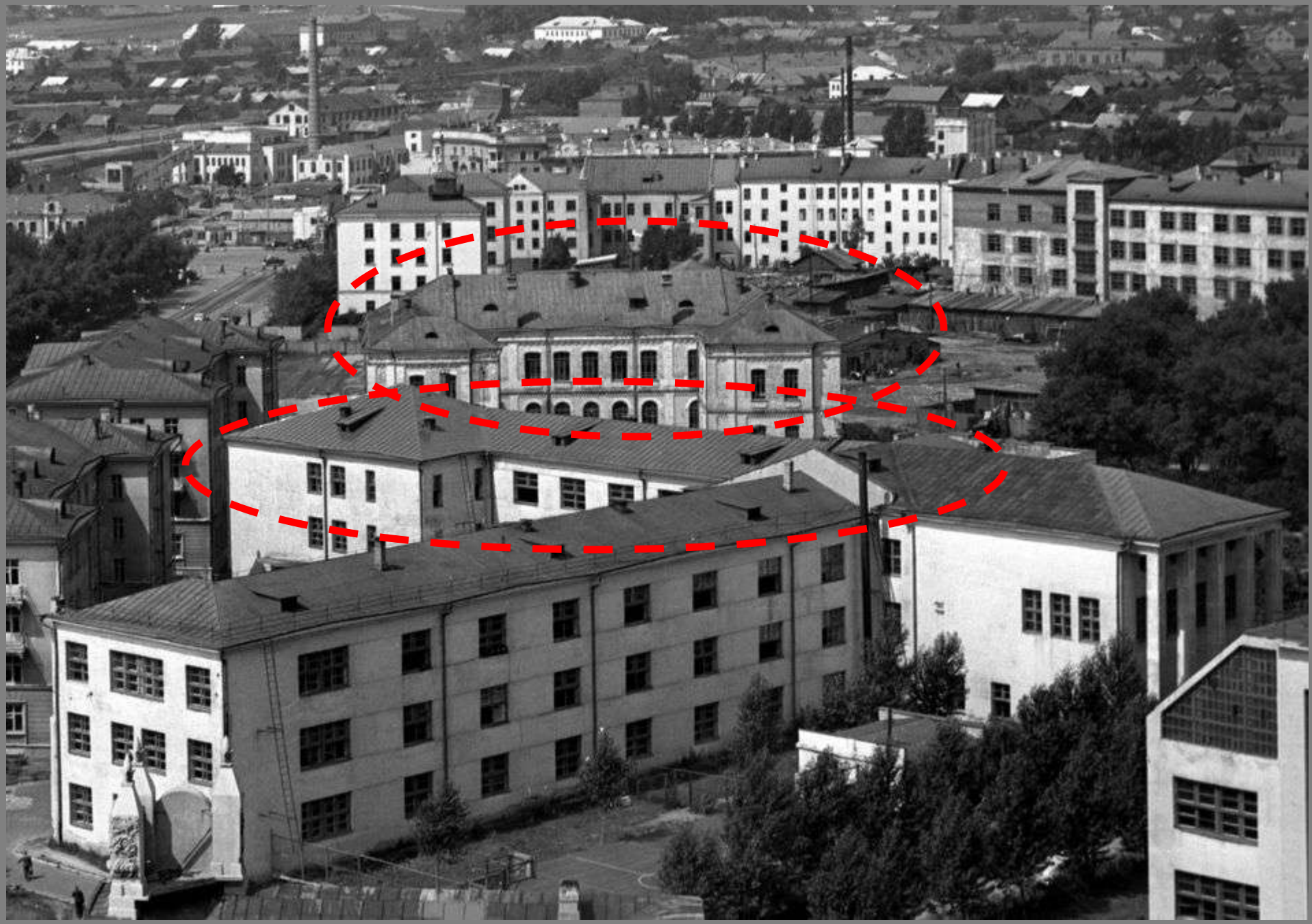


Staff total – *138*

Researchers – *80*

Dr.Sci. – *9*

Ph.D. – *26*

Institute for Nuclear Problems of Belarusian State University (INP BSU) was founded in October 1986 and currently is one of the leading Belarusian research organization in the area of nuclear physics and radiation-matter interactions.

PREHISTORY

Professor Vladimir Baryshevsky is the founder and first director (1986-2012) of the Institute

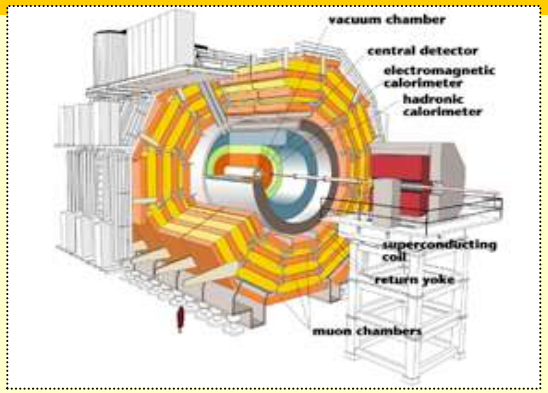
with Piotr Masherov

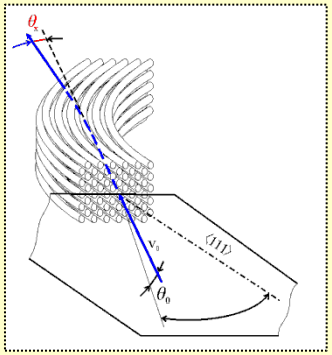
with Stanislav Shushkevich

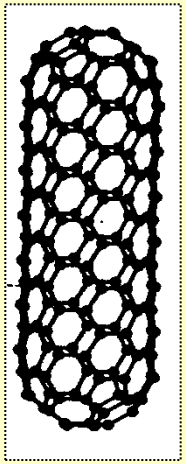
……

INP BSU: Physics and technologies of the radiation-matter interaction

- **Radiation-matter interaction and nuclear physics:**
  - Nuclear optics
  - Volume free-electron laser,
  - Novel scintillator materials and detectors for high energy physics and new methods of ionizing radiation control
  - Magnetic explosion generator
- **Particle and High Energy Physics:**
  - Collaboration with CERN and JINR,
  - Participation in collaborations CMS, ATLAS, FCC, …
  - Novel detectors, readout electronics
- **Electromagnetics of complex media:**
  - Nanoelectromagnetics
  - Novel composite, nano- and micro- structured materials
  - Microwave technologies in agriculture and medicine
- **Control of small doze radiation and radioactive pollution:**
  - Belarusian-American study of thyroid cancer and other thyroid diseases in Belarus caused by the Chernobyl disaster,
  - Radioactive pollution control instrumentation







HISTORY: Nuclear weapon detection project

In July 1989 the joint USSR-USA experiment was carried out.

It was proved that nuclear weapon onboard the ship can be successfully detected using the specialized detector system. INP BSU team was one of the leading developers of the system.

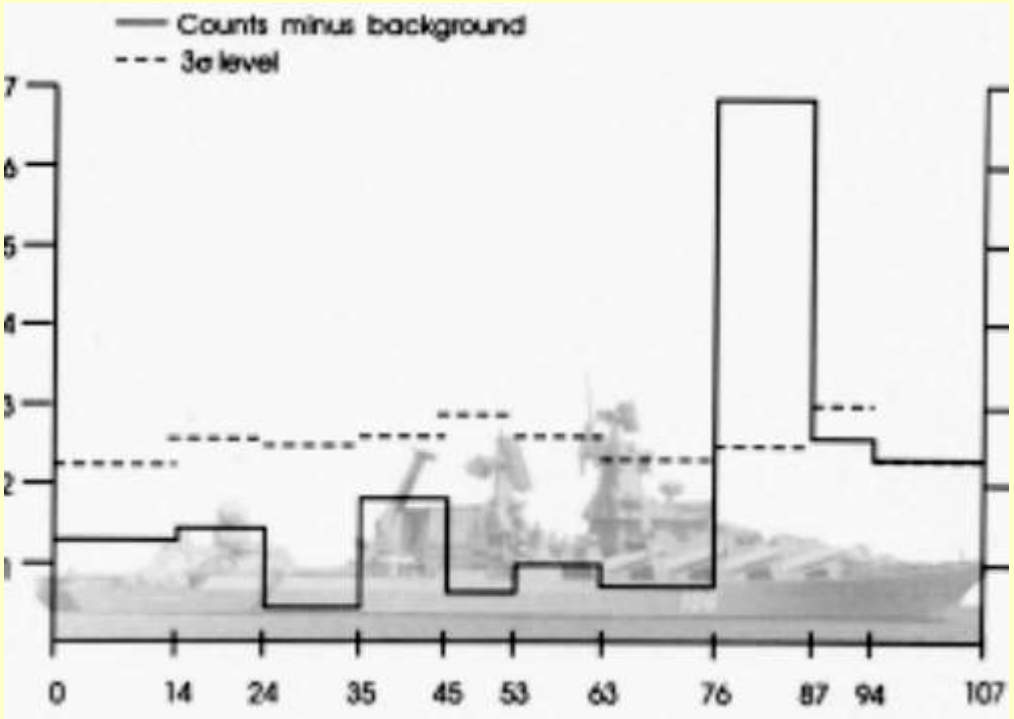
Newspaper «Pravda», 11.07.1989

Detector helicopter over the missiles

Missile cruiser "Slava"

Scientific leader — V.G. Baryshevsky

HISTORY: Nuclear weapon detection



President Larry D. Welch welcoming Vladimir Baryshevsky to the Institute for Defense Analyses.

