International Student Practice at JINR
September 9, 2015
Joint Institute for Nuclear Research

JINR is an International Intergovernmental Organization located in Dubna, Russian Federation, about 120 km north of Moscow.

DUBNA – island of stability
Agreement between RSA and JINR

An agreement between RSA and JINR was signed on October 5, 2005 in Moscow.

One of the first projects supported by the RSA DST in the framework of this Agreement was the organization the student practices at JINR, which were organized already eight times starting from 2007.

Our main goal now is to create conditions for long-term placement programme for SA young scientists.
Practice 2007
December 9-18, 2007

23 students from 8 universities of the RSA came to Dubna for the Practice for the first time in December, 2007.
Brief history
of JINR Educational Programs

- 1956 – JINR is established
- 1961 – Moscow State University branch is organized in Dubna (D.I.Blokhintsev, V.I. Veksler and S.N.Vernov)
- 1991 – JINR University Centre is established
- 1995 – JINR’s PhD program is opened
- 1994 – Dubna International University (DIU) is founded
- 2003 – education program in physics is started at DIU
- 2004 – International Summer Practices are started
- 2014 – Summer Students Program at JINR is started
- 2014 – Scientific-engineering group of UC is created
Main directions of UC activity

• Students, JINR-based departments
• JINR postgraduate programmes
• International education actions
• Secondary-school oriented activity
• Student laboratory infrastructure
STUDENTS at JINR
## JINR-based departments

<table>
<thead>
<tr>
<th>Moscow State University</th>
<th>Dubna International University</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Elementary Particle Physics</td>
<td>- Nuclear Physics</td>
</tr>
<tr>
<td>- Neutron physics</td>
<td>- Theoretical Physics</td>
</tr>
<tr>
<td>- Fundamental and Applied Problems of Micro-world Physics</td>
<td>- Biophysics</td>
</tr>
<tr>
<td>- Experimental methods of nuclear physics</td>
<td>- Distributed Computing Systems</td>
</tr>
<tr>
<td></td>
<td>- Nanotechnologies and New Materials</td>
</tr>
<tr>
<td></td>
<td>- Personal Electronics</td>
</tr>
<tr>
<td></td>
<td>- Electronics for Physics Research Installations</td>
</tr>
</tbody>
</table>
Efficiency of training programs

Comparison of the number of senior students to the number of students employed by JINR after graduation

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of senior students</th>
<th>Number of students employed by JINR after training</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>215</td>
<td>16</td>
<td>7%</td>
</tr>
<tr>
<td>2010</td>
<td>228</td>
<td>29</td>
<td>13%</td>
</tr>
<tr>
<td>2011</td>
<td>287</td>
<td>39</td>
<td>14%</td>
</tr>
<tr>
<td>2012</td>
<td>242</td>
<td>54</td>
<td>22%</td>
</tr>
<tr>
<td>2013</td>
<td>248</td>
<td>42</td>
<td>17%</td>
</tr>
<tr>
<td>2014</td>
<td>220</td>
<td>43</td>
<td>20%</td>
</tr>
</tbody>
</table>
TRAINING PROGRAMS

• Lecture courses at JINR-based departments
• Training on the modern physical installations
• HEP data analysis and engineering training programs

LECTURE COURSES

• particle physics and quantum field theory – 24
• mathematical and statistical physics – 7
• condensed matter, physics of nanostructures and neutron physics – 16
• informational technologies – 8
• nuclear physics – 19
• physical equipments – 7
Training course in CATIA-GDML Geometry Builder

This training was organized in collaboration with Research Center FAIR-Russia of the Facility for Antiproton and Ion Research in Europe GmbH
# Nuclear Knowledge Base

**http://nrv.jinr.ru/**

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### Nuclear Properties

<table>
<thead>
<tr>
<th>Nuclear Map</th>
<th>Nuclear Models</th>
<th>Nuclear Decays</th>
<th>Nuclear Reactions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Shell Model</td>
<td>Alpha-decay</td>
<td>Elastic scattering</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Classical</td>
</tr>
<tr>
<td></td>
<td>Liquid Drop Model</td>
<td>Beta-decay</td>
<td>Inelastic Scattering</td>
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<tr>
<td></td>
<td>Two-Center Shell Model</td>
<td>Fission</td>
<td>Transfer reactions</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Direct process (DWIA)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Channel Coupling</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3-body classical model</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Two-mass transfer</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Mixture transition</td>
</tr>
</tbody>
</table>

### Nuclear Properties (Continued)

<table>
<thead>
<tr>
<th>Decay of excited nuclei</th>
<th>Break-up reactions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Direct process (DWIA)</td>
</tr>
<tr>
<td></td>
<td>3-body classical model</td>
</tr>
<tr>
<td></td>
<td>Sequential decay</td>
</tr>
</tbody>
</table>

