

**XXXVI International  
Workshop on High Energy  
Physics "Strong Interactions:  
Experiment, Theory,  
Phenomenology"**

**Report of Contributions**

Contribution ID : 1

Type : **not specified**

## Pion degrees of freedom in nuclear matter, from 1971 till tomorrow

*среда, 24 июля 2024 г. 11:30 (45)*

After a historical introduction I will review progress in description of the pion degrees of freedom in equilibrium and nonequilibrium nuclear matter. Effects of the softening of the pion mode and pion condensation will be considered. Applications to such nuclear systems as atomic nuclei, neutron stars, heavy-ion collisions, and hypothetical nuclear systems will be discussed.

### References

D.N. Voskresensky, "Pion Softening and Pion Condensation,"  
Phys. Atom. Nucl. 83 (2020) no.2, 188-202

D.N. Voskresensky, "Many particle effects in nucleus nucleus collisions,"  
Nucl. Phys. A 555 (1993), 293-328

D.N. Voskresensky, "S-wave pion condensation in symmetric nuclear matter,"  
Phys. Rev. D 105 (2022) no.11, 116007

D.N. Voskresensky, "Pion-sigma meson vortices in rotating systems,"  
Phys. Rev. D 109 (2024) no.3, 034030

D.N. Voskresensky, " Pion degrees of freedom in nuclear matter, from 1971 till tomorrow".

**Primary author(s)** : Prof. VOSKRESENSKY, Dmitry (LTF, JINR, Dubna)

**Presenter(s)** : Prof. VOSKRESENSKY, Dmitry (LTF, JINR, Dubna)

**Session Classification** : Morning session 24/07/2024

**Track Classification** : Strongly interacting (QCD) matter

Contribution ID : 3

Type : **not specified**

## Lattice study of rotating QCD properties

*среда, 24 июля 2024 г. 10:15 (45)*

In this report the influence of relativistic rotation on QCD properties will be considered. I am going to review the results that were obtained within lattice simulation of QCD. It has become commonplace to perform such studies in the reference frame rotating with the system under investigation. In this case there appears the gravitational field and the problem is reduced to study of QCD in this external gravitational field. Within the report the following topics will be reviewed. The influence of relativistic rotation on the QCD critical temperatures. Equation of state of rotating QCD and the moment of inertia of quark-gluon plasma. Inhomogeneous phase transitions in rotating quark-gluon plasma.

**Primary author(s)** : Prof. BRAGUTA, Viktor (JINR)

**Presenter(s)** : Prof. BRAGUTA, Viktor (JINR)

**Session Classification** : Morning session 24/07/2024

**Track Classification** : QCD (lattice, (non) perturbative, effective models)

Contribution ID : 4

Type : **not specified**

## Current Status of the Odderon

*четверг, 25 июля 2024 г. 10:15 (45)*

Odderon is the C-odd amplitude which does not die out (or die very slowly) with energy. We consider the constrains on the Odderon properties and the perturbative QCD odderon given at the lowest  $\alpha_s$  order by the three gluon exchange. Then we discuss the experimental indications for the odderon contribution to high energy proton-proton elastic scattering and some other processes in which the odderon may reveal itself.

### References

ATLAS Collaboration, G. Aad et al., Eur. Phys. J. C 83, 441 (2023).

Odderon contribution in light of the LHC low-tt data ,  
E.G.S. Luna, M.G. Ryskin, V.A. Khoze, e-Print:2405.09385 [hep-ph]

**Primary author(s)** : Dr RYSKIN, Mikhail (Petersburg Nuclear Physics Institute)

**Presenter(s)** : Dr RYSKIN, Mikhail (Petersburg Nuclear Physics Institute)

**Session Classification** : Morning session 25/07/2024

**Track Classification** : Diffractive scattering

Contribution ID : 5

Type : **not specified**

## What do we know about the confinement mechanism?

I will compare the main confinement mechanisms in QCD, confinement by magnetic monopoles and by quantised magnetic flux tubes, vortices. Then, I will concentrate on problems with the detection of vortices. A further interesting question concerns the relation to the spontaneous breaking of chiral symmetry.