ВЕСТНИК АГЕНТСТВА ПЕЧАТИ НОВОСТИ

№ 153 (6998) 8 августа 1989 года

СПЕЦИАЛЬНЫЙ ВЫПУСК

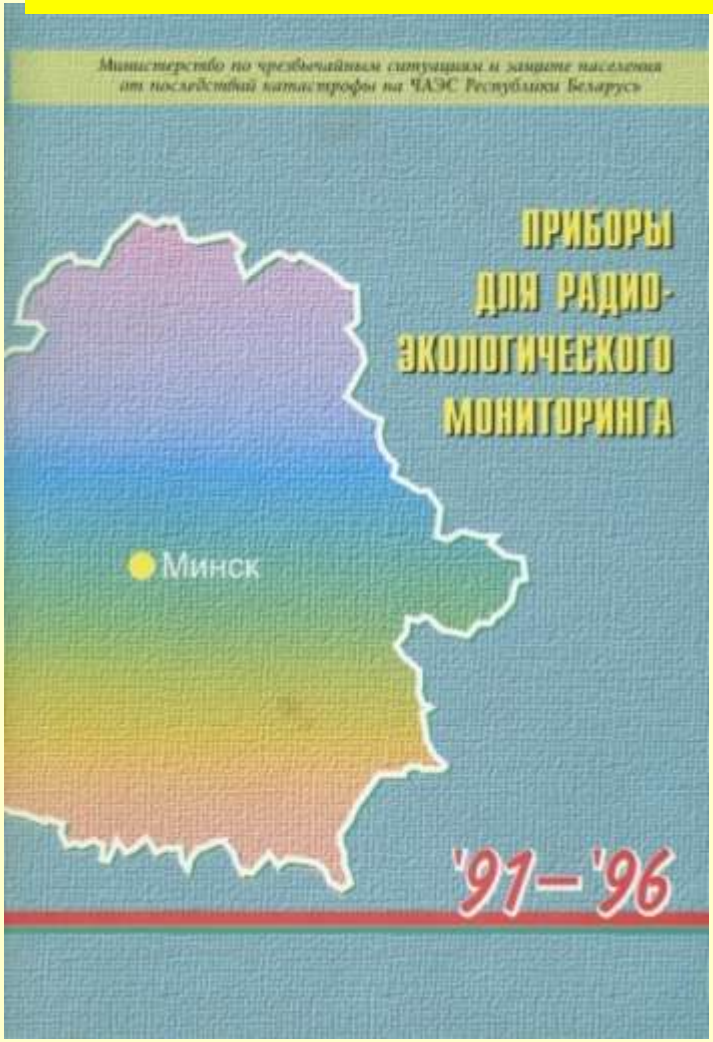
ЯДЕРНОЕ ОРУЖИЕ НА БОРТУ КОРАБЛЯ: МОЖНО ЛИ ЕГО СКРЫТЬ ОТ КОНТРОЛЯ?

Недавно в Ялте был проведен совместный неправительственный советско-американский эксперимент по дистанционному контролю за наличием ядерного оружия на борту военного корабля. В его организации приняли участие ученые Академии наук СССР и Национального совета по защите природных ресурсов (НСЗПР) США.

HISTORY: Radioactive contamination monitoring after Chernobyl accident 1991-1995

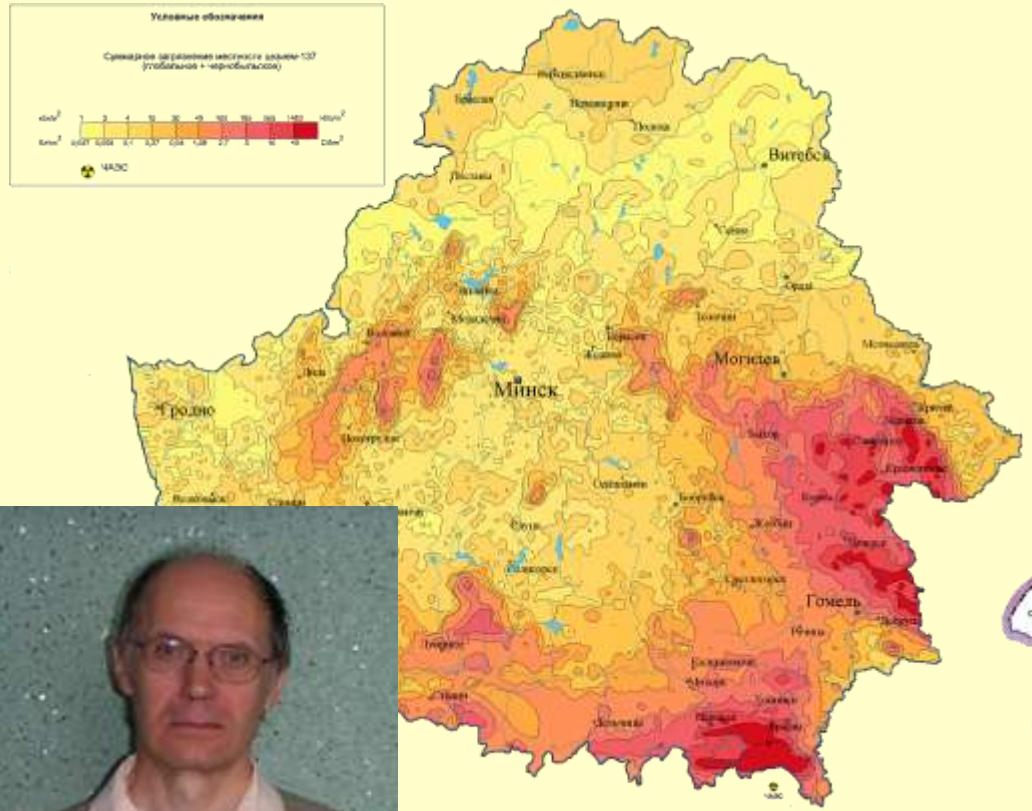
Scientific leaders — S.A. Kuten, A. Grubich

INP BSU was the head executive organization on the State Technical Program for development and implementation of methods and hardware tools for radiation and environmental safety.



Radioactive contamination monitoring after Chernobyl accident

Scientific leader — S.A. Kuten



Map of Cs-131 contamination in Belarus in 1986 and 2016

Expert examination of radiation safety of X-ray sources

INP BSU was granted a special permit (license) to perform expert evaluations of organizations and institutions for the work with ionizing radiation sources.

The expert examination is organized in the Laboratory of nuclear spectrometry and expert evaluation of radiation safety. The five INP BSU associates were certified for the security expertise work.

Dr Sci
Alexander Lobko

Igor Shpakovskii & Leonid Rydlevskii

Министерство по чрезвычайным ситуациям Республики Беларусь

СПЕЦИАЛЬНОЕ РАЗРЕШЕНИЕ

(ЛИЦЕНЗИЯ)

№ 33134 /615-4

на право осуществления деятельности в области использования атомной энергии и источников ионизирующего излучения

Выдано Научно-исследовательскому учреждению «Институт ядерных проблем» Белорусского государственного университета»

220030, г. Минск, улица Бобруйская, дом 11, к. 315

Учетный номер плательщика 100013276

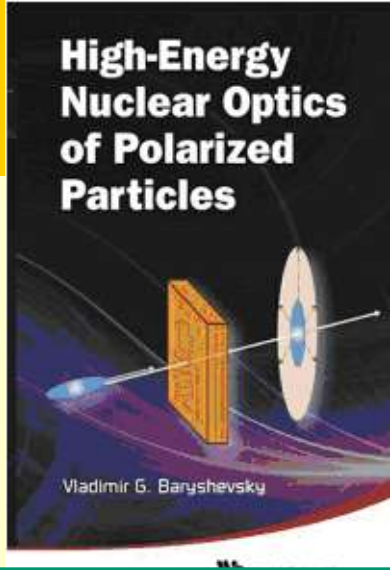
Специальное разрешение (лицензия) выдано на основании решения от 2 мая 2016 г. № 19 км и зарегистрировано в реестре специальных разрешений (лицензий) Департамента по ядерной и радиационной безопасности Министерства по чрезвычайным ситуациям Республики Беларусь за № 615.

