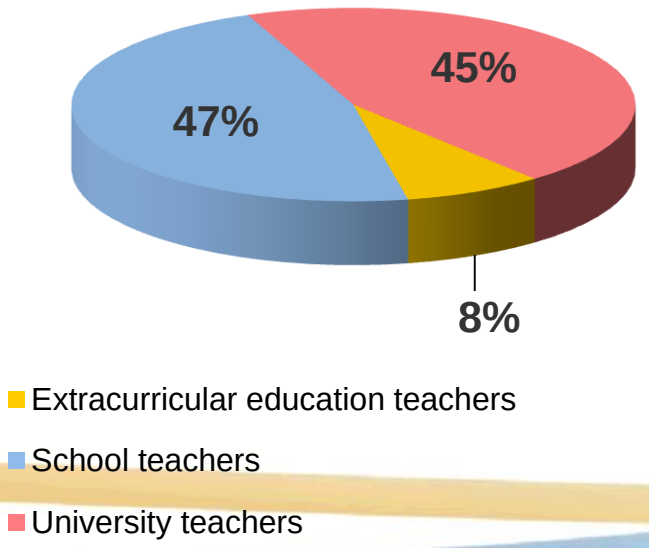
General coordination, organizational and methodological governance
is performed by

National Center “Minor Academy of Sciences of Ukraine”

STUDENTS AND TEACHERS OF MASU

There are over **250 thousand school students** involved in the system of the Minor Academy of Sciences of Ukraine
(where 33,1% are students from schools in rural area).

Young scientists are assisted
by **more than 7 thousand pedagogues**
in their scientific research:



MAIN DIRECTIONS

PRIORITY AREAS OF MINOR ACADEMY OF SCIENCES OF UKRAINE

- EDUCATIONAL PROJECTS OF MINOR ACADEMY OF SCIENCES OF UKRAINE
- CONDUCTING PUBLIC EVENTS WITH GIFTED SCHOOL YOUTH
- INCREASING THE PROFESSIONAL COMPETENCE OF PEDAGOGICAL STAFF OF MINOR ACADEMY OF SCIENCES OF UKRAINE
- COVERING OF THE SCIENTIFIC AND METHODOLOGICAL, RESEARCH AND EXPERIMENTAL DIRECTIONS OF EXTRACURRICULAR EDUCATION
- PROPAEDEUTICAL ACITIVITY
- COOPERATION WITH EDUCATIONAL AND SCIENTIFIC INSTITUTIONS, PUBLIC ORGANIZATIONS
- PROTECTING THE INTELLECTUAL PROPERTY OBJECTS
- PROMOTING THE ACTIVITY OF MINOR ACADEMY OF SCIENCES, ACHIEVEMENTS OF GIFTED SCHOOL YOUTH AND THE BEST EXPERIENCE OF SCIENTIFIC AND PEDAGOGICAL STAFF, PUBLISHING
- INTERNATIONAL COOPERATION

INTERNATIONAL COOPERATION

JOINT DECLARATION BETWEEN MASU AND EUROPEAN ORGANIZATON FOR NUCLEAR RESEARCH (CERN)

According to the Joint Declaration for scientific and technical cooperation between the Cabinet of Ministers of Ukraine and European organization for nuclear research of 2 August 2011, **the Joint Declaration between Minor Academy of Sciences of Ukraine and European organization for nuclear research (CERN)** was signed.

The Declaration provides the participation of teachers and students in educational programs of CERN.

INTERNATIONAL COOPERATION

SCIENTIFIC SCHOOLS FOR UKRAINIAN TEACHERS OF PHYSICS

According to the Declaration Ukrainian teachers – physicists – scientific supervisors of the projects of the members of MAS of Ukraine have the possibility to participate in the powerful educational activity, national programs in the spheres of the physics of the high energies and physics of the elementary particles.

12-19th of November 2011 in CERN the first scientific school for the scientific supervisors of the projects of the students - members of MASU took place.

13- 20th of October 2012 – second scientific school.

