



Joint Institute for Power and Nuclear  
Research – Sosny  
B. I. Stepanov Institute of Physics  
National Academy of Sciences of Belarus  
Belarusian Republican Foundation for  
Fundamental Research  
Belarusian State University  
Joint Institute for Nuclear Research

## **NONLINEAR PHENOMENA IN COMPLEX SYSTEMS**

***Fractals, Chaos, Phase Transitions,  
Self-organization***

**Minsk, Belarus**

**JUNE 24 – 28, 2024**

### **XXXI Annual International Seminar**

**Program**

<http://npcs.j-npcs.org/>

**Minsk, 2024**

#### **Monday, June 24, 09.00-19.20**

9.00 - 10.00 Registration  
10.00 - 10.10 Opening  
10.10 - 11.40 Plenary Session  
11.40 - 12.00 Coffee-Break  
12.00 - 13.15 Plenary Session  
13.15 - 14.00 Lunch  
14.00 - 16.00 Session: Particles  
16.00 - 16.20 Coffee-Break  
16.20 - 19.20 Session: Media

#### **Tuesday, June 25, 09.00-18.10**

09.00 - 11.00 Plenary Session  
11.00 - 11.30 Coffee-Break  
11.30 - 13.00 Plenary Session  
13.00 - 14.00 Lunch  
14.00 - 15.40 Session: Quantum Mechanical Problems, Gravity and  
Particles  
15.40 - 16.10 Coffee-Break  
16.10 - 18.10 Session: Quantum Mechanical Problems, Gravity and  
Mathematics

#### **Wednesday, June 26, 09.00 – 18.30**

09.00 - 11.00 Plenary Session  
11.00 - 11.30 Coffee-Break  
11.30 - 13.00 Session: Particles  
13.00 - 14.00 Lunch  
14.00 - 16.20 Session: Particles  
16.20 - 16.50 Coffee-Break  
16.50 - 18.30 Session: Particles

#### **Thursday, June 27, 09.00 – 19.00**

09.00 – 19.00 Field Session: round-tables  
15.00 - 16.00 Lunch  
Cultural part: Excursion

#### **Friday, June 28, 10.00 – 13.30**

10.00 - 12.00 Session: Modelling and Safety Related Analyses of NPP  
12.00 - 12.20 Coffee-Break  
12.20 - 13.20 Session: Posters  
13.20 - 13.30 Final Discussion: Problems, Perspectives, Philosophy  
13.30 – Closing

**Monday, June 24, 09.00-19.20**

**9.00 – 10.00 Registration**

**10.00 - Opening 10 min**

Trifonov A.G., Lukashevich A.G., Shaparau V.A.

**10.10 - 11.40 Plenary Session**

Chairman: Korbut T.N.

1. **Yuri Kulchitsky** (Joint Institute for Nuclear Research, Dubna, Russia) “Probe of the Standard Model using the LHC experiments results” (30 min)
2. **Д.О. Кривенков**, А.В. Аверьянов, Ю. Лукстиньш (Объединенный институт ядерных исследований, Дубна, Россия) “Эксперимент HyperNIS. Поиск и изучение нейтроноизбыточных гиперядер” (30 min)
3. **М.-М. Paraipan**, O.V. Belov, V.M. Javadova, L.K. Kostov, T.N. Tran, S.I. Tyutyunnikov (Joint Institute for Nuclear Research, Dubna, Russia) “Perspectives of accelerator driven subcritical reactors” (30 min)

**11.40 - 12.00 Coffee-Break**

**12.00 - 13.15 Plenary Session**

Chairman: Trifonov A.G.

1. **E.S. Kokoulina** (Joint Institute for Nuclear Research, Dubna, Russia) “Annihilation of leptons and hadrons” (25 min)
2. **Sergey V. Gaponenko** and Denis V. Novitsky (Stepanov Institute of Physics of the National Academy of Sciences of Belarus, Minsk, Belarus) “Electromagnetic Radiation In Plasmas: Asymptotic Tunneling And Sub-Planckian Emission” (25 min)
3. **Alexander Shalyt-Margolin** (Research Institute for Nuclear Problems, BSU, Minsk, Belarus) “Primordial black holes in the inflationary universe, the probabilities of their formation and some its implications for cosmological parameters estimate” (25 min)

**13.15 - 14.00 Lunch**

**14.00 - 16.00 Session: Particles**

Chairman: Galynskii M.V.