**Primary author(s)** : Prof. FABER, Manfred (Atominstitut, Technische Universität Wien)

**Presenter(s)** : Prof. FABER, Manfred (Atominstitut, Technische Universität Wien)

**Session Classification** : Morning session 24/07/2024

**Track Classification** : QCD (lattice, (non) perturbative, effective models)

Contribution ID : 6

Type : **not specified**

## QCD physics with ALICE, ATLAS and CMS experiments

*четверг, 25 июля 2024 г. 14:30 (45)*

The soft and hard QCD processes are analyzed by ALICE, ATLAS and CMS experiments using samples of proton-proton and AA collisions collected by the LHC at different energies. Measurements of jet production rates, jet properties, particle multiplicity, particle momentum spectra and correlations are presented.

The results are compared to predictions of theoretical models at leading- and next-to-leading orders of QCD. The data in combination with HERA and CMS and ATLAS results are used to measure the strong coupling constant and for PDF constraints.

**Primary author(s)** : Dr KODOLOVA, Olga

**Presenter(s)** : Dr KODOLOVA, Olga

**Session Classification** : Afternoon session 25/07/2024

**Track Classification** : Experimental data on hadron physics

Contribution ID : 7

Type : **not specified**

## Shear viscosity and parton distributions

The shear-like contributions to energy-momentum tensors appearing in the definitions of hadronic matrix elements are considered. Their extraction from sum rule for various parton distributions is analyzed. The counterparts of the viscosity smallness manifested in holographic QCD are discussed.

**Primary author(s)** : TERYAEV, Oleg (JINR)

**Presenter(s)** : TERYAEV, Oleg (JINR)

**Session Classification** : Afternoon session 23/07/2024

**Track Classification** : Strongly interacting (QCD) matter

Contribution ID : 8

Type : **not specified**

## Inclusive processes in the modified Quark-Gluon String Model.

*вторник, 23 июля 2024 г. 12:15 (45)*

Inclusive processes at high energies are studied in a non-perturbative approach in QCD using a modified Quark-Gluon String Model. Theoretical and experimental aspects of diffraction dissociation are especially discussed. In the calculations of cross sections, the parameters of complex nonlinear trajectories of Pomeron and Reggeons are used. Particular attention is paid to elastic and inelastic processes at LHC energies.