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All resources of the NRV Knowledge Base are free to use. We, nevertheless, need a support of our project by official establishment for further development of it. New models of nuclear dynamics and much more experimental data on nuclear reactions have to be included. If you get useful results, please quote the NRV in your papers and talks. In a case of elastic scattering, for example, appropriate reference could be V.I. Zagrebaev et al., OM code of NRV, http://nrv.jinr.ru/nrv/, and so on.
JINR PhD program
JINR postgraduate programmes

- Nuclear and Elementary Particle Physics;
- Theoretical Physics;
- Charged Particle Beam Physics and Accelerator Techniques;
- High Energy Physics;
- Solid State Physics;
- Physics Experiment Techniques, Instrument Physics, and Physics Research Automation;
- Computational Mathematics;
- Mathematical and Software Support of Computers, Computational Complexes, and Networks;
- Mathematical Simulation and Numerical Methods;
- Radiobiology.
Provision of training postgraduate students from the JUNR Member States

- according to new Law on Education in RF PhD studies becomes third level of the higher education system

- for PhD students from JINR Member States we propose the system of dual postgraduate studies (sandwich programs)
International Student
Practices, Program
and Schools at JINR
Goals of the Practice

- to give an idea about JINR fields of research
- to get to be acquainted with JINR research teams
- to work on student-research projects at JINR facilities
- to learn new facts in different sciences
- to attract students from different countries to start a scientific career at JINR
Egyptian Ministry of Science opened the Practice for ARE students in 2013
# RESEARCH-EDUCATIONAL PROJECTS AT ISP

@ http:\/\uc.jinr.ru\/

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### Flerov Laboratory of Nuclear Reactions (FLNR)

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A. Artvyukh</td>
<td>Study of the transfer and fragmentation reactions near Fermi energy, Production of exotic nuclei beams</td>
</tr>
<tr>
<td>2</td>
<td>O. Orelvitch</td>
<td>Scanning electron microscopy methods in study of micro objects</td>
</tr>
<tr>
<td>3</td>
<td>V.A. Skuratov</td>
<td>The irradiation testing of nuclear ceramics and oxides with heavy ions of fission fragment energy</td>
</tr>
<tr>
<td>4</td>
<td>V.A. Skuratov</td>
<td>Measurements and analysis of depth-resolved photoluminescence spectra in swift heavy ion bombarded insulators</td>
</tr>
<tr>
<td>5</td>
<td>V.A. Kuzmin</td>
<td>Testing of SRIM 2008 and MSTAR computer codes from the point of view of the reciprocity principle</td>
</tr>
<tr>
<td>6</td>
<td>A.T. Syvirkin</td>
<td>Neutron emission from spontaneous fission of heavy elements at the FLNR</td>
</tr>
<tr>
<td>7</td>
<td>G. Karninski</td>
<td>Neutron detection array based on stilbene scintillators</td>
</tr>
<tr>
<td>8</td>
<td>G. Karninski</td>
<td>Detection of charge particles generated in heavy ions collisions at low energies</td>
</tr>
<tr>
<td>9</td>
<td>A. Derinke</td>
<td>Study of heavy-ion elastic scattering within classical and quantum optical model</td>
</tr>
<tr>
<td>10</td>
<td>L. Krupa</td>
<td>Determination of masses of the super heavy elements in the experiments on synthesis of 112 and 114 elements using the reactions (^{48}\text{Ca} + 238\text{Pu}) and (^{46}\text{Ca} + 234\text{Pu})</td>
</tr>
<tr>
<td>11</td>
<td>L. Krupa</td>
<td>The systematic determination of cross sections for the production of proton-rich evaporation residues near the neutron N=126 shell closure in fusion reactions</td>
</tr>
<tr>
<td>12</td>
<td>L. Krupa</td>
<td>Production and spectroscopic investigation of new neutron-rich isotopes near the neutron N=126 shell closure using the multinucleon transfer reactions</td>
</tr>
<tr>
<td>13</td>
<td>L. Krupa</td>
<td>Monte-Carlo simulation of fusion and multinucleon transfer reactions in the MEDIPIX detector using the GEANT4</td>
</tr>
</tbody>
</table>
| 14  | L. Krupa       | Determination of the fusion cross sections of the 

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### News

**04.09.2015**
The third stage of the International Student Practice in JINR Fields of Research will be held on 7-25
International student practice (ISP) at JINR in 2014

May 18 – June 8: Arabic Republic of Egypt (24 participants)

