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Book of Abstracts

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Young Scientist Forum

Analytic calculation of some NRQCD master integrals

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The analytical calculation of Feynman integrals is an important problem in modern quantum field theory. This task is important both for obtaining the most accurate predictions for observable quantities and for some areas of pure mathematics such as theory of periods in algebraic geometry. Nevertheless, it is not always possible to obtain analytical solutions for all Feynman integrals beyond one loop. All difficulties are usually associated with the appearance of elliptic or more complex geometric structures which inevitably arise when taking into account the masses of propagators.
In this work, we use an example of two loop elliptic master integrals arising from non-relativistic QCD as a laboratory to develop new methods for calculating non-polylogarithmic Feynman integrals. First of all, we will consider a new method that allows to obtain exact, in terms of the dimensional regularization parameter, solutions for the integrals under consideration. In this case, the solutions are expressed in terms of well-converging Frobenius power series. We will also briefly consider a new method for obtaining integral representations for the same integrals.

Young Scientist Forum

A new method for the measurement of the Michel parameters that describe the daughter muon polarization in the $\tau^- \to \mu^- \bar{\nu}_\mu \nu_\tau$ decay

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This work provides a detailed description of the method for the first direct measurement of all Michel parameters in the $\tau^- \to \mu^- \bar{\nu}_\mu \nu_\tau$ decay related to the polarization of the daughter muon. An application of the suggested method in the existing and future experiments at e^+e^- colliders is considered. We have performed a feasibility study for the future Super Charm-Tau Factory and Belle II experiments. For the first one, the sensitivity to the Michel parameters ξ', ξ'', η'', α'/A, and β'/A is estimated. For the latter, only one Michel parameter, ξ', for which the sensitivity is maximum, is considered.

Young Scientist Forum

Canonical description for formulation of embedding gravity as General Relativity with additional matter

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The work is devoted to the study of canonical formalism for one of the General Relativity modifications, the embedding theory. It is known that the embedding theory can be rewritten as General Relativity with an additional contribution of matter, which is called the embedding matter. The canonical description of such embedding theory is interesting for a better understanding of the embedding matter properties point of view. In this paper, we calculate all primary and secondary constraints, obtain the formulation of the Hamiltonian as a linear combination of constraints, and discuss the classification of the resulting constraints into constraints of the first and second classes. We solve some of the constraints, then the results for the considered embedding theory formulation in the form of GR with additional matter are compared with the already known results for the pure embedding theory.

Young Scientist Forum

Dual formulation for the massless spin 2 theory

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We propose dual representation for the massless spin 2 theory by the third-rank tensor field with the hook Young diagram. We start from the linearized system of Einstein equations which includes Nordström equation. Once the linearized Nordström equation is a topological field theory, the general solution is a pure gauge. Substituting this general solution into the rest of Einstein system, we arrive at the field equations for the hook tensor, being the initial gauge parameter for the Nordström equation. The degree of freedom count confirms that these higher derivative equations describe massless spin 2 theory. This dual formulation is consistent in any $d \geq 3$.

Young Scientist Forum

Recent CMS flavor physics results

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The recent CMS results on flavor physics will be discussed, in particular, the full Run-2 study of dimuon decays of B0 and B0s mesons.