Начальник Департамента по ядерной и радиационной безопасности О.М.Луговская

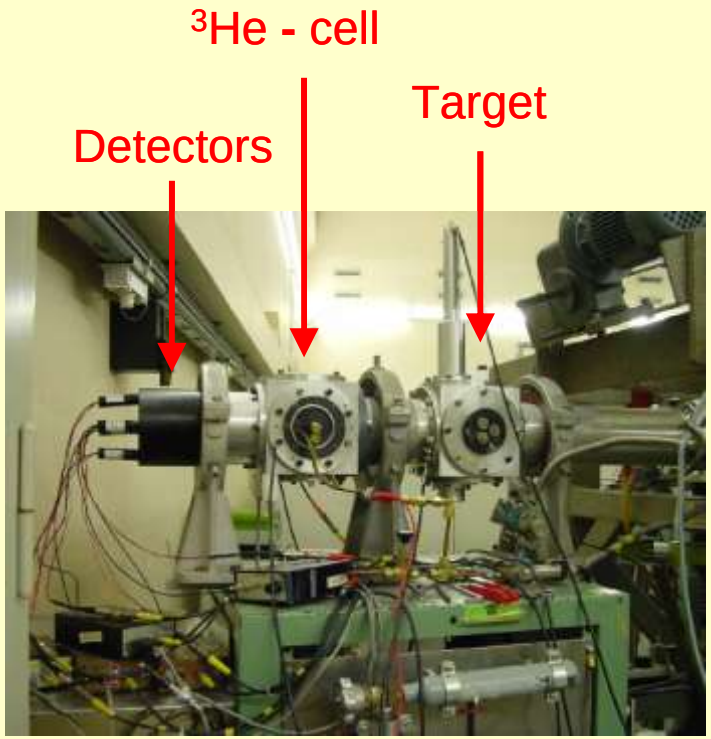
М.П.

Permit No33134/615-4 issued in May 2nd, 2016 by the Department for Nuclear and Radiation Safety of the Ministry for Emergency Situations

Nuclear Optics of Polarized Media

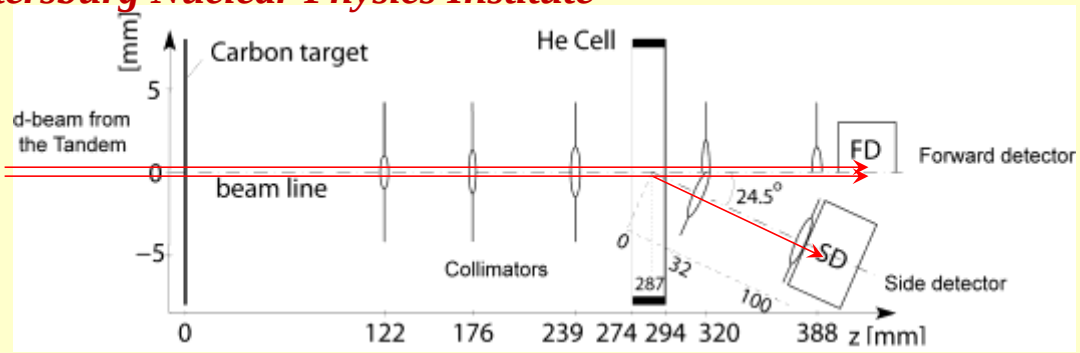


The investigations of nuclear-optical activity of matter were initiated by V. Baryshevsky and M. Podgoretsky (1965). Quasi-optical spin rotation of the neutron moving in matter with polarized nuclei, which is a kinematic analog of optical Faradey effect (effect of light polarization plane rotation), was predicted. For particles with spin 1 the quasi-optical birefringence effect could also be observed (Baryshevsky 1992)



First observation of spin dichroism with deuterons up to 20 MeV in a carbon target at Cologne tandem accelerator

INP BSU,
Institut für Kernphysik, Forschungszentrum Jülich,
Institut für Kernphysik, Universität zu Köln
Petersburg Nuclear Physics Institute

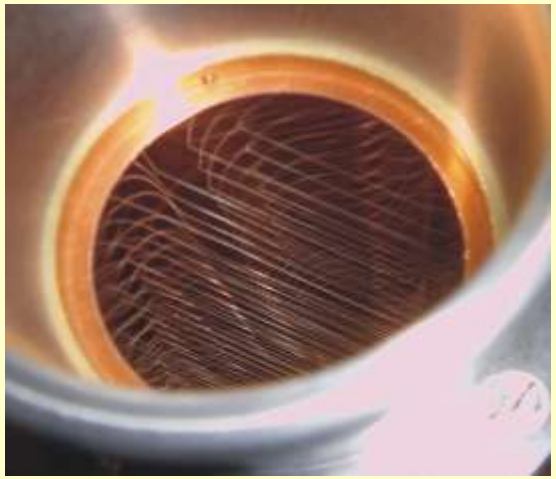


LANL : hep-ex/0501045

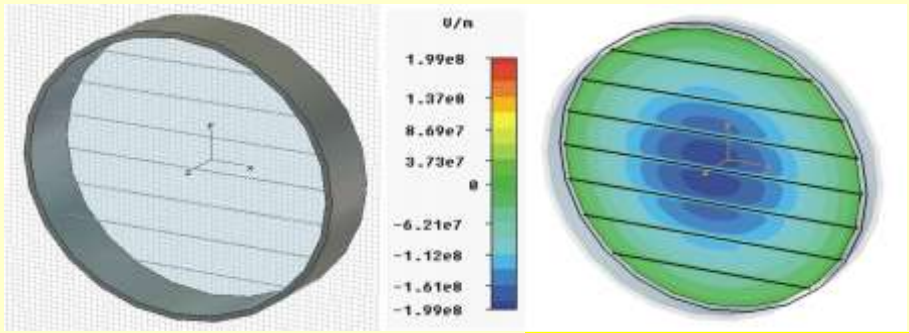
Proc. SPIN2006, New York, Melville, 2007. Vol. 915. P. 777.

Volume Free Electron Laser (VFEL)

Generation of Volume Free Electron Laser on photonic crystals was observed firstly in 2001



Grid resonator with photonic crystal



Scientific leader — V.G. Baryshevsky

High-power radiation sources

Development of high-power radiation sources from X-ray and gamma range to optical and microwave ones on the basis of high- current and high-voltage particle accelerators. Experimental prototype of virtual cathode oscillator provides 200 MW peak output power in frequency range from 2.5 to 5 GHz. Operating at voltage as low as 350-450 kV such a microwave source is unique.

Experimental prototype of virtual cathode oscillator provides 200 MW peak output power in frequency range from 2.5 to 5 GHz

Scientific leader — V.G. Baryshevsky

STATE PRIZE in SCIENCE and TECHNOLOGY 2002

Prof. V.G. Baryshevsky

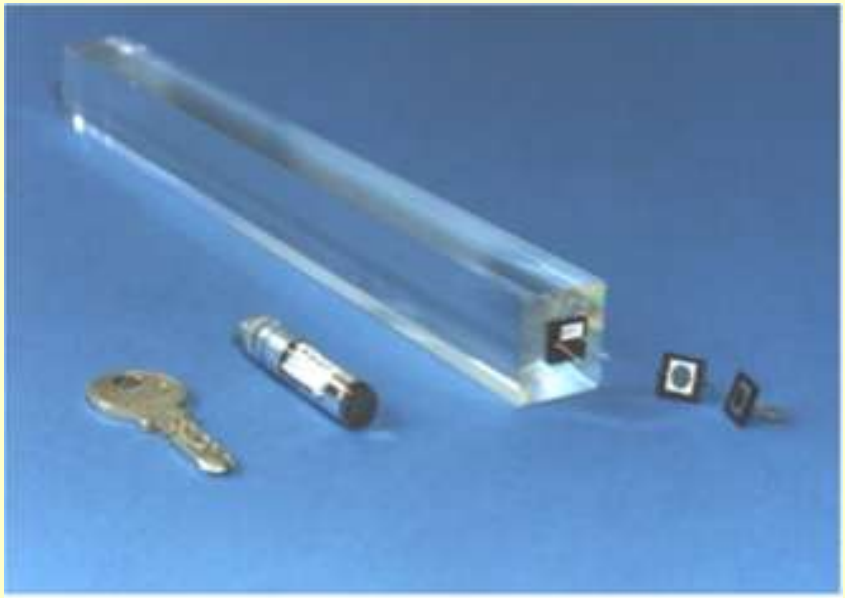
Prof. V.V. Tikhomirov

Prof. I.D. Feranchuk, BSU,
INP Council Member

Detectors of ionizing radiation for science, medicine, and industry

Scientific leader — M.V. Korzhik

Lead tungstate scintillation crystals (PWO) was chosen as basic material for development of electromagnetic calorimeters (ECAL) of collaborations CMS and ALICE (CERN), PANDA (GSI, Darmstadt)



The PWO crystal is a high density, fast and radiation hard scintillation material.
CMS ECAL made of PWO in 2011 showed promising results towards to discovery of the *Higgs* boson

CONGRATULATIONS!