1. **Yu.D. Chernichenko** (Gomel State Technical University, Gomel, Belarus) “Form Factor for a System of Two Fermions in the Relativistic Quasipotential Approach: Case of an Arbitrary Masses and Scalar Current” (20 min)
2. **В.И. Лашкевич**, О.П. Соловцова, Л.П. Каптарь (Gomel State Technical University, Gomel, Belarus) “Аналитические расчеты некоторых вкладов в аномальные магнитные моменты лептонов от поляризации вакуума четырьмя лептонными петлями” (20 min)
3. **Oleg Rogachevsky** (Joint Institute for Nuclear Research, Dubna, Russia) “Usage of transverse rapidity in nuclear interactions” (20 min)
4. **R.G. Shulyakovsky**, A.Yu. Manko (Stepanov Institute of Physics of the National Academy of Sciences of Belarus, Minsk, Belarus) “Particle production at SPD (NICA) by using of instanton mechanism” (20 min)
5. **V.Yu. Haurysh**, V.V. Andreev (Gomel State Technical University, Gomel, Belarus) “Hadronic decay of  $\rho^\pm$  – meson in relativistic quantum mechanics (20 min)
6. **A.Yu. Manko**, R.G. Shulyakovsky (Stepanov Institute of Physics of the National Academy of Sciences of Belarus, Minsk, Belarus) “Lepton pair production by instanton mechanism” (20 min)

**16.00 - 16.20 Coffee-Break**



**Tuesday, June 25, 09.00-18.10**

**09.00 - 11.00 Plenary Session**

Chairman: Trifonov A.G.

1. **Н.Е. Савицкая** (ПИЯФ НИЦ КИ, Гатчина, Россия), Т.А. Федорова (Санкт-Петербургский Государственный Морской технический университет, Санкт-Петербург, Россия) “Dynamic properties of the voter model with stochastic activation of links driven by avalanche-like perturbations” (30 min)
2. **Svetlana Sytova** (Research Institute for Nuclear Problems, BSU, Minsk, Belarus) “Modelling of nonlinear dynamics of electromagnetic radiation generated by charged particle beams in non-one-dimensional spatially periodic structures” (30 min)
3. **N.N. Shenets** (Высшая школа кибербезопасности Института компьютерных наук и кибербезопасности, Санкт-Петербург, Россия) “A General Approach to Authenticated Key Establishment based on Homomorphic Secret Sharing” (30 min)
4. **V.M. Red'kov**, A.V. Ivashkevich, A.V. Bury, E.M. Ovsyuk, V.V. Kisel (Stepanov Institute of Physics of the National Academy of Sciences of Belarus, Minsk, Belarus) “Fedorov’s Equation for Spin 2 Particle, the Non-Relativistic Approximation in Presence of Electromagnetic Fields” (30 min)

**11.00 - 11.30 Coffee-Break**

**11.30 - 13.00 Plenary Session**

Chairman: Babichev L.F.

1. **M.V. Voitkova** (Stepanov Institute of Physics of the National Academy of Sciences of Belarus, Minsk, Belarus) “Fractal dimension of ambulatory blood pressure monitoring data and heart-rate time series” (30 min)

2. **А.В. Сидоренко**, Н.А. Солодухо (Белорусский государственный университет, Минск, Беларусь) “Оценка влияния электромагнитного шумового излучения диапазона WiFi на эмоциональное состояние оператора” (30 min)
3. **Andrey Kuvshinov** (Medical center "Melissa-med", Minsk, Belarus) “Chemical structure and interaction features of the main groups of materials used in dentistry” (30 min)

**13.00 - 14.00 Lunch**

**14.00 - 15.40 Session: Quantum Mechanical Problems, Gravity and Particles**

Chairman: Krylov G.G.