Young Scientist Forum

Extended Chern–Simons Model for a Vector Multiplet

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We consider a gauge theory of vector fields in 3D Minkowski space. At the free level, the dynamical variables are subjected to the extended Chern–Simons (ECS) equations with higher derivatives. If the color index takes n values, the third-order model admits a 2n-parameter series of second-rank conserved tensors, which includes the canonical energy–momentum. Even though the canonical energy is unbounded, the other representatives in the series have a bounded from below the 00-component. The theory admits consistent self-interactions with the Yang–Mills gauge symmetry. The Lagrangian couplings preserve the energy–momentum tensor that is unbounded from below, and they do not lead to a stable non-linear theory. The non-Lagrangian couplings are consistent with the existence of a conserved tensor with a 00-component bounded from below. These models are stable at the non-linear level. The dynamics of interacting theory admit a constraint Hamiltonian form. The Hamiltonian density is given by the 00-component of the conserved tensor. In the case of stable interactions, the Poisson bracket and Hamiltonian do not follow from the canonical Ostrogradski construction. Particular attention is paid to the “triply massless” ECS theory, which demonstrates instability even at the free level. It is shown that the introduction of extra scalar field, serving as Higgs, can stabilize the dynamics in the vicinity of the local minimum of energy. The equations of motion of the stable model are non-Lagrangian, but they admit the Hamiltonian form of dynamics with a Hamiltonian that is bounded from below.

Young Scientist Forum

Formation of primordial black holes after Starobinsky inflation with single field model

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We adapted the Appleby-Battye-Starobinsky (ABS) model of $F(R)$-gravity towards describing double cosmological inflation and formation of primordial black holes with masses up to $10^{19}g$ in the single-field model. Masses of primordial black holes in this model are beyond the Hawking limit $10^{15}g$, and this allows us to assert that primordial black holes can form a part of cold dark matter. Our results agree with the current measurements of cosmic microwave background radiation within 3σ, but require fine-tuning of the parameters.

Young Scientist Forum

Generalized method of symmetric embeddings construction and its application to spacetimes of general relativity

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It can be shown that an arbitrary (pseudo) Riemannian manifold can be considered as a surface in a flat space of a larger number of dimensions. This approach, for example, leads to a modified theory of gravity -- the embedding theory. However, the construction of explicit embeddings in a flat space is a nontrivial task that can be reformulated as the solution of a system of nonlinear partial differential equations. The method that will be presented in this report can be used to simplify the construction of explicit embeddings for spaces with abelian symmetry, and in some cases, to construct an explicit embedding completely. It will be shown how this method allows us to construct explicit embeddings of manifolds of (2+1) dimensional gravity: a BTZ black hole with angular momentum and a magnetic monopole.

Young Scientist Forum

Gravitational chiral anomaly for fields with spin 3/2 in the Rarita-Schwinger-Adler theory

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We find the gravitational chiral anomaly for spin 3/2 fields in the framework of the new theory proposed by S. L. Adler. This anomaly differs by -19 times from the anomaly for Dirac field. Adler's theory includes Rarita-Schwinger fields and an additional field with spin 1/2, interaction with which allows solving the well-known problem with the construction of a quantum-field perturbation theory.

Young Scientist Forum

On the one loop effective action in 6D N=(1,0) hypermultiplet self-coupling model

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We study the six-dimensional $calN = (1, 0)$ supersymmetric model of interacting gauge multiplet and hypermultiplet with arbitrary self-coupling. Using the background field method in the harmonic superspace, we calculate the divergent part of the one-loop effective action and discuss the possible finite contribution to the low-energy effective action. We demonstrate that the one-loop divergences do not vanish even in the case of the on-shell background superfields.

Young Scientist Forum

Quantum chaos in nonlinear vector mechanics

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Out-of-time ordered correlation functions (OTOCs) are widely used as a diagnostic of quantum chaos and allow one to estimate the quantum Lyapunov exponent, which reproduces classical Lyapunov exponent in the semiclassical limit. However, in most cases, OTOCs and quantum Lyapunov exponent are calculated numerically. We consider nonlinear vector mechanics with a broken $O(N)$ symmetry, which exhibits a chaotic behavior in classical case, and analytically calculate the quantum Lyapunov exponent summing the ladder diagrams in the large-N limit. Furthermore, we explicitly show that in the high-temperature limit, quantum exponent reproduces the classical one.