**Primary author(s)** : Dr SERGEENKO, Mikhail (Stepanov Institute of Physics NAS, Belarus)

**Presenter(s)** : Dr SERGEENKO, Mikhail (Stepanov Institute of Physics NAS, Belarus)

**Session Classification** : Morning Session 23/07/2024

**Track Classification** : Strongly interacting (QCD) matter



Contribution ID : 11

Type : **not specified**

## COLLECTIVE EFFECTS IN STRONG INTERACTION PROCESSES: EXPERIMENTAL HIGHLIGHTS

*вторник, 23 июля 2024 г. 17:15 (45)*

Collective effects are reviewed for collisions of various systems – from proton-proton to heavy ion – in wide energy range. Collectivity is one of the crucially important and most essential features in reactions with subatomic particles due to strong interaction. As consequence, a study of collective behavior in multiparticle production processes provides one of the most sensitive and promising probes for detailed investigation of basic features of strong interaction. Recent experimental results obtained at the Relativistic Heavy Ion Collider (RHIC) and the Large Hadron Collider (LHC) are considered. Hadron jets being one of the most famous collective effects in strong interaction are intensively study in various collisions [1]. In proton-proton interactions such studies devote to the better understanding of hadronization, precise determination of strong coupling constant, parameters of top quark and its production [2], verification of the predictions of Quantum Chromodynamics (QCD) in events with different topology, search for the physics beyond of Standard Model (SM), in particular, within Effective Field Theory (EFT) approach [3, 4] for top quark sector [2, 5–8]. Investigations of different nuclear collisions focus on exploration of the phase diagram of strongly interacting matter, particularly, on detailed study of properties of quark-gluon matter under extreme conditions considered presently as the strongly coupled quark-gluon plasma (sQGP). Results at RHIC [9] and LHC [10–12] energies provide important information about event shapes as well as transport and thermodynamics properties of the hot medium for various flavors. Measurements show clearly the collective behavior of heavy quarks in nucleus-nucleus interactions. Studies of jets in strongly interacting environment via correlations of different particles including heavy hadrons lead to new constraints for energy loss models, allow the search of the new physics signatures with heavy-ion collisions. First results have been obtained at the LHC for massive gauge bosons and antitop-top pair production in proton-nuclear and heavy ion collisions at multi-TeV energies. The surprising sQGP-like collectivity has been observed in collision systems smaller than even moderate nuclei, especially, at the LHC energies. Experimental results obtained for discrete symmetries of QCD at finite temperatures confirm indirectly the topologically non-trivial structure of QCD vacuum [13–17]. Such investigations are important for the decision of the problems of CP invariance of the strong interaction and baryon asymmetry of Universe. In the soft sector of the strong interaction one can expect some novel mechanisms for multiparticle production due to collectivity in very high energy nuclear collisions, in particular, increasing of coherent particle production. The investigation of Bose–Einstein condensation (BEC) will shed new light on the nature of superfluidity of strongly interacting matter which is the one of the fundamental properties of sQGP, on the possibility of laser-like regime for pion production at very high energies [18]. Studies of collective effects in strong interaction processes provide new important results for relativistic astrophysics, cosmology and cosmic ray physics. The recent measurements of femtoscopic correlations allow, in particular, the indirect estimations for parameters of hyperon–nucleon potentials. The new constrains for these potentials will make model predictions more reliably for compact astrophysical objects [19–23]. Studying the possible BEC effect on the pion yield at very high energies [24] can be considered one of perspective research directions for better understanding of the nature of the muon puzzle in ultra-high energy cosmic ray (UHECR) measurements [25–27]. Therefore collective effects in strong interaction processes studied on accelerator facilities are important for various fields of fundamental physics and investigation of the effects has large interdisciplinary value.

### References

- [1] V. A. Okorokov, *Int. J. Mod. Phys. A* 27, 1250037 (2012).
- [2] U. Husemann, *Prog. Part. Nucl. Phys.* 95, 48 (2017).
- [3] S. Willenbrock and C. Zhang, *Annu. Rev. Nucl. Part. Sci.* 64, 83 (2014).

