“Advanced Studies Institute on Symmetries and Spin”

SPIN-Praha-2013

Miroslav Finger

Charles University, Faculty of Mathematics and Physics, Prague
Advanced Studies Institute on Symmetries and Spin

SPIN-Praha-2013

Tribute to the memory of B.S. Neganov

Prague, Czech Republic

July 7 – 13, 2013

Charles University, Faculty of Mathematics and Physics, V Holesovickach 2,
180 00 Prague 8, Czech Republic
Was 29th in the series of Prague meetings on Spin Research Programme
organized with the support of

- International Committee for Spin Physics Symposia
- Joint Institute for Nuclear Research, Dubna, Russia
- Charles University, Prague
- Czech Technical University, Prague
- Institute of Physics, Academy of Sciences of Czech Republic, Prague
- Institute of Scientific Instruments, Academy of Sciences of Czech Republic, Brno
- University of Florida, Gainesville

hosted by

- Charles University in Prague, Faculty of Mathematics and Physics
SPIN-Praha-2013 was the 29th meeting in the series

- **the first meeting** of this series at JINR Dubna, in 1975
- and continued after that **from 1976 on regular basis at Czech Republic.**

- Prague spin physics meetings cover topics related to symmetry and polarization phenomena in particle and nuclear physics and astrophysics.
ADVANCED STUDIES INSTITUTE -- SYMMETRIES AND SPIN
SPIN-Praha-2013

Scope

• to take the broadest possible view of the discipline by inviting distinguished speakers both theoreticians and experimentalists from different collaborations aiming at the research of symmetry phenomena in various physics disciplines;

• to promote contacts among researchers with different background of physics to review and discuss present status and perspectives of their research;

• to help to form new collaborations;

• to help young researchers and students to take active part in the respective international research programmes.
ADVANCED STUDIES INSTITUTE
SYMMETRIES AND SPIN

SPIN-Praha-2013

• The host
• Charles University in Prague
• Faculty of Mathematics and Physics
Participants

SPIN-Praha-2013    July 7 - 13, 2013

1. Czech Republic  42
2. JINR           38
3. Germany        6
4. Italy          6
5. Japan          6
6. Russia         6
7. USA            4
8. CERN           3
9. Poland         2
10. India         1
11. South Africa  1

Total            110
Scientific Programme

SPIN-Praha-2013    July 7 – 13, 2013

Sessions

Introductory      3
Overview           25
Dedicated          25            Students    20

Total oral presentations   73        40 hours
<table>
<thead>
<tr>
<th>Group</th>
<th>Entries</th>
<th>Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>5</td>
<td>Finger, Baumruk, Skrbek, Mach, Krisch</td>
</tr>
<tr>
<td>LHC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ATLAS</td>
<td>4</td>
<td>Grosse-Knetter, Kiryumin, Malyukov, Sanchez</td>
</tr>
<tr>
<td>ALICE</td>
<td>2</td>
<td>Bielcikova, Bufalino</td>
</tr>
<tr>
<td>LHCb</td>
<td>2</td>
<td>Ukleja, Anderlini</td>
</tr>
<tr>
<td>FAIR</td>
<td>1</td>
<td>Nicmorus</td>
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<tr>
<td>FAIR/CBM</td>
<td>1</td>
<td>Heuser</td>
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<tr>
<td>FAIR/PANDA</td>
<td>1</td>
<td>Maggiora</td>
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<tr>
<td>RHIC/PHENIX</td>
<td>1</td>
<td>Fields</td>
</tr>
<tr>
<td>NICA</td>
<td>14</td>
<td>Pesekhonov, Kovalenko, Kondratenko, Filatov, Shatunov, Butenko, Fimuskin,</td>
</tr>
<tr>
<td></td>
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<td>Kurilkin, Murin, Merkin, Akunzhianovm, Mashcheryakov, Savin, Nagaytsev</td>
</tr>
<tr>
<td>NICA/SPD</td>
<td>7</td>
<td>Savin, Nagaytsev, Gusov, Shimanski, Rossiyskaya, Rodionov, Zemlyninckina,</td>
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<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NICA/PPD/TH</td>
<td>3</td>
<td>Efremov, Shevchenko, Teryaev</td>
</tr>
<tr>
<td>NUCLotron</td>
<td>2</td>
<td>Litvinenko, Piskunov</td>
</tr>
</tbody>
</table>
Scientific Programme