Young Scientist Forum

The cosmological signature of light sgoldstino: gravitational waves from electroweak phase transition

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Nowadays the supersymmetic models are widely used to extend the Standard Model. In some realistic ones the supersymmmetry is spontaneously violated at energies of order 1 TeV. This fact is effectively described by a chiral sgoldstino multiplet consisting of a Goldstone fermion, goldstino, a scalar sgoldstino and an auxiliary field with a none-zero vev.
In the paper 2112.06083 we consider light sgoldstinos with mass about 100 GeV. Other superpartners are much heavier, so they are not active at the electroweak scale. Being the additional scalar degrees of freedom, light sgoldstinos contribute to the effective potential at a finite temperature.
We study the possibility of the first-order electroweak phase transition (EWPT) due to this contribution and search for region in the model parameter space where the EWPT takes place. Using the packages PhaseTracer and FindBounce we have found several points with EWPT at temperatures

60-140 GeV. We also estimate the spectra of gravitational waves produced during the EWPT. The predicted signals can be observed by LISA, BBO and DECIGO experiments.

Young Scientist Forum

Energy reconstruction with machine learning techniques in JUNO: aggregated features approach

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The Jiangmen Underground Neutrino Observatory (JUNO) is a neutrino experiment under construction with a broad physics program. The main goals of JUNO are the determination of the neutrino mass ordering and the high precision measurement of neutrino oscillation properties. High quality reconstruction of reactor neutrino energy is crucial for the success of the experiment.

The JUNO detector is equipped with a huge number of photomultiplier tubes (PMTs) of two types: 17 612 20-inch PMTs and 25 600 3-inch PMTs. The detector is designed to provide an energy resolution of 3% at 1 MeV. Compared to traditional reconstruction methods, Machine Learning (ML) is significantly faster for the detector with so many PMTs.

In this work we studied ML approaches for energy reconstruction from the signal gathered by the PMT array and presented fast models using aggregated features: fully connected deep neural network and boosted decision trees. The dataset for training and testing is generated with full simulation using the official JUNO software.

Young Scientist Forum

Measurement of the T-odd correlation in the K+ --> eˆ{+} nu piˆ{0} gamma radiative decay at OKA setup

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Measurements of the T-odd correlation in the K+ --> eˆ{+} nu piˆ{0} gamma radiative decay are performed at the ``OKA'' detector exposed to 18 GeV/c RF separated beam of the U-70 PS. About 100K events of the decay are selected with a background of 15%. The measured correlation ksi is a mixed product of the eˆ{+}, piˆ{0} and gamma momenta in the kaon rest frame, normalised to M_{K}ˆ{3}. For the estimate of the T-odd asymmetry a variable A_ksi = N_{+}-N_{-} / N_{+}+N_{-}, where N_{+-} is the number of events with ksi > (<) 0 is used . The measurement of the asymmetry gives: A_ksi = (-2.1 +- 4.3 (stat) +- 1.1 (syst)) x 10ˆ(-3), or | A_ksi |< 7.8 x 10ˆ{-3} at 90% C.L.

Young Scientist Forum

Measurements of gluon fusion and vector-boson-fusion production of the Higgs boson in H⟶WW*⟶eνμν decays using pp collisions at √s=13 TeV with the ATLAS detector

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The gluon fusion and vector-boson-fusion Higgs boson production modes are measured using proton-proton collisions in the $H \to WW^* \to e\nu\mu\nu$ decay channel. The Large Hadron Collider delivered proton-proton collisions at a centre-of-mass energy of 13 TeV between 2015 and 2018 which were recorded by the ATLAS detector, corresponding to an integrated luminosity of 139 fb^{-1}. The products of the total gluon fusion and vector-boson-fusion cross sections times the $H \to WW^*$ branching fraction are respectively measured to be 12.4 ± 1.5 pb and $0.79\ ^{+0.19}_{-0.16}$ pb, in agreement with Standard Model predictions. Higgs boson production is further characterised through measurements of Simplified Template Cross Sections in a total of 11 kinematical fiducial regions.