INP BSU laboratory head **Dr. Sci. Mikhail Korzik** won the RF Government megagrant “New generation of scintillating materials and detectors for the neutron registration in a wide energy range”. Sept. 2016

ПОЗДРАВЛЯЕМ !

Зав. лабораторией НИИ ЯП БГУ **Коржика Михаила Васильевича** с победой в конкурсе «**мегагрантов**» Правительства РФ для господдержки научных исследований, проводимых под руководством ведущих учёных в российских образовательных организациях высшего образования, научных учреждениях и государственных научных центрах Российской Федерации
Тема проекта: *Новое поколение сцинтилляционных материалов и детекторов на их основе для регистрации нейтронов в широком энергетическом диапазоне*
Принимающая организация: *федеральное государственное бюджетное учреждение "Национальный исследовательский центр "Курчатовский институт"*

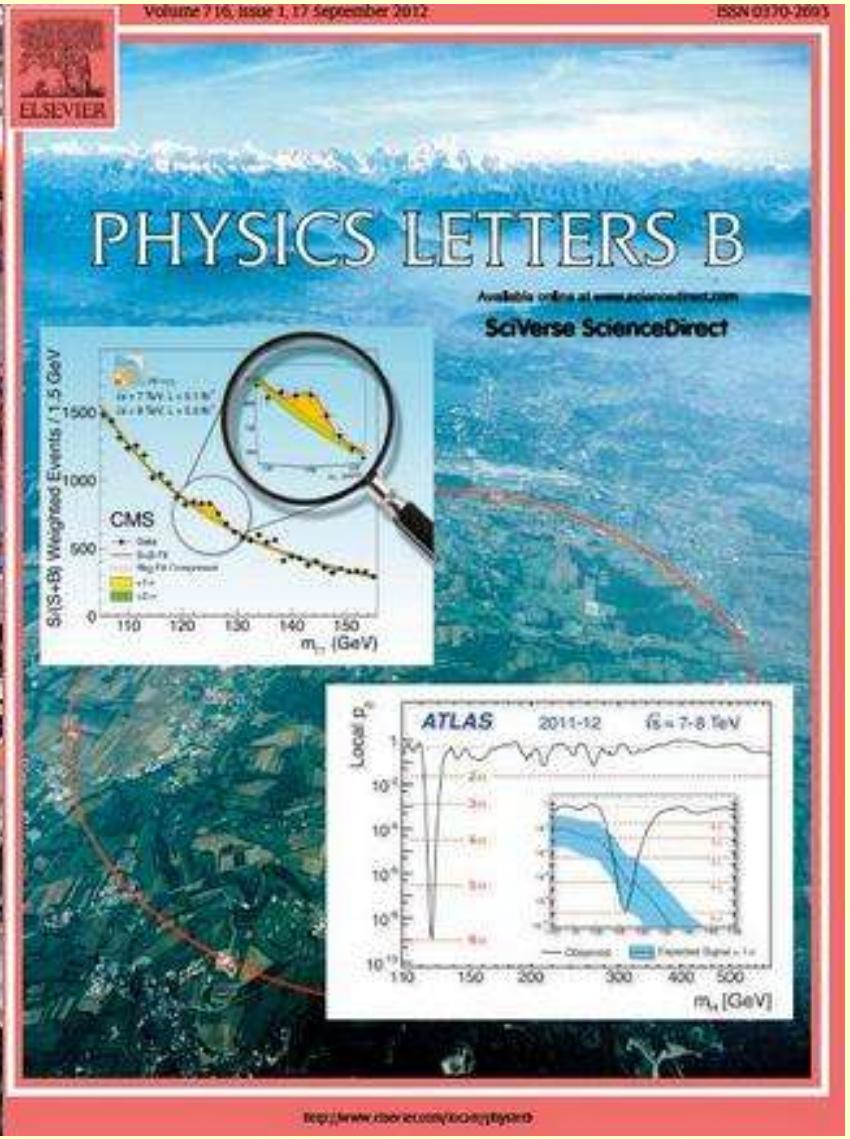
CMS Experiment at CERN

Prof. Nikolai Shumeyko

2002, CERN. Installation of CMS end-cap hadron calorimeter absorber

Dr. Juan Suarez, Representative of Belarus in CMS

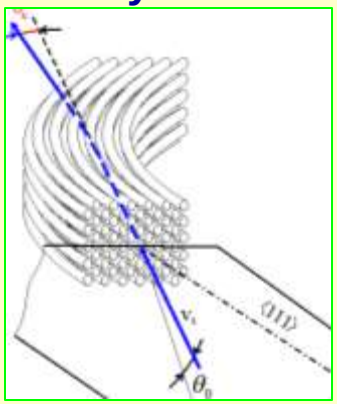
Higgs boson discovery: 14 co-authors from INP

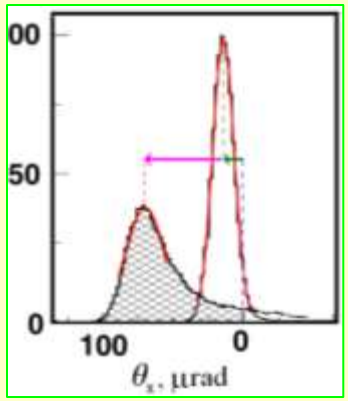


The Higgs boson discovery publications in journals Science and Physics Letters B

Particles and high energy physics

In cooperation with Ferrara University and Istituto Nazionale di Fisica Nucleare (Italy), effect of multiple volume reflection of high-energy particles by different bent planes of a single crystal theoretically has been predicted by INP scientists and experimentally observed at CERN.





PRL **112,** 135503 (2014) PHYSICAL REVIEW LETTERS

Steering of a Sub-GeV Electron Beam through Planar Channeling Enhanced by Rechanneling

A. Mazzolari, E. Bagli, L. Bandiera, and V. Guidi*
INFN Sezione di Ferrara, Dipartimento di Fisica e Scienze della Terra, Ferrara Via Saragat 1, 44100 Ferrara, Italy

H. Backe and W. Lauth
hysik der Universität Mainz, Fachbereich Physik, und Informatik, D-55099 Mainz, Ger

V. Tikhomirov
for Nuclear Problems, Belarusian Stat kaya street, 11, Minsk 220030, Belar

. Berra, D. Lietti, and M. Prest
ggio 11, 22100 Como, Italy and INFN a della Scienza 3, 20126 Milano, Italy

E. Vallazza
di Trieste, Via Valerio 2, 34127 Trie

D. De Salvador

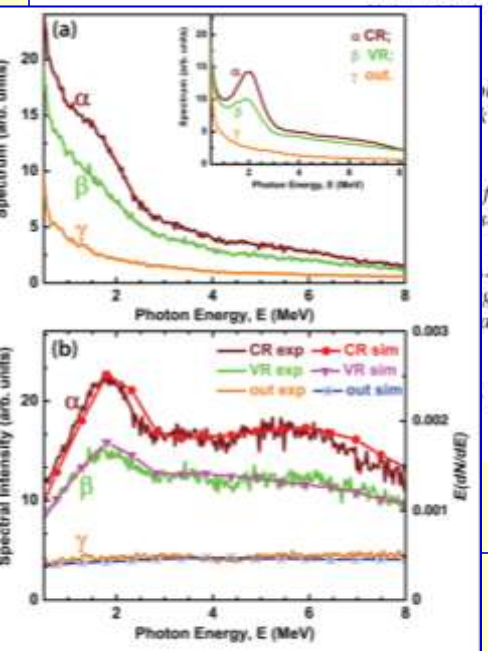


FIG. 2 (color online). (a) Experimental radiation spectra (solid lines) for the cases of channeling ($\theta_{in} = 0$ μrad, α), VR ($\theta_{in} = 493$ μrad, β), and far from (111) bent planes ($\theta_{in} = 8726$ μrad, γ). Beam-off background has been subtracted.