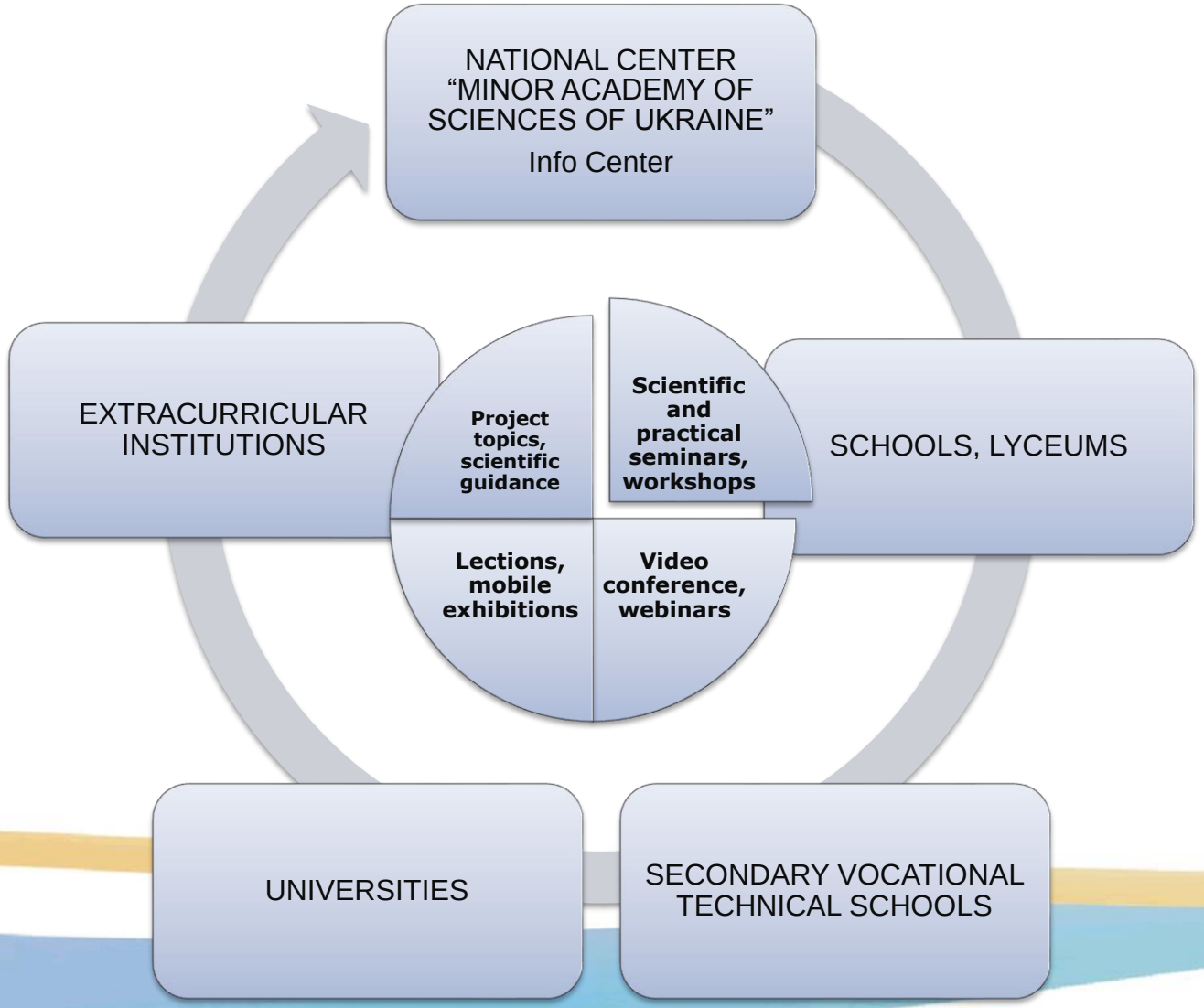
INTERNATIONAL COOPERATION

SCIENTIFIC SCOOLS OF PHYSICS FOR STUDENTS OF MINOR ACADEMY OF SCIENCES OF UKRAINE

National Center "Minor Academy of Sciences of Ukraine" together with the European Centre for Nuclear Research (CERN) organized and conducted **Science schools of physics for students of Minor Academy of Sciences of Ukraine** in Geneva (Switzerland): 27 June-2 July, 2012, and 11-16 June, 2013.

To the participants of schools perspective areas of the scientific research in high-energy physics were presented, they visited scientific centers and experimental laboratories of the European Centre for Nuclear and had excursions to museums of CERN, the Museum of History of Science, Museum of Natural Sciences in Geneva.

ALL-UKRAINIAN EDUCATIONAL PROGRAM "MODERN PHYSICS"



COOPERATION TO PROMOTE KNOWLEDGE GENERATED BY CERN

Scientific and educational center «Fundamental physics of the micro and macro world»

For the realization of the program Scientific and educational center **“Fundamental physics of micro and macro world”.**

Founders:

National Academy of Sciences of Ukraine

Kyiv National Taras Shevchenko University

State Fund of Fundamental Research

National Center “Minor Academy of Sciences of Ukraine”

ALL-UKRAINIAN EDUCATIONAL PROJECTS OF MASU OF UKRAINE

SCIENCE OF XXI CENTURY: PERSPECTIVE DIRECTIONS OF DEVELOPMENT (field lectures)

SCIENTIFIC DIRECTION: "HIGH-ENERGY PHYSICS"

Within the framework of All-Ukrainian scientific and educational project of MAN of Ukraine "Science of XXI century: perspective directions of development" in 2011-2012 there were performed field scientific lectures in all regions of Ukraine. Its participators were about 4,5 thousands students.