1. Yu.A. Kurochkin, L.L. Jenkovszky, , **N.D. Shaikovskaya**, V.O. Soloviev (Stepanov Institute of Physics of the National Academy of Sciences of Belarus, Minsk, Belarus) “Nonrelativistic quantum mechanical problem for the Cornell potential in Lobachevsky space” (20 min)
2. **V.S. Otchik** and Yu.A. Kurochkin (Stepanov Institute of Physics of the National Academy of Sciences of Belarus, Minsk, Belarus) “On the levels widths in the Stark effect in hydrogen” (20 min)
3. **V.M. Red'kov**, E.M. Ovsyuk, V.V. Kisel, A.V. Bury, P.O. Sachenok (Mozyr State Pedagogical University, Mozyr, Belarus) “Spin 1 Particle with Two Additional Characteristics, Anomalous Magnetic Moment and Polarizability” (20 min)
4. **N.G. Krylova**, V.M. Red'kov (Belarusian State Agrarian Technical University, Minsk, Belarus) “Dirac field in Newman-Unti-Tamburino background: solutions of angular and radial equations” (20 min)
5. **A.V. Baran** and V.V. Kudryashov (Institute of Physics of National Academy of Belarus, Minsk, Belarus) “Solution of quasi-radial equation for a charged particle in the field of two coulomb centers in two-dimensional lobachevsky space” (20 min)



**Wednesday, June 26, 09.00-18.30**

**09.00 - 11.00 Plenary Session**

Chairman: Trifonov A.G.

1. **V.A. Shaparau** (Joint Institute for Power and Nuclear Research – Sosny of the NAS of Belarus, Minsk, Belarus) “Squeezed states in QCD and their influence on the intermittency effect” (30 min)
2. **H.V. Grushevskaya** and G.G. Krylov (Belarusian State University, Minsk, Belarus) “A four-side Kitaev graphene chain as a quantum bit based on pseudo-Majorana-type pn-graphene junctions” (30 min)
3. **George Krylov** and Halina Grushevskaya (Belarusian State University, Minsk, Belarus) “Local density of states and electronic properties of electrostatically confined graphene quantum dots” (20 min)
4. **A.V. Baran** and V.V. Kudryashov (Stepanov Institute of Physics of the National Academy of Sciences of Belarus, Minsk, Belarus) “Simulation of circular quantum dots with the help of composition of Kratzer potentials” (20 min)
5. **N.V. Efimova** (Belarus State University, Minsk, Belarus) “Media space of the modern city” (20 min)

**11.00 - 11.30 Coffee-Break**

**11.30 - 13.00 Session: Particles**

Chairman: Shaparau V.A.

1. **Yuri Kulchitsky** (Joint Institute for Nuclear Research, Dubna, Russia) “Femtосcopy in pp collisions at 13 TeV with ATLAS at the LHC” (20 min)
2. **Yuri Kulchitsky** (Joint Institute for Nuclear Research, Dubna, Russia) “Study of the KNO scaling at the LHC” (20 min)

3. **M.V. Galynskii**, V.A. Zykunov (Joint Institute for Power and Nuclear Research – Sosny of the NAS of Belarus, Minsk, Belarus) “Polarization effects in the elastic  $\bar{e}\bar{p} \rightarrow \bar{e}\bar{p}$  process” (30 min)
4. **V. Kiseeva**, I. Boyko, A. Didenko, O. Dolovova, N. Huseynov, I. Yeletskikh (Joint Institute for Nuclear Research, Dubna, Russia) “Automatic optimization of neural network parameters for data analysis of the Large Hadron Collider” (20 min)

**13.00 - 14.00 Lunch**

**14.00 - 16.20 Session: Particles**

Chairman: Babichev L.F.