- [4] E. E. Boos, *Phys. Usp.* 65, 653 (2022).
- [5] C. Zhang and S. Willenbrock, *Phys. Rev. D* 83, 034006 (2011).
- [6] I. Brivio et al., *JHEP* 2002, 131 (2020).
- [7] S. Bißmann et al., *JHEP* 2106, 010 (2021).
- [8] V. A. Okorokov, *J. Phys.: Conf. Ser.* 1690, 012006 (2020); *Phys. At. Nucl.* 86, 742 (2023).
- [9] V. A. Okorokov, *Phys. At. Nucl.* 72, 147 (2009); *Proc. of the HEPFT2014*. Eds. V. Petrov and R. Ryutin. World Scientific, Singapore (2015), p. 189; *Eur. Phys. J. Web of Conf.* 158, 01004 (2017).
- [10] ALICE Collaboration, arXiv: 2211.04384 [nucl-ex].
- [11] G. Aad et al. (ATLAS Collaboration), arXiv: 2404.06829 [hep-ex].
- [12] A. Hayrapetyan et al. (CMS Collaboration), arXiv: 2405.10785 [hep-ex].
- [13] D. E. Kharzeev, *Annals Phys.* 325, 205 (2010).
- [14] V. A. Okorokov, *Phys. At. Nucl.* 80, 1133 (2017).
- [15] J. Zhao and F. Wang, *Prog. Part. Nucl. Phys.* 107, 200 (2019).
- [16] W. Li and G. Wang, *Annu. Rev. Nucl. Part. Sci.* 70, 293 (2020).
- [17] D. E. Kharzeev and J. Liao, *Nature Rev. Phys.* 3, 55 (2021).
- [18] V. A. Okorokov, *Adv. High Energy Phys.* 2016, 5972709 (2016); *Phys. At. Nucl.* 82, 838 (2019).
- [19] M. Oertel et al., *Rev. Mod. Phys.* 89, 015007 (2017).
- [20] G. Baym et al., *Rep. Prog. Phys.* 81, 056902 (2018).
- [21] L. Baiotti, *Prog. Part. Nucl. Phys.* 109, 103714 (2019).
- [22] F. J. Llanes-Estrada and E. Lope-Oter, *Prog. Part. Nucl. Phys.* 109, 103715 (2019).
- [23] J. M. Lattimer, *Annu. Rev. Nucl. Part. Sci.* 71, 433 (2021).
- [24] V. A. Okorokov, *Phys. At. Nucl.* 87, 172 (2024).
- [25] S. Mollerach and E. Roulet, *Prog. Part. Nucl. Phys.* 98, 85 (2018).
- [26] L. A. Anchordoqui, *Phys. Rep.* 801, 1 (2019).
- [27] M. Kachelrieß and D. V. Semikoz, *Prog. Part. Nucl. Phys.* 109, 103710 (2019).

**Primary author(s) :** Prof. OKOROKOV, Vitalii (National Research Nuclear University MEPhI (Moscow Engineering Physics Institute) )

**Presenter(s) :** Prof. OKOROKOV, Vitalii (National Research Nuclear University MEPhI (Moscow Engineering Physics Institute) )

**Session Classification :** Afternoon session 23/07/2024

**Track Classification :** QCD (lattice, (non) perturbative, effective models)

Contribution ID : 14

Type : **not specified**

## Gravitational formfactors, equivalence principle and shear viscosity

*вторник, 23 июля 2024 г. 16:30 (45)*

Gravitational formfactors describe the (angular) momentum distribution in hadrons as well as their coupling to gravity. The equivalence principle may be extended to be valid separately for quarks and gluons. The small violation of such an extension may be related to the analog of shear viscosity contribution and be a counterpart of its smallness.

**Presenter(s)** : TERYAEV, Oleg (JINR)**Session Classification** : Afternoon session 23/07/2024**Track Classification** : QCD (lattice, (non) perturbative, effective models)