Theoretical lessons for school students were conducted by teachers, who have been trained in scientific schools at CERN.








EVENTS OF THE MINOR ACADEMY OF SCIENCES OF UKRAINE

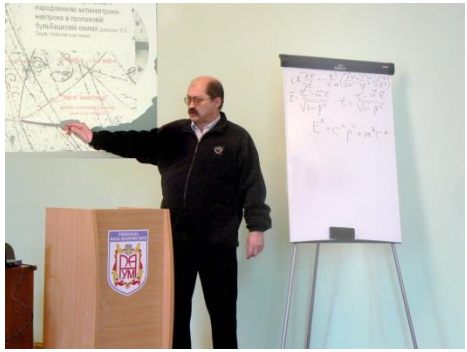
ALL-UKRAINIAN SCIENTIFIC RESEARCH AND PRACTICE SEMINAR IN PHYSICS

29 May 2012 in Alushta, the Autonomous Republic of Crimea, National center “Minor Academy of Sciences of Ukraine with the support of the State Agency on Science, Innovations and Informatization of Ukraine, the European Organization for Nuclear Research (CERN, Geneva, Switzerland), Joint Institute for Nuclear Research (JINR, Dubna, Russia)” held an All-Ukrainian research and practice seminar in physics. 170 teachers of secondary schools and territorial departments of the Minor Academy of Sciences of Ukraine were the participants of seminar.

TEACHERS OF THE MINOR ACADEMY OF SCIENCES OF UKRAINE ARE THE GUIDES OF SCIENTIFIC KNOWLEDGE GENERATED BY CERN

Events held by the teachers after training at CERN:

- All-Ukrainian seminars for the teachers of physics and astronomy (11 events, 607 participants);
- Professional trainings for physics teacher (over 2400 participants);
- Meeting of methodical unions of physics teachers at regional, district and city levels on the activities of CERN (over 1300 participants);
- Round tables for the school and extracurricular institutions teachers (64 events);
- Seminars and workshops for pedagogues who work with talented children (about 100 events);
- Research and practice conferences for physics teachers and young scientists (27 events);
- Initiated All-Ukrainian educational program “Modern physics”;
- Lectures for students of the Minor Academy of Sciences of Ukraine, school and university students (about 11200 students);
- Presentations for the scientific student union members (74 events).



PROMOTION OF CERN ACTIVITIES BY MINOR ACADEMY OF SCIENCES OF UKRAINE

- 3 movies
- 7 TV program «Intelect.ua»
- 28 broadcasts on the central Ukrainian TV channels
- Over 30 news broadcasts
- Over 34 publications in press
- Over 35 presentation on radio
- Over 120 publications in e-mass media
- About 100 news broadcasts on regional TV

PROMOTION OF CERN ACTIVITIES BY MINOR ACADEMY OF SCIENCES OF UKRAINE

EXHIBITIONS

National Center "Minor Academy of Sciences of Ukraine" initiated regular CERN themed exhibitions (63 exhibitions in 27 regions of Ukraine)

Every Ukrainian teacher who participated in CERN educational programs shared this knowledge with 8000 people.
For the past three years of cooperation with CERN around 652000 people has been covered

МИСТЕЦЬКИЙ АРСЕНАЛ
MYSTETSKYI ARSENAL

INTERNATIONAL EXHIBITION "THE WEEK OF ADVANCED SCIENCE"

October 23 – November 2

MAKE YOUR NEXT STEP WITH UKRAINE

The Exhibition key points

- Contribution of Ukrainians to the development of world science;
- Contribution of European organizations and scientists to the development of world science;
- Common future of Ukrainian and world scientific elite.

Exhibition blocks

- Ukrainian scientists who contributed to the development of world science;
- CERN 60th anniversary;
- George Charpak's 90th anniversary;
- exhibition of Michael Hoch's works;
- exhibition of Nicole Lemaire's works;
- films about forgotten and unknown scientists;
- "Macrocosm";
- "Microcosm";
- National Center "Minor Academy of Sciences of Ukraine"10th anniversary;
- exhibition of innovative solutions, inventions and creative ideas of Ukrainian school students "The Future of Ukraine";
- cinema of Minor Academy of Sciences of Ukraine.

МИСТЕЦЬКИЙ АРСЕНАЛ
MYSTETSKYI ARSENAL

INTERNATIONAL EXHIBITION "THE WEEK OF ADVANCED SCIENCE"

October 23 – November 2

COME AND MAKE YOUR FUTURE