PRL **115,** 025504 (2015) PHYSICAL REVIEW LETTERS week ending 10 JULY 2015

Investigation of the Electromagnetic Radiation Emitted by Sub-GeV Electrons in a Bent Crystal

L. Bandiera, E. Bagli, G. Germogli, V. Guidi,* and A. Mazzolari
INFN Sezione di Ferrara and Dipartimento di Fisica e Scienze della Terra, Università degli Studi di Ferrara Via Saragat 1, 44122 Ferrara, Italy

H. Backe and W. Lauth
Institut für Kernphysik der Universität Mainz, Fachbereich Physik, Mathematik und Informatik, D-55099 Mainz, Germany

A. Berra, D. Lietti, and M. Prest
Università degli Studi dell'Insubria, Via Valleggio 11, 22100 Como, Italy and INFN Sezione di Milano Bicocca, Piazza della Scienza 3, 20126 Milano, Italy

D. De Salvador
INFN Laboratori Nazionali di Legnaro, viale dell'Università 2, 35020 Legnaro, Italy and Dipartimento di Fisica, Università Di Padova, Via Marzolo 8, 35131 Padova, Italy

E. Vallazza
INFN Sezione di Trieste, Via Valerio 2, 34127 Trieste, Italy

V. Tikhomirov

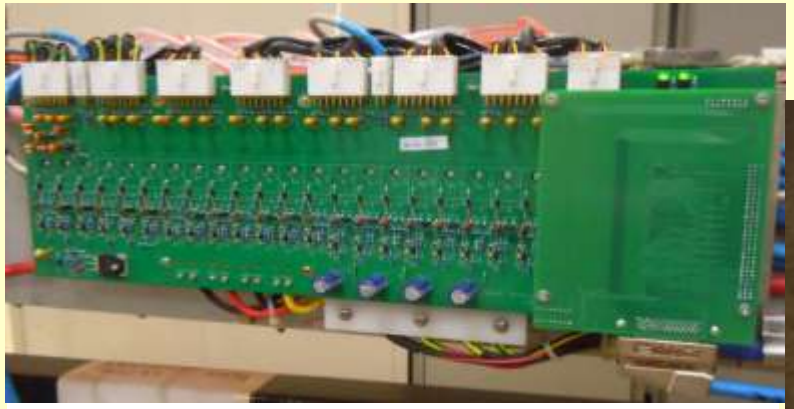
Nuclear Electronics

Vladimir Tchekhovski

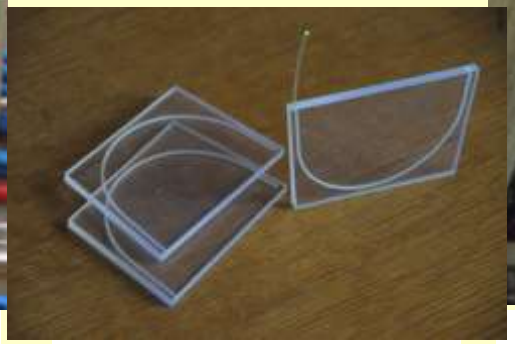
- Development, manufacture support and testing of application-specific analog and mixed-signal IC for nuclear electronics, radio-electronic and electronic measuring equipment
- Development of electronic components and assemblies for the experimental equipment used in modern particle physics experiments
- Development and prototyping of specialized control and measurement electronics for testing IC and modern element base.

Igor Emeliantchik

Dr. Michail Batouritski



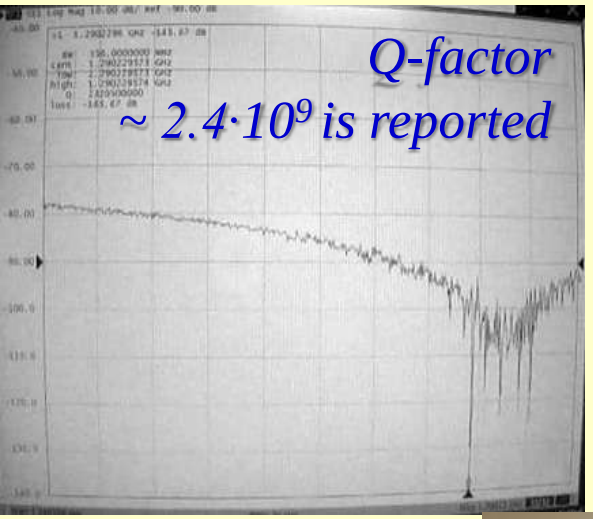
Electronic module for low voltage power supply system of CMS muon detecror



Active elements of the end-cap hadron calorimeter in the CMS experiment

32-channel plates installed in mini-drift tubes of the D0 forward muon system

Single-Cell Superconducting niobium Cavities for Linear Accelerators of Electrons and Positrons



- *Joint Institute of Nuclear Research*
- *INP BSU*
- *Scientific And Practical Materials Research Center, NAS Belarus*
- *Physical-Technical Institute, NAS Belarus*

INTERNATIONAL COOPERATION in HEP

According to the contract with State Committee on Science and Technology of the Republic of Belarus (SCST) the **Institute is responsible for the organizational support for scientific research carried out in the Joint Institute for Nuclear Research (Dubna**) with the participation of organizations and institutions of the Republic of Belarus.

The institute takes active part in huge international experimental collaborations in the field of high energy physics:

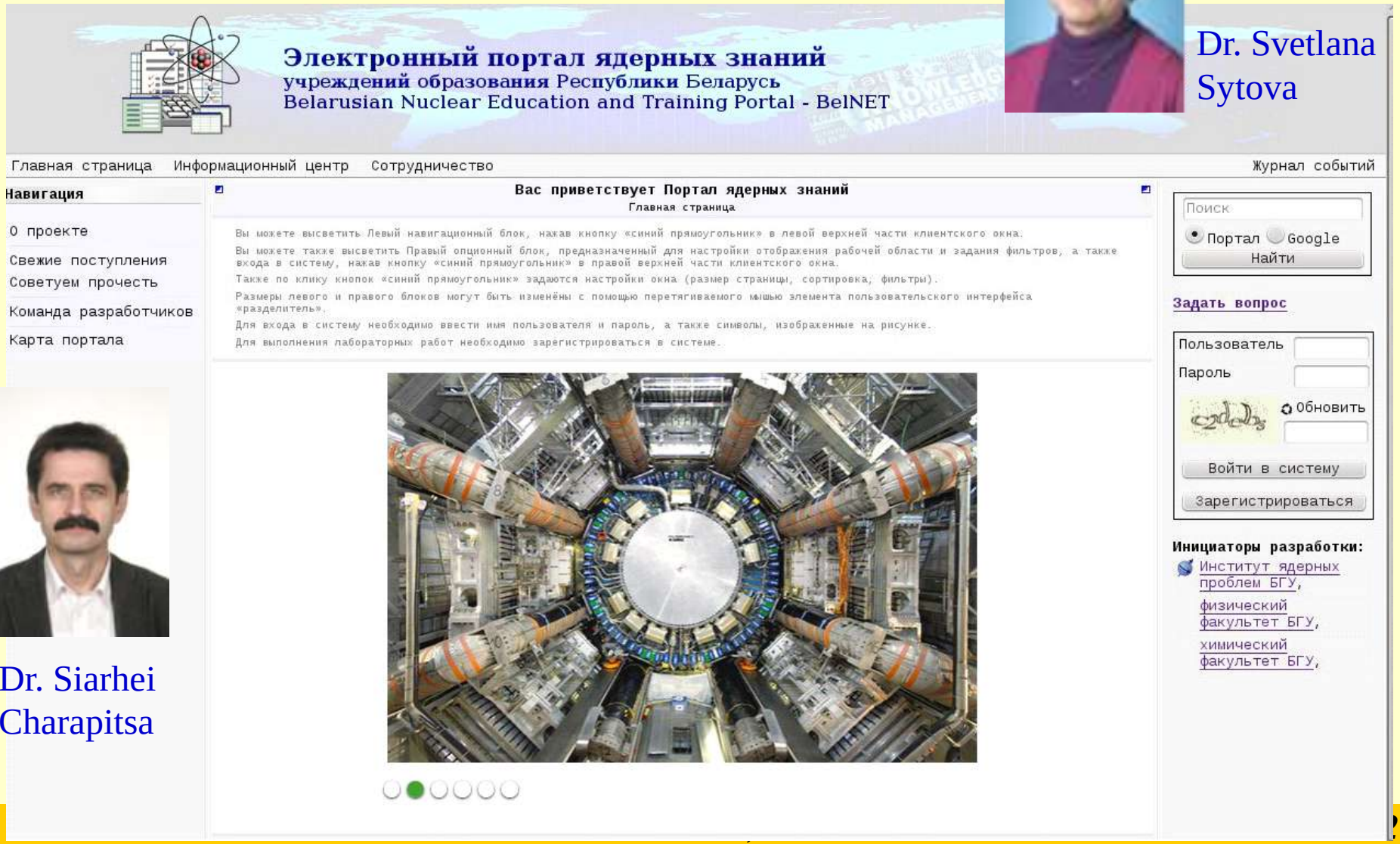
- **CMS, ATLAS, FCC, CLICdp** (CERN, Switzerland)
- **JINR** (Dubna Russia)
- **EDM** Collaboration (Brookhaven USA)
- **PANDA** (GSI Germany)
- **COSY** (Julich Germany)
- **LAPP** (Annecy France)
- **FCAL** (Europe)