July 06 - 27: Czech Republic, Poland, Bulgaria, Slovak Republic, Romania (70 participants)

September 8 – 24: South Africa, Belorussia, Serbia (45 participants)
## Statistics of 1st (May-June), 2nd (July) and 3rd (September) Stages

<table>
<thead>
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</tr>
</thead>
<tbody>
<tr>
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<td>16</td>
<td>15</td>
<td>20</td>
<td>15</td>
<td>20</td>
<td>24</td>
<td>26</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td>136</td>
</tr>
<tr>
<td>RSA</td>
<td>23</td>
<td>21</td>
<td>23</td>
<td>29</td>
<td>31</td>
<td>33</td>
<td>26</td>
<td>33</td>
<td>26</td>
<td>33</td>
<td>25</td>
<td>33</td>
<td>219</td>
</tr>
<tr>
<td>Belarus</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>9</td>
<td>12</td>
<td>8</td>
<td>10</td>
<td>8</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>136</td>
</tr>
<tr>
<td>Serbia</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>4</td>
<td>5</td>
<td>12</td>
<td></td>
<td></td>
<td>306</td>
</tr>
<tr>
<td>Cuba</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>306</td>
</tr>
</tbody>
</table>

### Calculation:

- **Azerbaijan**: 32 → 26 + 73 + 33 = 132
- **Romania**: 9 + 13 + 20 + 27 + 26 + 22 + 21 + 24 + 20 + 21 + 23 + 23 = 209
- **Poland**: 11 + 8 + 21 + 27 + 26 + 22 + 21 + 24 + 21 + 20 + 22 + 20 = 243
- **Slovakia**: 4 + 6 + 8 + 3 + 8 + 4 + 4 + 2 + 9 + 10 + 10 = 68
- **Egypt**: 16 + 15 + 20 + 15 + 20 + 24 + 26 = 136
- **RSA**: 23 + 21 + 23 + 29 + 31 + 33 + 26 + 33 + 25 = 219
- **Belarus**: 9 + 12 + 8 + 10 + 8 + 2 = 49
- **Serbia**: 1 + 1 + 1 + 1 + 4 + 5 = 12
- **Cuba**: 136 + 684 + 306 = 1126

**Total**

- **Azerbaijan**: 2
- **Bulgaria**: 25
- **Romania**: 137
- **Slovakia**: 68
- **Egypt**: 136
- **RSA**: 219
- **Belarus**: 49
- **Serbia**: 12
- **Cuba**: 306

**Total** = 1126
2014 Student Practice in JINR
Fields of Research (3rd stage)

Student presentations

1. **Introduction to parallel computing using the MPI technology**
   Students:
   - Mulaudzi Masilu Godfrey (University of Limpopo, SA)
   - Sive Mazwi (University of Western Cape, SA)
   - Thandokazi Mfikoyi (Walter Sisulu University, SA)
   - Marius Hromnik (UCT)
   Supervisors:
   - E. Zemlyanaya, T. Sapochnikova (LIT)

2. **Crystalline structure of manganites and zirconia doped with ceria**
   Students:
   - Nelisiwe Chonco (University of Zululand, Kwa Dlangezwa, SA)
   - Luleka Menzi (University of Fort Hare, Alice, SA)
   Supervisors:
   - Mihail-Liviu Craus, Vitalji Turchenko (FLNP)

3. **Ion Beam Analysis**
   Students:
   - Lukhwa Rendani (Physics Department University of the Western Cape, SA)
   - Nolufundo Sintwa (University of Fort Hare, SA)
   - Sinazo Mselana (University of Fort Hare, SA)
   Supervisor:
   - A.P. Kobzev (FLNP)
Student’s opinion

Daphney Singo,
a PhD student of Stellenbosch University:

"It is the second time that I have participated in such Practice. I specialize in neutron nuclear physics, but this time I have been involved in condensed matter research with neutrons under the supervision by Dr. Alexander Kuklin. I am very much satisfied; I am really impressed by the opportunities the IBR-2 reactor offers for this kind of research.

Thank you very much for all the organizing, the hospitality, the kindness as well as the trouble that you went through to get us all safely to Russia.

We have learned a tremendous amount and had a lot of fun in doing so. We sincerely hope that our paths may cross again in the future.

Thank you! Спасибо!

Stellenbosch University students

Photo credit: J Geyer (Taken one early morning...)
Purpose and Implementation of the Program

Program Purpose

The main purpose of the Summer Student Program at JINR is to attract graduate students from the JINR Member States on a competitive basis to the Institute scientific groups that implement the main JINR research projects.

Program Dates

The Summer Student Program at JINR will be organized in the form of student research projects in the scientific groups and will last from 6 to 8 weeks during the period from June to September of each calendar year.