1. **B.A. Бабкин** (Объединенный институт ядерных исследований, Дубна, Россия) “Статус и перспективы времяпролетной системы идентификации частиц TOF эксперимента MPD” (20 min)
2. **A.V. Ivanov** (Joint Institute for Nuclear Research, Dubna, Russia) “FARICH simulation in SPD” (20 min)
3. **Ruslan Akhunzyanov** (Joint Institute for Nuclear Research, Dubna, Russia) “Monte-Carlo simulations of the Straw Tracker performance in SPD setup” (20 min)
4. **N.S. Rogacheva** (Joint Institute for Nuclear Research, Dubna, Russia) “Analysis of  $K_S^0$  production in SPD at NICA” (20 min)
5. **V.M. Baryshnikov**, Adhikari Rivu, Bhattacharji Maharnab, Dronik V., Dubrovin A.Y., Dubrovin I.S., Golovatyuk V.M., Kostylev A.I., Krechetov Y.F., Kulikov V.V., Lobastov S.P., Martemyanov M.A., Semenov A.Y., Terletsky A.V., Shutov A.V., Filippov I.A., Tyapkin I.A. (Joint Institute for Nuclear Research, Dubna, Russia) “Monitoring stability of the electromagnetic calorimeter ECal at MPD/NICA experiment” (20 min)
6. **С.Л. Авакян**, Е.З. Авакян (Gomel State Technical University, Gomel, Belarus) “Нелептонные взаимодействия мезонов с ненулевой странностью” (20 min)









**Friday, June 28, 10.00-13.30**

**10.00 - 12.00 Session: Modelling and Safety Related Analyses of NPP**

Chairman: Trifonov A.G.

1. **A.G. Lukashevich**, E.G. Vashetko (Joint Institute for Power and Nuclear Research – Sosny of the NAS of Belarus, Minsk, Belarus) “Analysis of severe large-break loss-of-coolant accident for a VVER-1200 reactor” (20 min)
2. **В.А. Шапоров**, Е.А. Шапорова (Объединенный институт энергетических и ядерных исследований – Сосны НАН Беларуси, Минск, Беларусь) “Применение разработанной для ПК ATHLET модели реакторной установки ВВЭР-1200 Белорусской АЭС для анализа безопасности при авариях, моделируемых в виде течи теплоносителя” (20 min)
3. **S.N. Sikorin**, S.A. Polazau, Y.V. Domorad (Joint Institute for Power and Nuclear Research – Sosny of the NAS of Belarus, Minsk, Belarus) “Benchmark evaluation of water-moderated hexagonal lattices 75% enriched UO<sub>2</sub> fuel rods at “ROSE” critical facility” (20 min)
4. **I.V. Rudziankou**, L.F. Babichev (Joint Institute for Power and Nuclear Research – Sosny of the NAS of Belarus, Minsk, Belarus) “Analysis of the calculation of small-group constants calculation for DYN3D in Serpent using various leakage approximations” (20 min)
5. **С.А. Толкачёв**, Н.А. Карпенко, М.Г. Андреев, Н.Е. Атаманчук, А.В. Мицкевич, В.Ю. Ничипор (РУП «Белорусская атомная электростанция», Гродненская область, Островецкий р-н, Беларусь) “Оценка надёжности функционирования активных систем безопасности с учётом зависимых отказов систем пожаротушения II, III категорий сейсмостойкости при максимальном расчётном землетрясении” (20 min)

6. **A.G. Trifonov**, E.A. Mikhalycheva (Joint Institute for Power and Nuclear Research – Sosny of the NAS of Belarus, Minsk, Belarus) “Analysis of the Impact of Common Cause Faults on the Safety of Nuclear Power Plant with the VVER-Reactor” (20 min)

**12.00 - 12.20 Coffee-Break**

**12.20 - 13.20 Session: Posters**

Chairman: Krylov G.G.

1. **О.П. Соловцова** (Gomel State Technical University, Gomel, Belarus), **О.В. Теряев**, **Д.А. Волкова** (Joint Institute for Nuclear Research, Dubna, Russia) “Исследование гипотезы вакуумной доминантности по экспериментальным данным процесса аннигиляции электрон-позитронных пар в пионы”
2. Е.А. Шапорова (Объединенный институт энергетических и ядерных исследований – Сосны НАН Беларуси, Минск, Беларусь) “Влияние поляядерного гидроксильного комплексообразования на процессы очистки сточных вод от радионуклидов и тяжелых металлов”
3. Е.А. Шапорова (Объединенный институт энергетических и ядерных исследований – Сосны НАН Беларуси, Минск, Беларусь) “Аквагидроксикомплексы хрома(III) и ряда 3d-металлов как прекурсоры в синтезе наноструктурных гидроксидно-оксидных материалов”
4. М.Л. Жемжуров (Объединенный институт энергетических и ядерных исследований – Сосны НАН Беларуси, Минск, Беларусь), **Д.И. Павлов** (АО КИС «Исток», Санкт-Петербург, Россия) «Варианты различных технических решений для приповерхностного захоронения радиоактивных отходов Белорусской АЭС»
5. **Е.М. Ovsiyuk**, P.O. Sachenok, A.S. Martynenko, V.V. Kisel (Mozyr State Pedagogical University, Mozyr, Belarus) “Scalar Particle with Two Additional Characteristics, Cox structure and Polarizability”