Belarusian Nuclear Education and Training Portal - BelNET

http://lar.inpnet.net/el/belnet/

Dr. Svetlana Sytova

Dr. Siarhei Charapitsa



HF-systems and components

Dr. Victor Karpovich

Equipment for neutralization of the dangerous medical waste

Microwave sterilization and drying of foodstuff and materials

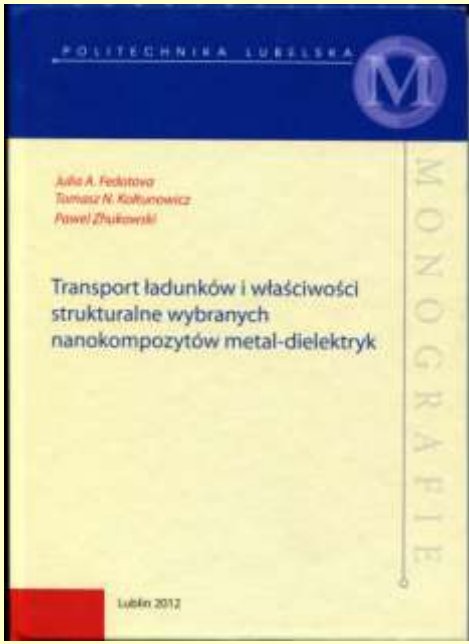
Presowing biophysical treatment of agricultural seeds

NANO Research

Dr. Sci.
Julia Fedotova

Design and fabrication of nanostructured magnetic materials:

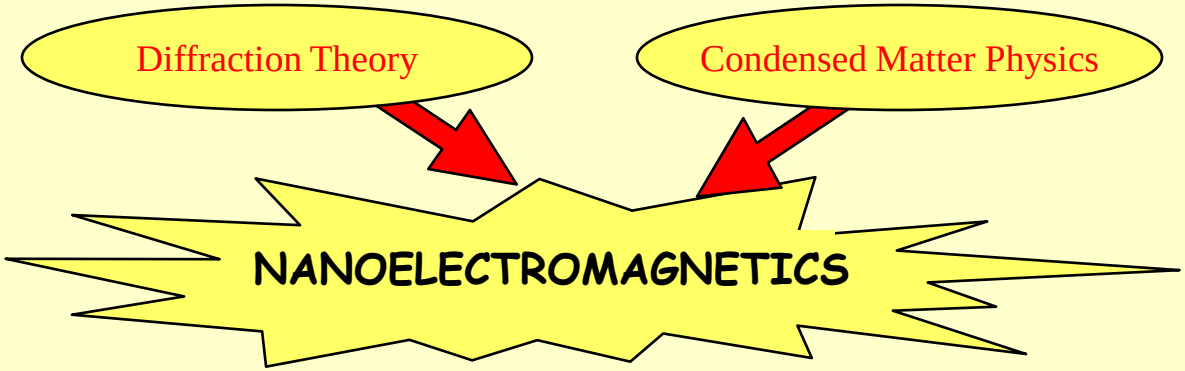
- multilayered 3d-metal – Pt, Pd/CoO, IrMn thin films with patterned structure,
- granular metal-insulator films 3d-metal –Al_2O_3, PZT, CaF_2,
- core-shell" nanoparticles 3d-metal – Pt, Pd, Au, Ag,
- magnetic nanoparticles on graphene.

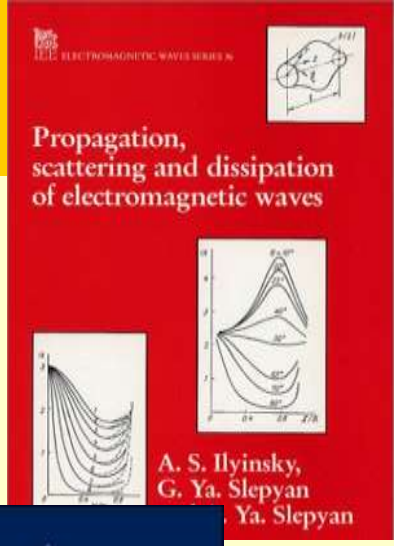


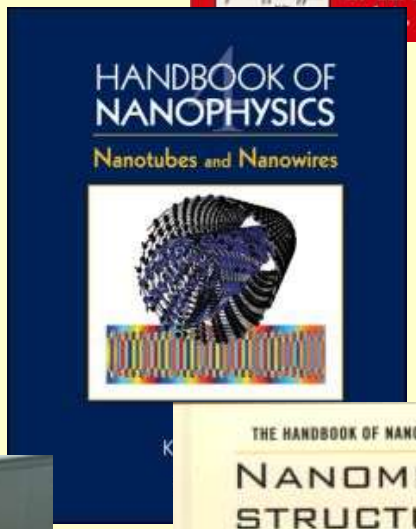
Mössbauer spectrometer with closed cycle refrigerator

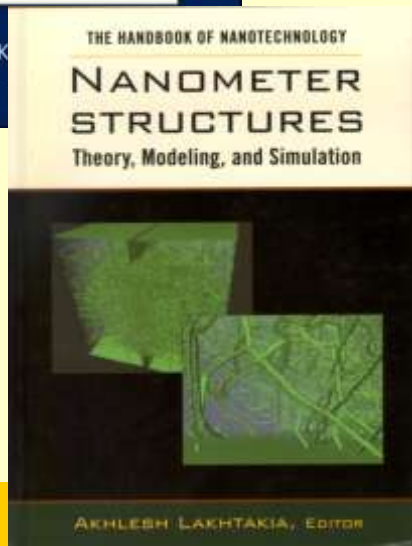
Nanoelectromagnetics

A research discipline studying the behaviour of high-frequency electromagnetic radiation on nanometer scale is currently emerging as a synthesis of macroscopic electrodynamics and microscopic theory of electronic properties of different nanostructures









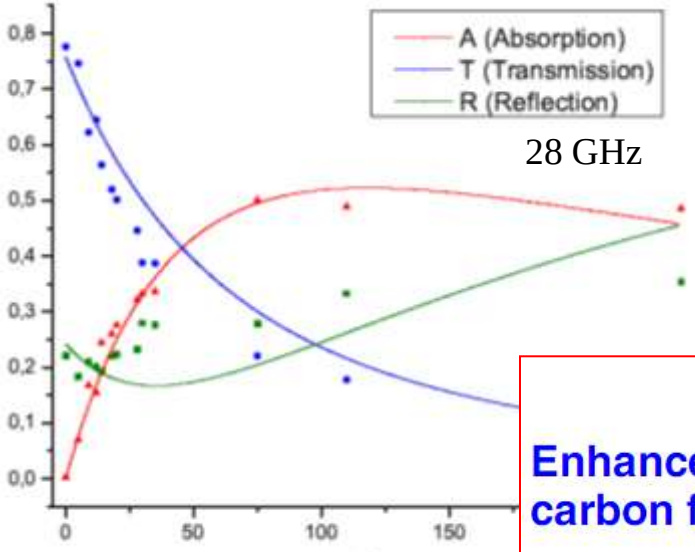
Prof. G. Slepyan,
Tel Aviv University

Prof. S. Maksimenko,
SPIE Fellow

Dr P. Kuzhir

Graphene-like Thin Films in Microwaves

Graphene-like films being 100-1000 times thinner than skin depth provide reasonably high EM absorptive properties in microwaves



SCIENTIFIC REPORTS

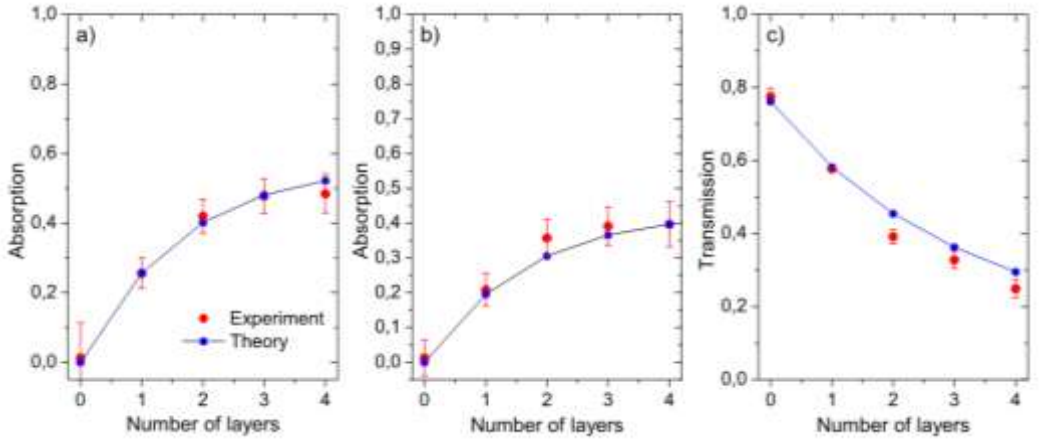
Art. No 7191, 2014

OPEN

SUBJECT AREAS:
GRAPHENE
ELECTRONIC PROPERTIES AND DEVICES
NANOSCALE MATERIALS

Flexible transparent graphene/polymer multilayers for efficient electromagnetic field absorption