SPIN-Praha-2013     July 7 - 13, 2013

COMPASS                   10  Denisov, Szabelski, Wilfert , Matousek, Pesek, Novy, Bodlak, Krumshtein, Chirikov –Zorin, Anfimov,

JParc                     1  Kuno
EMUL                      1  Artemenkov
Neutrino                  1  Ejiri
DBD                       1  Ejiri
GDH                       1  Laskaris
PT                        1  Plis

NN                        3  Prokofev, Verma, Finger

Theory                    5  Goloskokov, Selyugin, Zavada, Uzikov, Kolganova
Scientific Programme

SPIN-Praha-2013    July 7 - 13, 2013    NICA-SPIN-2013

General  Krisch Alan: Future of Polarized Beams

NICA    Peshekhonov Dmitry: NICA project at JINR

NICA Spin Physics Detector – NICA/SPD

• Nagaytsev Alexander: Spin Programme at NICA
• Shevchenko Oleg: Drell Yan studies at NICA
• Efremov Anatoly: On Nucleon Spin Structure and Drell-Yan
• Guskov Alexey: Direct photons
• Teryaev Oleg: Final state spin physics at NICA
• Shimanski Stepan: High p_T spin physics
Parameters of NICA:

- circumference: 503 m,
- number of intersection points (IP): 2,
- beta function $\beta_{\text{min}}$ in the IP: 0.35 m,
- number of protons per bunch: $\sim 1 \cdot 10^{12}$,
- number of bunches: 22,
- RMS bunch length: 0.5 m,
- bunch crossing rate: $\sim 1/60$ ns.


Nuclotron external beam lines

<table>
<thead>
<tr>
<th>Lines</th>
<th>$P_{\text{max}}$ (GeV/c)</th>
<th>$I_{\text{max}}$ (ppc)</th>
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<tbody>
<tr>
<td>VP-1</td>
<td>15</td>
<td>$10^{12}$</td>
</tr>
<tr>
<td>1v</td>
<td>9</td>
<td>$10^{8}$</td>
</tr>
<tr>
<td>3v</td>
<td>9</td>
<td>$10^{9}$</td>
</tr>
<tr>
<td>4v</td>
<td>9</td>
<td>$10^{7}$</td>
</tr>
<tr>
<td>5v</td>
<td>12</td>
<td>$10^{7}$</td>
</tr>
<tr>
<td>6v</td>
<td>12</td>
<td>$10^{7}$</td>
</tr>
</tbody>
</table>

Slowly extracted beam
NICA Spin Physics Detector – NICA/SPD

- Kovalenko Alexander: Polarized protons and deuterons at NICA
- Filatov Iurii: Polarized Proton Beam Acceleration
- Kondratenko Anatoliy: Control of Beam Polarization
- Shatunov Yury: Full and partial Siberian snakes from helical magnets
- Butenko Andrey, Kovalenko Alexander: Injector for Nuclotron/NICA polarized beams
- Fimushkin Victor: Status of Polarized Ions Source
- Kurilkin Pavel: Proton Beam Polarimetry at Nuclotron and NICA
- Kurilkin Pavel: Deuteron Beam Polarization Measurements at the Nuclotron
- Rodionov Valery: Preliminary proposal on SPD design
- Zemlyanichkina Elena: Estimations of J/Psi measurements
Scientific Programme

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NICA Spin Physics Detector – NICA/SPD