Contribution ID : 15

Type : **not specified**

## **Current status of the Standard Model Effective Field Theory (SMEFT)**

*вторник, 23 июля 2024 г. 9:30 (45)*

///

**Presenter(s)** : BOOS, Eduard (SINP MSU)

**Session Classification** : Morning Session 23/07/2024

**Track Classification** : QCD (lattice, (non) perturbative, effective models)

Contribution ID : 16

Type : **not specified**

## Some new ideas in nonperturbative QCD

*вторник, 23 июля 2024 г. 10:15 (45)*

*///*

**Presenter(s)** : LUKASHOV, Mikhail S. (NRC "Kurchatov Institute")

**Session Classification** : Morning Session 23/07/2024

**Track Classification** : QCD (lattice, (non) perturbative, effective models)

Contribution ID : 17

Type : **not specified**

## Present state of the proton spin problem

*вторник, 23 июля 2024 г. 11:30 (45)*

*///*

**Presenter(s)** : ERMOLAEV, Boris (Ioffe Institut)

**Session Classification** : Morning Session 23/07/2024

**Track Classification** : Strongly interacting (QCD) matter

Contribution ID : **18**

Type : **not specified**

## Multiquarks

*вторник, 23 июля 2024 г. 14:30 (45)*

*///*

**Presenter(s)** : Prof. PARKHOMENKO, Alexander (Demidov State University, Yaroslavl)

**Session Classification** : Afternoon session 23/07/2024

**Track Classification** : Strongly interacting (QCD) matter

Contribution ID : 19

Type : **not specified**

## **Production of bound states of quarks and leptons in rare Higgs boson decays**

*вторник, 23 июля 2024 г. 15:15 (45)*

///

**Presenter(s)** : Dr MARTYNENKO , Alexey (Samara State University)

**Session Classification** : Afternoon session 23/07/2024

**Track Classification** : Strongly interacting (QCD) matter



Contribution ID : 20

Type : **not specified**

## Exploring Chiral Phase Transitions & Strong Magnetic Fields in Lattice QCD

*среда, 24 июля 2024 г. 9:30 (45)*

The transition of strong-interaction matter from the hadronic phase to the quark-gluon plasma phase is a rapid crossover rather than a true phase transition in nature. A true phase transition in strong-interaction matter is expected to exist only under certain conditions, such as the chiral limit of massless quarks.

In this talk, I will present our recent studies on the true phase transition of strong-interaction matter in the chiral limit of massless quarks, along with its microscopic origin. Our research is based on (2+1)-flavor lattice QCD simulations using highly improved staggered fermions, with pion masses ranging from 160 MeV down to 55 MeV. Additionally, I will discuss baryon electric charge correlation, which can serve as a magnetometer of QCD.

**Presenter(s)** : DING, Heng-Tong**Session Classification** : Morning session 24/07/2024**Track Classification** : QCD (lattice, (non) perturbative, effective models)

Contribution ID : 21

Type : **not specified**

## What do we know about the confinement mechanism?

*среда, 24 июля 2024 г. 12:15 (45)*

I will compare the main confinement mechanisms in QCD, confinement by magnetic monopoles and by quantised magnetic flux tubes, vortices. Then, I will concentrate on problems with the detection of vortices. A further interesting question concerns the relation to the spontaneous breaking of chiral symmetry.

**Presenter(s)** : FABER, Manfred (Atominstytut, Technische Universität Wien)

**Session Classification** : Morning session 24/07/2024

**Track Classification** : QCD (lattice, (non) perturbative, effective models)

Contribution ID : 22

Type : **not specified**

## Hyperon polarization in HIC

*среда, 24 июля 2024 г. 14:30 (45)*

///

**Presenter(s)** : KOLOMEITSEV, Evgeni (BLTP JINR, Dubna, Matej Bel University, Banska Bystrica)

**Session Classification** : Afternoon session 24/07/2024

**Track Classification** : QCD (lattice, (non) perturbative, effective models)

Contribution ID : 23

Type : **not specified**

## Fluctons

*среда, 24 июля 2024 г. 15:15 (45)*

*///*

**Presenter(s)**: ЮРЧЕНКО, Семён (Санкт-Петербургский государственный университет)

**Session Classification** : Afternoon session 24/07/2024

**Track Classification** : Strongly interacting (QCD) matter

Contribution ID : 24

Type : **not specified**

## Perspective of a Z factory

*среда, 24 июля 2024 г. 16:30 (45)*

...

**Presenter(s)** : LEVICHEV, Eugene (Budker INP)

**Session Classification** : Afternoon session 24/07/2024

**Track Classification** : Experimental data on hadron physics

Contribution ID : 25

Type : **not specified**

## Physics at a Z factory

*среда, 24 июля 2024 г. 17:15 (45)*

The most valuable task for high-energy physics at future colliders is the study of the Standard Model features in detail. That is required to resolve crucial problems of this model including the origin of the spontaneous symmetry breaking, the metastability of the Higgs boson vacuum, the symmetry and mass hierarchy of three fermion generations, etc. High statistics and advanced experimental accuracy at future Z factories can provide a substantially new level of the SM verification [1]. The physical program of such factories extends the studies performed at LEP because of higher statistics, modern detectors and advanced analysis techniques. All that challenges theory to provide adequately accurate SM predictions. Those challenges and some recent developments are discussed. ReneSANCe [1] Monte Carlo event generator and MCSANC [3] integrator presented. They are developed for high-precision studies of electroweak physics at future electron-positron colliders.