6. L.F. Babichev, Y.A. Rusak (Joint Institute for Power and Nuclear Research – Sosny of NASB, Minsk, Belarus) “Fluctuations and correlations as a criteria for hot and dense matter formation in heavy ion collisions using different parton energy loss models”
7. Y.A. Rusak, O.V. Rogachevsky, L.F. Babichev (Joint Institute for Power and Nuclear Research – Sosny, Minsk, Belarus) “Event-by-event analysis of heavy ion collisions with multifractal method using a 3-fluid model for MPD experiment”
8. N.D. Kuzmina, E.A. Mikhalycheva, I.O. Moroz (Joint Institute for Power and Nuclear Research – Sosny of NASB, Minsk, Belarus) “Analysis of radiological hazards associated with accidents at radioactive waste storage/disposal facilities”
9. A.V. Ivashkevich, A.V. Bury (Stepanov Institute of Physics of NASB, Minsk, Belarus) “Massless Stueckelberg Field, Solutions with Spherical Symmetry, the Gauge Symmetry”
10. A.V. Ivashkevich, A.V. Bury (Stepanov Institute of Physics of NASB, Minsk, Belarus) “Massless Stueckelberg Field, Solutions with Cylindrical Symmetry, the Gauge Symmetry”
11. D.A. Volkova, N.A. Gramotkov, I.A. Zemlyakov, A.V. Kotikov, O.V. Teryaev, I.R. Gabdrakhmanov (Joint Institute for Nuclear Research, Dubna, Russia), O.P. Solovtsova (Gomel State Technical University, Gomel, Belarus) “Bjorken sum rule with finite infrared derivative”
12. E.A. Dikumar, A.L. Pushkarchuk, T.V. Bezlyaznaya, E.A. Akishina (Institute of Physical Organic Chemistry of the National Academy of Sciences of Belarus; Minsk, Belarus), L.F. Babichev (Joint Institute for Power and Nuclear Research – Sosny, Minsk, Belarus), A.G. Soldatov, S.A. Kuten, D.V. Ermak, T.S. Pivovarchik, D.B. Migas, S.G. Styopin, A.P. Nizovtsev, S.Ya. Kilin, V.A. Kulchitskiy, G.K. Mukusheva, M.R. Aliyeva, V.I. Potkin “Quantum chemical modeling of three-component system: cisplatin-fullerenol-quinine: HF-3c quantum chemical modeling”
13. P.P. Andrushevich (The Educational Institution Brest State College of Communications, Brest, Belarus) “Internal symmetry of generalized Majorana particles, classical and quantized theory, presence of electromagnetic and gravitational fields”
14. S.O. Komarov, A.K. Gorbatsievich, G.V. Vereshchagin, A.S. Garkun (Belarusian State University, Minsk, Belarus) “Electromagnetic field of a charged axially-symmetric ring in the vicinity of Kerr black hole”
15. S.I. Timoshin, E.S. Timoshin (Gomel State Technical University, Gomel, Belarus) “The Inclusive and Semi-Inclusive Deep Inelastic Scattering the Neutrino on the Polarised Protons and Neutrons”
16. S.I. Timoshin, E.S. Timoshin, (Gomel State Technical University, Gomel, Belarus) “The deep inelastic scattering the neutrino and antineutrino on the polarized deuterons with the charged weak current”

**13.20 - 13.30 Final Discussion: Problems, Perspectives, Philosophy**  
Chairman: Trifonov A.G.

**13.30 Closing**