Young Scientist Forum

Monte-Carlo studies of heavy sterile neutrino from Ds+ decay

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Standard Model of high energy physics is very successful, but neutrino sector is not completely accommodated into it (e.g. neutrino oscillations). One of the possible solution is introduction of heavy sterile neutrino, which does not have any flavour and interacts with only flavour SM neutrinos via oscillations.

In this talk studies of heavy sterile neutrino N is presented, where neutrino originates from D_s^+ decay, namely $D_s^+ \to \mu^+ N \to \mu^+\mu^+\pi^-$. Origin of D_s^+ mesons are semileptonic decays $B_s^0 \to D_s^+\mu^-\mu_\nu$. Studies are provided using Monte-Carlo simulation samples with CMS detector at CERN Run-2 conditions (proton-proton collisions with $\sqrt{s} = 13$ TeV). Full simulation (Pythia + EvtGen + Photos + Geant4) is provided, as well as the full reconstruction of the simulated decay. Several points on $(m_N, V_{N\mu})$ plane are generated for the sterile neutrino properties, where m_N and $V_{N\mu}$ are the expected mass of N and coupling parameter with mass. We provide studies of kinematic and topological variables of the involved particles, reconstruction efficiencies in dependence of N properties, detector resolution and selection criteria, fit functions etc.

The obtained results and estimated sensitivity in $(m_N, V_{N\mu})$ plane will be used for the future search for this decay and heavy sterile neutrino, using real CMS Experiment data.

Young Scientist Forum

Revisiting PS191 limits on sterile neutrinos

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We perform Monte Carlo simulations of the sterile neutrino signal at the fixed target experiment PS191 operated on a proton beam of 19.2GeV at CERN in the eighties. We find that the strongest bounds the PS191 could obtain are significantly lower than what they published, and now are obsolete being surpassed by recent T2K, NA62, E949, TRIUMF and PIENU experiments.

(Based on arXiv:2112.06800.)

Young Scientist Forum

Searches for the light invisible hypothetic pseudoscalar in the [K+ --> piˆ{+} piˆ{0} P] decay at the OKA setup

Sergey Akimenko[1] ; Alexander Artamonov[1] ; Alexander Gorin[1] ; Sergey Donskov[1] ; Alexander Inyakin[1] ; Vladimir Kolosov[1] ; Victor Kurshetsov[1] ; Michail Medynsky[1] ; Yury Mikhailov[1] ; Vladimir Obraztsov[1] ; Artem Okhotnikov[1] ; Vitaly Polyakov[1] ; Vladimir Romanovsky[1] ; Vladimir Rykalin[1] ; Alexander Sadovsky[1] ; Vladimir Samoilenko[1] ; Oleg Stenyakin[1] ; Ilya Tyurin[1] ; Vladimir Uvarov[1] ; Alexey Filin[1] ; Gennadiy Khaustov[1] ; Sergey Kholodenko[1] ; Oleg Yushchenko[1] ; Evgeny Guschin[2] ; Vladimir Kravtsov[2] ; Yury Kudenko[2] ; A. Yu. Polyarush[2] ; S.N. Filippov[2] ; A. Khudyakov[2] ; B. Zalikhanov[3] ; G. Kekelidze[3] ; V. Bychkov[3] ; V. Lysan[3]

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Searches for the light invisible hypothetic pseudoscalar in the decay $K^+ \to \pi^+\pi^0 P$ are performed for two alternative scenarios, namely for the pseudoscalar sgoldstino and for the axion. We analysed the data taken from the ``OKA'' detector in 2018. The setup uses 18 GeV/c RF separated beam of the U-70 proton synchrotron.
No signal is observed, the upper limits for the branching ratio of the decay are derived for both scenarios.
The 90% CL upper limit for the case of sgoldstino is estimated to be in the region $3 \cdot 10^{-5}$ to $2 \cdot 10^{-6}$ depending on the sgoldsino mass from 40 to 200 MeV. The upper limit for the axion is changing from $2 \cdot 10^{-5}$ to $2.5 \cdot 10^{-6}$ for the axion mass range from 20 to 200 MeV.