K. Batrakov[1], P. Kuzhir[1], S. Maksimenko[1], A. Paddubskaya[1], S. Voronovich[1], Ph Lambin[2], T. Kaplas[3] & Yu Svirko[3]



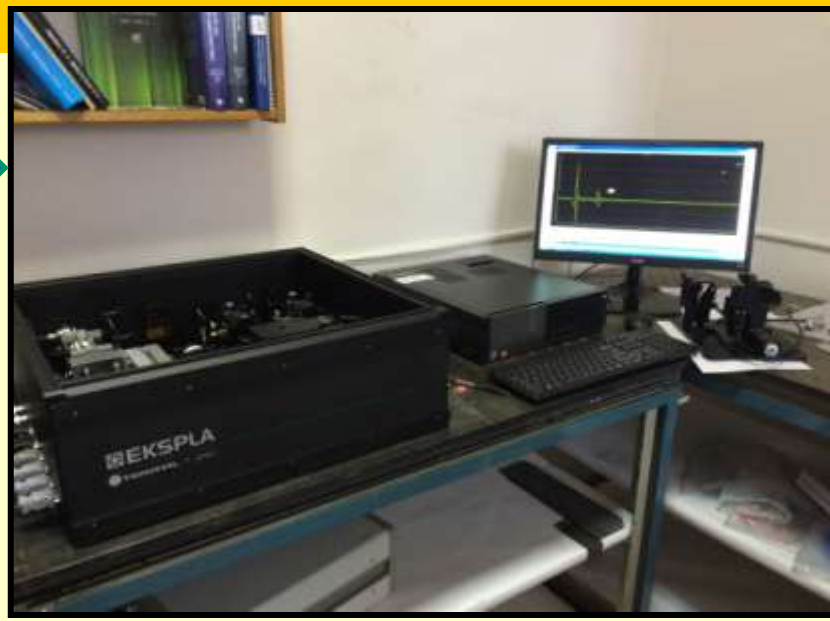
APPLIED PHYSICS LETTERS 103, 073117 (2013)

Enhanced microwave shielding effectiveness of ultrathin pyrolytic carbon films

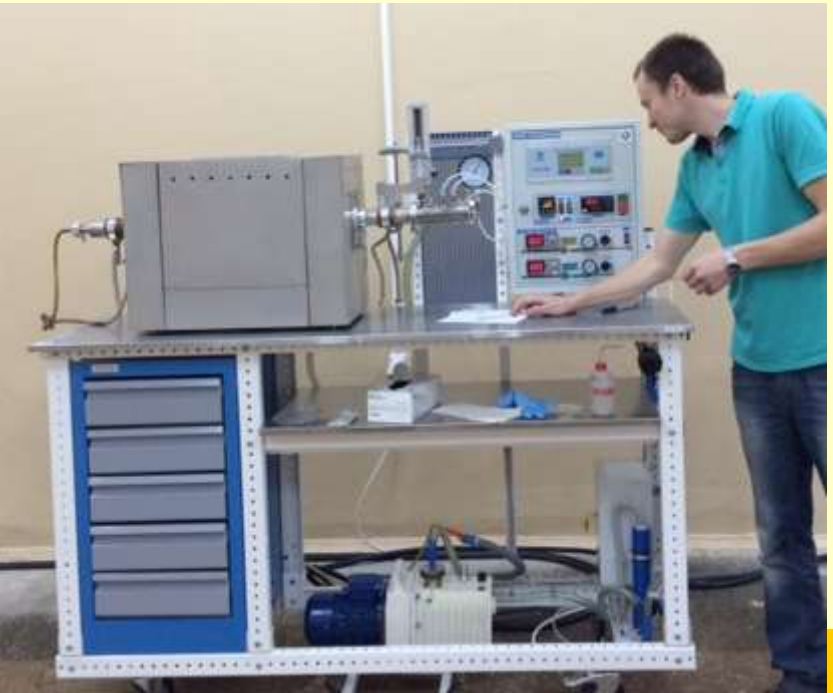
K. Batrakov,[1,a),b)] P. Kuzhir,[1,b),c)] S. Maksimenko,[1] A. Paddubskaya,[1] S. Voronovich,[1] T. Kaplas,[2] and Yu. Svirko[2]

NANOCARBON Fabrication and EM Study

THz range spectrometer (EKSPLA, Lithuania)



CVD fabrication of MWCNTs & GNP



Nanoelectromagnetics international projects

Institutional Development of Applied Nanoelectromagnetics: Belarus in ERA Widening
FP7-266529 BY-NanoERA

Collective Excitations In Advanced Nanostructures
Horizon 2020 - 644076
CoExAN

Graphene/polymer based flexible transparent EM shielding for GHz and THz applications

GRAPHENE FLAGSHIP

FP7- 604391, H2020-649953

Nanosized Cherenkov-type THz light emitter based on double-walled carbon,
CRDF # AF20-15-61804-1

Carbon-nanotube-based terahertz-to-optics rectenna
FP7-612285 CANTOR

Nanocarbon based components and materials for high frequency electronics
FP7-247007 CACOMEL

Terahertz applications of carbon-based nanostructures
FP7-230778 TERACAN

Nanocarbon based composite materials for electromagnetic Applications
ISTC B-1708

Nano-Thin and Micro-Sized Carbons: Toward EMC Application
FP7-610875 NAMICEMC

Fundamental and Applied Electromagnetics of Nano-Carbons
FP7- 318617 FAEMCAR

New!

Multifunctional Graphene-based Nanocomposites with Robust Electromagnetic and Thermal Properties for 3D-printing Application
Horizon 2020 734164 Graphene 3D

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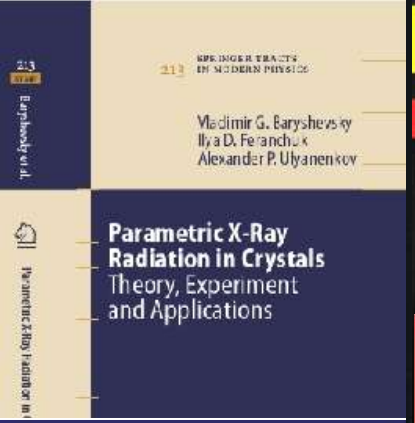
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SPRINGER TRACTS IN MODERN PHYSICS
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Ilya D. Feranchuk
Alexander P. Ulyanenkov
Parametric X-Ray Radiation in Crystals
Theory, Experiment and Applications


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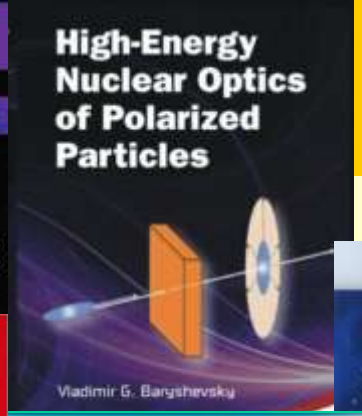
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Vladimir G. Baryshevsky


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Optimisation des paramètres de scintillation des cristaux de tungstate de plomb pour leur application dans la calorimétrie électromagnétique