[1] A. Blondel, J. Gluza, S. Jadach et al., CERN Yellow Reports: Monographs 3/2019; arXiv:1809.01830 [hep-ph].

[2] R. Sadykov, V. Yermolchyk, Comput. Phys. Commun. 256 (2020), 107445.

[3] S.G. Bondarenko, A.A. Sapronov, Comput. Phys. Commun. 184 (2013), 2343-2350.

**Presenter(s)** : ARBUZOV, Andrej (BLTP JINR)

**Session Classification** : Afternoon session 24/07/2024

**Track Classification** : Experimental data on hadron physics

Contribution ID : 26

Type : **not specified**

## **Pomeron in QCD**

*четверг, 25 июля 2024 г. 9:30 (45)*

...

**Presenter(s)** : KIM, Victor (NRC KI - PNPI, Gatchina)

**Session Classification** : Morning session 25/07/2024

**Track Classification** : Diffractive scattering

Contribution ID : 27

Type : **not specified**

## Oscillations in elastic hadron scattering

*четверг, 25 июля 2024 г. 11:30 (45)*

...

**Presenter(s)** : SELYUGIN, Oleg (JINR)

**Session Classification** : Morning session 25/07/2024

**Track Classification** : Diffractive scattering



Contribution ID : 28

Type : **not specified**

## **Physics with flows and correlations at MPD, NICA**

*четверг, 25 июля 2024 г. 12:15 (45)*

...

**Presenter(s)** : PARFENOV, Petr (JINR)

**Session Classification** : Morning session 25/07/2024

**Track Classification** : Experimental data on hadron physics

Contribution ID : 29

Type : **not specified**

## **Electromagnetic probes of quark-gluon matter**

*четверг, 25 июля 2024 г. 15:15 (45)*

...

**Presenter(s)** : KHARLOV, Yuri (IHEP)

**Session Classification** : Afternoon session 25/07/2024

**Track Classification** : Experimental data on hadron physics

Contribution ID : 30

Type : **not specified**

## Problems of confinement in QCD

*четверг, 25 июля 2024 г. 16:30 (45)*

*///*

**Presenter(s)**: KHAIDUKOV, Zakhar (National Research Centre "Kurchatov Institute",MIPT)

**Session Classification** : Afternoon session 25/07/2024

**Track Classification** : QCD (lattice, (non) perturbative, effective models)

Contribution ID : 31

Type : **not specified**

## **Evolution of concepts and methods in physics of strong interactions**

*четверг, 25 июля 2024 г. 17:15 (45)*

...

**Presenter(s)** : Mr PETROV, Vladimir (IHEP)

**Session Classification** : Afternoon session 25/07/2024

**Track Classification** : Historical aspects of strong interactions theory

Contribution ID : **32**

Type : **not specified**

## Discussion 1

*вторник, 23 июля 2024 г. 18:00 (60)*

Discussion leader Roman Zhokhov (IZMIRAN, Troitsk)

**Session Classification :** Afternoon session 23/07/2024

**Track Classification :** Strongly interacting (QCD) matter

Contribution ID : 33

Type : **not specified**

## Discussion 2

*среда, 24 июля 2024 г. 18:15 (60)*

Discussion leaders

Oleg Teryaev (JINR, Dubna) &

Vitaly Bornyakov (Logunov IHEP, NRC KI, Protvino)

**Session Classification :** Afternoon session 24/07/2024

**Track Classification :** Experimental data on hadron physics

Contribution ID : 34

Type : **not specified**

## Discussion 3

*четверг, 25 июля 2024 г. 18:00 (60)*

Discussion leader:

V. A. Petrov (Logunov IHEP, NRC KI, Protvino)

**Session Classification :** Afternoon session 25/07/2024

**Track Classification :** Diffractive scattering

Contribution ID : 35

Type : **not specified**

## Opening address

*вторник, 23 июля 2024 г. 9:20 (10)*

**Presenter(s)** : PETROV, Vladimir (IHEP)

**Session Classification** : Morning Session 23/07/2024



Contribution ID : 36

Type : **not specified**

## Closing address

*четверг, 25 июля 2024 г. 19:00 (10)*

**Presenter(s)** : PETROV, Vladimir (IHEP)

**Session Classification** : Afternoon session 25/07/2024

Contribution ID : 37

Type : **not specified**

## Posters

*среда, 24 июля 2024 г. 18:00 (15)*

...