• Akhunzyanov Ruslan: Feasibility of DY at NICA
• Mescheryakov Gleb: Estimations of particle rates for SPD
• Rossiyskaya Natalia: Background studies for SPD
• Anfimov Nikolay, Krumstein Zinovi: A new electromagnetic calorimeter
• Chirikov -Zorin Igor: Design a new electromagnetic calorimeter
• Nagaytsev Alexander: Future Drell-Yan experiments

NICA/MPD

• Murin Yuri: MPD Vertex Detector
• Merkin Mikhail: Development of Si Sensors
Scientific Programme

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LHC

ATLAS
- **Sanchez Arturo Rodolfo**: Determination of the Higgs boson spin at ATLAS
- **Grosse-Knetter Joern**: Recent results by the ATLAS Collaboration
- **Malyukov Sergei**: ATLAS detector overview and performance
- **Kiryunin Andrey**: Upgrades of the ATLAS detector

ALICE
- **Bielcikova Jana**: Recent results from the ALICE experiment
- **Bufalino Stefania**: Upgrades of the ALICE detector

LHCb
- **Ukleja Artur**: Highlights of LHCb results
- **Anderlini Luzio**: Upgrade of the LHCb detector
FAIR
• Maggiora Marco: Transverse parton distribution functions in Drell-Yan production at FAIR

FAIR/CBM
• Heuser Johann: The CBM Project at FAIR

FAIR/PANDA
• Maggiora Marco: The Panda Project at FAIR

RHIC PHENIX
• Fields Douglas: Spin Physics at PHENIX

NUCLOTRON
• Piskunov Nikolay: ALPOM2 proposal: first measurements
• Litvinenko Anatoly: Dependence from atomic mass of the cross section of deuterons fragmentation into cumulative and double-cumulative pions.
COMPASS

- Denisov Oleg: Study of hadron structure using Drell-Yan scattering
- Szabelski Adam: Measurement of TMD observables at COMPASS
- Wilfert Malte Christian: Results on A1p and g1p from 2011 COMPASS data
- Pesek Michael: Polarization measurements in COMPASS polarized target
- Matousek Jan: COMPASS polarized target for Drell-Yan programme
- Novy Josef: Prototype of new data acquisition system for COMPASS experiment
- Bodlak Martin: COMPASS DAQ upgrades
- Anfimov Nikolay, Krumstein Zinoviy: A new electromagnetic calorimeter for COMPASS-II
- Chirikov -Zorin Igor: Design a new electromagnetic calorimeter for COMPASS II experiment at CERN
COMPASS facility at CERN

Most important features:
1. Muon or hadron secondary beams
2. Solid state NH$_3$ ($^6$LiD) target
3. Powerful tracking system – 350 planes
4. PiD – Muon Walls, Calorimeters, RICH
Key elements:
1. COMPASS PT
2. Tracking system (both LAS abs SAS) and beam telescope in front of PT
3. Muon trigger (in LAS is of particular importance - 60% of the DY acceptance)
4. HCal1 based trigger (veto) in LAS (to reduce DY di-muon trigger rate if needed)
5. RICH1, Calorimetry – also important to reduce the background (the hadron flux downstream of the hadron absorber ~ 10 higher then muon flux)
Redesign of the 3-cells cavity into the 2-cells cavity.