Program Participants

Participants of the Program may be students finishing third (penultimate) year of bachelor studies, master students or PhD students enrolled in the first year of graduate school, studying at universities and research organizations of the JINR Member States.

Application Procedure

To participate in the selection competition one has to:

• register at the web-page of the Program indicating all necessary contact information;
• fill in the application form in the section "SUMMER PROGRAM - 20**" to participate in the Program of year 20**.
In 2014 we got 30 applications from 9 JINR Member States. 8 students were selected by LHEP and LIT. Their reports are available at the program website.

In 2015 we got 127 applications and 34 students from 11 Member States were selected by 5 JINR laboratories.
### Participants lists

<table>
<thead>
<tr>
<th>Photo</th>
<th>Name / Nationality / University</th>
<th>Supervisor</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Photo" /></td>
<td>Кирилл Виленович Локтаев Russia Объединенный институт атомной энергетики ИАТЭ НИЯУ МИФИ</td>
<td>Максим Викторович Булавин</td>
</tr>
<tr>
<td><img src="image2" alt="Photo" /></td>
<td>İbrahım Mohamed Hany Ahmed Egypt Nuclear &amp; Radiation Engineering Department, Faculty of Engineering, Alexandria University</td>
<td>Georgiy Alexandrovich Chelkov</td>
</tr>
<tr>
<td><img src="image3" alt="Photo" /></td>
<td>Тигран Рафаелович Мурadian Armenia Международный научно-образовательный центр НАН RA</td>
<td>Анатолий Олегович Сидорин</td>
</tr>
<tr>
<td><img src="image4" alt="Photo" /></td>
<td>Анастасия Олеговна Мерзляя Russia Федеральное государственное бюджетное образовательное учреждение высшего профессионального образования «Санкт-Петербургский государственный университет»</td>
<td>Vyacheslav Mikhailovich Golovatyuk</td>
</tr>
<tr>
<td><img src="image5" alt="Photo" /></td>
<td>Christiaan Petrus Brits Republic of South Africa Stellenbosch University</td>
<td>Vyacheslav Mikhailovich Golovatyuk</td>
</tr>
<tr>
<td><img src="image6" alt="Photo" /></td>
<td>Сергей Васильевич Фёдоров Russia Омский государственный университет им. Ф.М. Достоевского</td>
<td>Alexander Vladimirovich Karpov</td>
</tr>
<tr>
<td><img src="image7" alt="Photo" /></td>
<td>Андрей Леонидович Янчительский Ukraine Национальный технический университет Украины &quot;Киевский политехнический институт&quot;</td>
<td>Григорий Владимирович Трубников</td>
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</tbody>
</table>
Seventh International Student Summer School on Nuclear Physics – Science and Applications (NUCPHYS-SC&APPL)

Faculty of Physics Adam Mickiewicz University
Poznań, Poland, June 24 – July 4, 2015
Outreach programs
Teacher Programs

http://teachers.jinr.ru/

- First school held in 2009
- Seven schools at CERN (260 part.)
- Six schools at JINR (239 part.)

- More than 30 videoconferences between CERN-JINR and schools
- Increasing of motivated students
VIDEO-CONFERENCES June 23 and 25 2015
Virtual excursions to JINR Labs
Student Laboratories Infrastructure
Project «Development of modern educational programs»

The goal of the project is to include current scientific data into the educational process, conduct virtual and online laboratory research based on information and communication technologies using modern scientific equipment and data obtained from the existing physical facilities.

Project was presented and approved on the 38th session of PAC on CMP and 114th session of JINR Scientific Council.
Virtual Laboratory of Nuclear Fission

The goal of the project is to include current scientific data into the educational process, to conduct virtual and online laboratory research based on information and communication technologies using modern scientific equipment and data obtained from the existing physical facilities.
Virtual Laboratory of Nuclear Fission
Virtual Laboratory of Nuclear Fission

http://newuc.jinr.ru/section.asp?id=553

Virtual Laboratory of Nuclear Fission

The study of the spectrum of fission fragments

There are the structural elements of the experimental setup. Assemble the experimental setup out of structural elements and analyze the obtained data.

Analyze the spectrum chart.

Write down your results into the logbook.
Infrastructure to train engineer-physicists

• To create training and engineering department at UC
• This department has to develop regular training programs on real "training" facilities
• These programs can be offered to the Member States and can be used in organizing International Student Practices and the Summer Student Program
THANK YOU FOR YOUR ATTENTION
Contacts

http://uc.jinr.ru/

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       +7(916)3047673

Fax:   +7(49621)65851

Skype: pakuliak