А. С. Лобко
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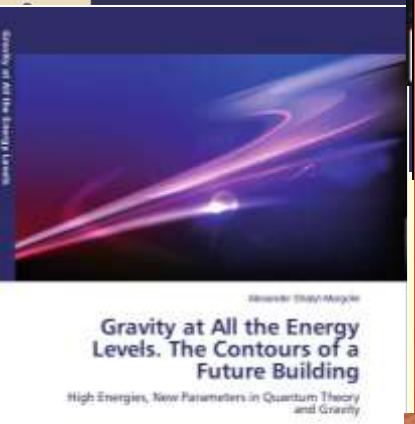
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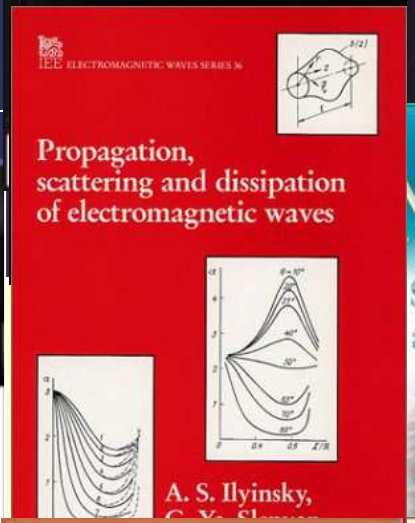
High Energies, New Parameters in Quantum Theory and Gravity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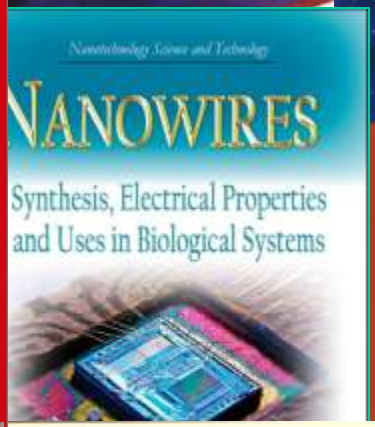
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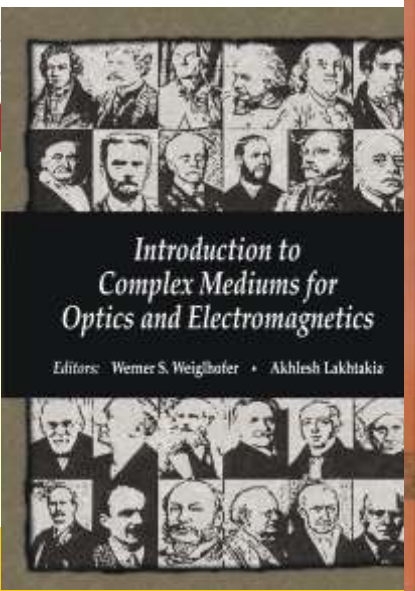
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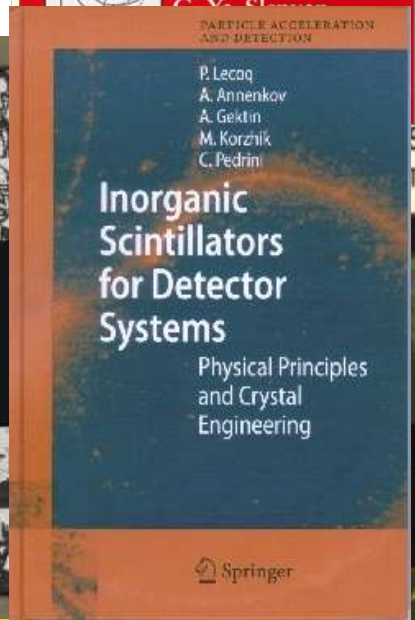
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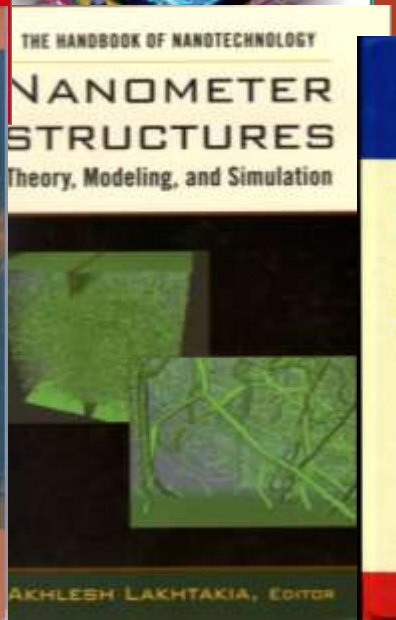
THE HANDBOOK OF NANOTECHNOLOGY
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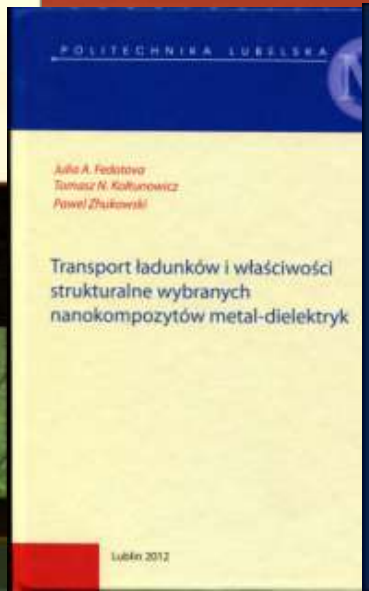
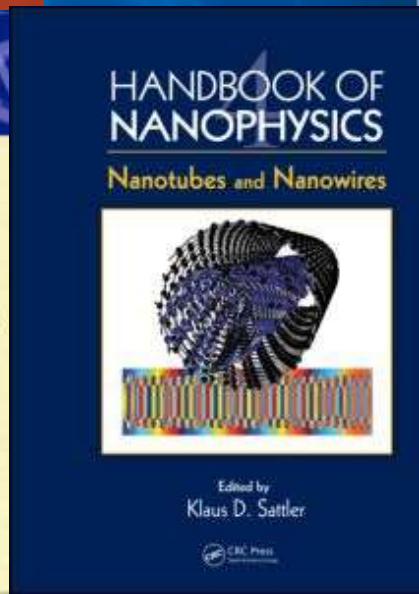

POLITECHNIKA LUBELSKA
Julia A. Fedotova
Tomasz N. Koltunowicz
Paweł Zhukowski
Transport ładunków i właściwości strukturalne wybranych nanokompozytów metal-dielektryk
Lublin 2012


HANDBOOK OF NANOPHYSICS
Nanotubes and Nanowires
Edited by
Klaus D. Sattler
CRC Press

Organization of international schools, seminars and conferences

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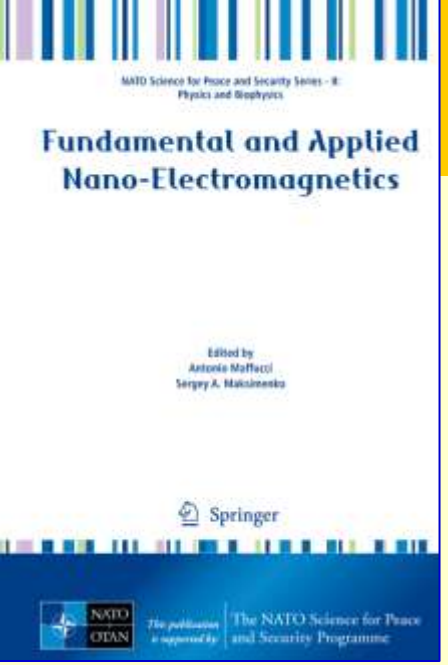
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Edited by
Antonio Maffucci
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Fundamental and Applied NanoElectroMagnetics
FANEM' 12
25th anniversary of the Research Institute for Nuclear Problems BSU
2nd Call for Papers
Belarusian State University, Minsk, Belarus, May 22-25, 2012
EU FP7 Project № 266529 BY-NanoERA, ISTC project B-1708


NATO Advanced Research Workshop
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Fundamental and Applied NanoElectroMagnetics
Belarusian State University, Minsk, Belarus, May 25-27, 2015
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Modern nuclear methods in condensed matter physics

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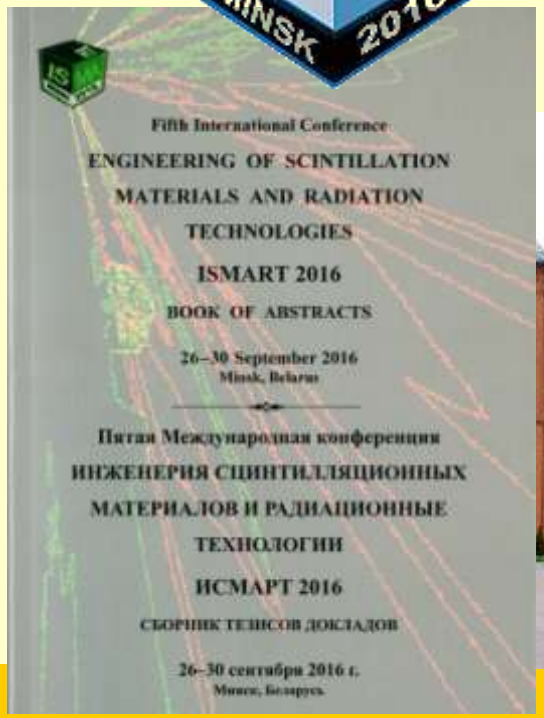

International schools, seminars and conferences

Workshop Belarus - CERN Minsk, NC PHEP, May 14, 1996

Minsk 2014, International meeting on novel resonator technologies for future linear colliders

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