**Session Classification :** Afternoon session 24/07/2024

Contribution ID : 38

Type : **not specified**

## Physics at a Z factory

The most valuable task for high-energy physics at future colliders is the study of the Standard Model features in detail. That is required to resolve crucial problems of this model including the origin of the spontaneous symmetry breaking, the metastability of the Higgs boson vacuum, the symmetry and mass hierarchy of three fermion generations, etc. High statistics and advanced experimental accuracy at future Z factories can provide a substantially new level of the SM verification [1]. The physical program of such factories extends the studies performed at LEP because of higher statistics, modern detectors and advanced analysis techniques. All that challenges theory to provide adequately accurate SM predictions. Those challenges and some recent developments are discussed. ReneSANCe [1] Monte Carlo event generator and MCSANC [3] integrator presented. They are developed for high-precision studies of electroweak physics at future electron-positron colliders.

[1] A. Blondel, J. Gluza, S. Jadach et al., CERN Yellow Reports: Monographs 3/2019; arXiv:1809.01830 [hep-ph].

[2] R. Sadykov, V. Yermolchyk, Comput. Phys. Commun. 256 (2020), 107445.

[3] S.G. Bondarenko, A.A. Saprnov, Comput. Phys. Commun. 184 (2013), 2343-2350.

**Primary author(s)** : ARBUZOV, Andrej (BLTP JINR)

**Presenter(s)** : ARBUZOV, Andrej (BLTP JINR)

**Track Classification** : Experimental data on hadron physics

Contribution ID : 39

Type : **not specified**

## Production of bound states of quarks and leptons in rare Higgs boson decays

The rare decay process of the Higgs boson into a pair of  $J/\Psi$  and  $\Upsilon$  particles is studied within the perturbative Standard Model and the relativistic quark model. We study also the processes of single and paired production of lepton bound states (positronium, dimuonium, ditauonium) within the framework of the relativistic approach we are developing [1-5]. The relativistic corrections connected with the relative motion of heavy quarks and leptons are calculated in the production amplitude and the wave functions of the bound states. Numerical values of the decay widths of the Higgs boson are obtained, which can be used for comparison with future experimental data.

1. A.P. Martynenko, F.A. Martynenko, Paired Double Heavy Baryons Production in Decays of the Higgs Boson //Symmetry. – 2023. – V. 15. –No.10. – P. 1944.
2. A.P. Martynenko, F.A. Martynenko, Relativistic Corrections to the Higgs Boson Decay into a Pair of Vector Quarkonia //Symmetry. – 2023. – V. 15. –No. 2. – P. 448.
3. R.N. Faustov, A.P. Martynenko, F.A. Martynenko, Relativistic corrections to paired production of charmonium and bottomonium in decays of the Higgs boson //Physical Review D. – 2023. – V. 107. –No.. 5. – P. 056002.
4. R.N. Faustov, F.A. Martynenko, A.P. Martynenko, Higgs boson decay to the pair of S-and P-wave Bc mesons //The European Physical Journal A. – 2022. – V. 58. –No. 1. – P. 4.
5. F. A. Martynenko, A. P. Martynenko and A. V. Eskin, Production of dileptonic bound states in the Higgs boson decay, <http://arxiv.org/abs/2405.00829v1>.

**Primary author(s) :** Dr MARTYNNENKO, Alexei (Samara U.)

**Presenter(s) :** Dr MARTYNNENKO, Alexei (Samara U.)

**Track Classification :** Strongly interacting (QCD) matter