Young Scientist Forum

Study of the $\omega \to \pi^0 e^+ e^-$ conversion decay with the CMD-3 detector at VEPP-2000 collider

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Measurements of the branching ratios of conversion decays are necessary to test the vector dominance model and estimate the background in the study of quark-gluon plasma. An important source of information about the physical processes occurring in a quark-gluon plasma is the production of dileptons, in particular, the production of electron-positron pairs. In experiments, the measured number of lepton pairs exceeds the theoretically predicted one. One of the main contributions to background events in the analysis of dilepton spectrum is the conversion decays of vector mesons. In particular, ω meson decay into $\pi^0 e^+ e^-$ should be taken into account.
The study of the conversion decay $\omega \to \pi^0 e^+ e^-$ in the decay channel $\pi^0 \to \gamma\gamma$ was performed with the CMD-3 detector at the VEPP-2000 e^+e^- collider at the BINP in Novosibirsk. The analysis uses the data collected at the center of mass energy range 660 MeV -- 840 MeV with total integrated luminosity of about 10 1/pb.
The main background processes are $\pi^0\pi^+\pi^-$ events, QED events, and $\pi^0\gamma$ decay events, when a monochromatic photon is converted into e^+e^- pair on the material before the sensitive volume of the detector. To suppress the latter type of background, a deep neural network was used. The efficiencies of photons reconstruction, trigger, reconstruction of close tracks, and neural network application were calculated. The Born cross-section of the process under study was measured in the range 660 MeV -- 840 MeV and a preliminary result was obtained for the branching ratio of $\omega \to \pi^0 e^+ e^-$. The result is twice more precise than any previous measurements.

Young Scientist Forum

The DUNE experiment PRISM method for data-driven predictions

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Mixing matrix parameters in a lepton sector are expected to be measured precisely by the next-generation experiments. One of them is an accelerator deep underground neutrino experiment DUNE, which will have a wide physics program in particular neutrino oscillations. Its main goal is to determine the neutrino mass hierarchy, the charge-parity phase δ_{CP} and the octant of mixing angle θ_{23}. DUNE will consist of near and far detector complexes. The last one will measure neutrino spectra after oscillations. The near detector system will be used for controlling the systematic uncertainties. Two detectors of the near complex, LAr and GAr, will be able to move perpendicular on 33 m long to the beam axis and make precision reaction-independent spectrum measurements. Such design is named as DUNE PRISM and is unique relative to other existing experiments.
DUNE PRISM methods using a linear combination of near detector off-axis measurements are able to create far detector oscillated predictions without dependence on the model of neutrino interactions and fluxes. These uncertainties can unfold a bias of the far detector spectrum that effects directly on the experiment sensitivity to the oscillation parameters.

Young Scientist Forum

Early universe first order phase transition due to the composite Higgs boson dynamics in the soft-wall holographic model

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The composite Higgs model assume that the Higgs field arises as the pseudo-Goldstone mode corresponding to a dynamical symmetry breaking in a new strongly coupled sector. We present the soft-wall holographic model where such symmetry breaking occurs as a first order phase transition. In this case the bubble nucleation in the early universe becomes possible. To study the homogeneous solutions in the models of this type we present the perturbation theory approach.

Poster Session - Board: 1

Prospects for the search for HN in the CMS experiment using the lepton decay of the Ds meson into μν

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One of the ways to detect a sterile neutrino, as well as to measure its mass and strength of connection with an ordinary neutrino, is to search for decays of heavy hadrons, in which the lepton number conservation law is violated. The report discusses the prospects for searching for a heavy sterile neutrino in the decay of a D_s meson into two muons of the same sign and a pion of opposite charge, using data from the CMS experiment at the Large Hadron Collider at CERN, collected in 2018 in proton-proton collisions with an energy of 13 TeV in the center of mass system .