These bars show MW-absorbers separating cavities.
JParc
- Kuno Yoshitaka: Search for Charged Lepton Flavor Violation at J-PARC

EMUL
- Artemenkov Denis: Study of light nuclei cluster structure with nuclear track emulsion

DBD
- Ejiri Hiroyasu: Review on double beta decay experiments and neutrino response studies
- Ejiri Hiroyasu: Double beta decays and nuclear spin isospin responses for neutrinos
PT
Plis Yury: Topics on polarized ion sources including depolarization at acceleration

NN
• Prokofev Aleksandr: Spin correlation in pp-elastic scattering. Energy dependence
• Mchedlishvili David: Polarised nucleon-nucleon scattering experiments at ANKE-COSY
• Shindin Roman: Search for dineutron in the nd-p(nn) quasi elastic reaction at energy $T_n = 0.55 ^V 2.0 \text{ GeV}$
• Laskaris Georgios: First measurements of spin-dependent double-differential cross sections and the Gerasimov-Hearn integrand from $\vec{^3}\text{He}(\vec{\gamma},n)pp$ at incident photon energies of 12.8 and 14.7 MeV
THEORY

- **Goloskokov Sergey:** Transversity effects in light meson leptoproduction
- **Selyugin Oleg:** Spin effects in elastic scattering at NICA
- **Uzikov Yury:** Polarized deuteron charge exchange reaction $dp \rightarrow (pp)_sX$ with excitation of the Delta-isobar and the T20 puzzle
- **Shevchenko Oleg:** Direct connection between the different QCD orders for parton distribution and fragmentation functions
Tribute to the memory of

Boris Stepanovichich Neganov

B.S. Neganov
charismatic personality,
talented and critical physicist,
extcellent teacher, colleague and friend of many of us

passed away on August 19th, 2012
B.S. Neganov

* has finished his studies at Lenigrad State University in 1951
* since that B.S.N. has been working at the Laboratory, which in 1956 become Laboratory of Nuclear Problems of the Joint Institute for Nuclear Research
* B.S.N. took part in broad research of nucleon-nucleon interactions on 660 MeV proton synchrocyclotron
* since the beginning of sixtieth of the last century B.S.N. was working on the development of the method to obtain low temperatures in mK region by means of 3He-4He refrigeration for physics experiments.
I was privileged to know B.S.N. Since 1963 when I came as PhD student to the NPL JINR in Dubna.

Since that time I was the witness of great successes of B.S.N. at least in three directions, which had the important impact on the spin physics experiments as we know them today.
The pioneering achievements:

1. B. Neganov was the first who obtained very low temperatures based on 3He-4He dilution refrigeration

* A method for obtaining low temperatures based on dissolution of 3He in 4He.
B. Neganov, N. Borisov, M. Liburg.
JETP 50 (1966) 1445-1457

* About the method for obtaining low temperatures by dilution of 3He in 4He.
B. Neganov.
Preprint JINR, Dubna, 1968, P13-4014

* A new method for obtaining low temperatures.
B. Neganov.
News of the Academy of Sciences of the USSR, Nayka 12 (1968) 49-53
The pioneering achievements:

2. B. Neganov was the first who developed frozen spin polarized target based on 3He-4He dilution refrigerator

* Ultra-low temperatures and proton and deuteron polarized targets.
B. Neganov, 1967

* Polarized proton target.
L.B. Parfenov, B.S. Neganov.
Preprint JINR Dubna, 1968, 13-4143

* Progress in the development of polarized targets.
B.S. Neganov.

* Frozen polarized proton target.
Preprint JINR Dubna, 1976, 13-10253, Part I

* Frozen polarized proton target.
Instrum.Exp.Tech. 21 (1978) 299-308

* Proton Polarized Frozen Target for High-energy Particle Secondary Beams.
The pioneering achievements:

3. B. Neganov was the first who developed the system for low temperature nuclear orientation of short lived nuclei.

* SPIN Facility.

* A Combined 3He-4He Dilution Refrigerator.

SPIN – YASNAPP-2 FACILITY: AVAILABLE EXPERIMENTS

- Proton beam
- Mass-separator
- Ion sources
- Off-line refrigerator
- Implantation chamber
- Orientation and detection system
  - g-rays angular distribution
  - Temperature dependence of anisotropy
  - g-rays linear polarization
  - Alpha, beta... angular distribution
  - Nuclear magnetic resonance
  - Spin-lattice relaxation studies
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Thank you!