Poster Session - Board: 2

Production and two-photon decay of ηc at energy of SPD NICA

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η_c-meson production and two-photon decay at the NICA energies was studied. Square of the amplitude of the above process was found and the signal-background ratio was constructed. The process of diphoton birth (direct and with fragmentation) was chosen as the background. Special attention was paid to the influence of experimental cut on transverse momentum on the calculation results.The diphoton decay of the π_0 meson tried out as the background, and the signal-background ratio was evaluated in this case as well.

Poster Session - Board: 4

Notes on peculiarities of quantum fields in space-times with horizons

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We consider massive scalar field theory on static four-dimensional space-times with horizons. We study the near horizon behavior of the quantum expectation values of the stress--energy tensor operator for thermal state with generic temperatures. It turns out that the dependence of the expectation values on the temperature and tensor structure of the stress--energy tensor differs from the usual one in the Minkowski space-time. Moreover, for non--canonical temperatures these expectation values are divergent on the horizons. We also show that the Wightman functions have additional infrared peculiarities near the horizons.

Poster Session - Board: 5

The charm baryons production in high-energy pp collisions at $\sqrt{s}_{pp}$ = 8 TeV

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The charm hadron production in high-energy pp collisions into the forward region ($2 < \eta < 5$) has been recently studied by LHCb experiment at several centre-of-mass energies of 5, 7 and 13 TeV [1-3]. These studies were done mainly for charm mesons and there is a certain lack of the data for baryons. Moreover, excited states were not investigated at all.

The ongoing research is devoted to the measurement of relative differential cross sections for the production of the Σ_c^{++}, Σ_c^0, $\Lambda_c(2595)^+$ and $\Lambda_c(2625)^+$ baryons with respect to their ground state Λ_c^+. Decays $\Sigma_c^{++,0} \to \Lambda_c^+\pi^\pm$ and $\Lambda_c^{*+} \to \Lambda_c^+\pi^+\pi^-$ followed by $\Lambda_c^+ \to pK^-\pi^+$ are used for these purposes. The studies are done with the dataset collected by LHCb at the $\sqrt{s}_{pp}$ = 8 TeV. The obtained results will be useful for the tuning of the Monte-Carlo generators, especially as they will shed a light on the hadronisation process. We expect that they may help to obtain fragmentation fractions for these excited states.

Main analysis steps are selection of the candidates including the separation of the prompt component, correction on the detection as well as on particle identification efficiencies. These steps will be discussed in the contribution.

1. LHCb Collaboration, Prompt charm production in pp collisions at $\sqrt{s} = 7$ TeV, Nucl. Phys. B, 871 (2013)
2. LHCb Collaboration, Measurements of prompt charm production cross-sections in pp collisions at $\sqrt{s} = 13$ TeV, JHEP 03, 159 (2016), JHEP 09, 013 (2016), JHEP 05, 074 (2017)
3. LHCb Collaboration, Measurements of prompt charm production cross-sections in pp collisions at $\sqrt{s} = 5$ TeV, JHEP 06 147 (2017)

Poster Session - Board: 6

Ξc(2645) and Ξc(2815) production in pp interactions at the LHCb

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The information about the fragmentation process is used to describe the dynamics of hard processes at the different parts of experimental high energy physics. The information about probability of production of a final state hadron from a parton of a specific type plays a key role in those studies. The fragmentation processes are difficult to simulate, but the information about them could be obtained by analyzing the so-called fragmentation fractions, which can be evaluated using the relations between differential production cross sections. Electron-positron, electron-proton and proton-proton interactions are used for these purposes.

Until now, only the fragmentation fractions of charm hadrons such as: D^0, D^+, D_s^+, Λ_c^+, Ξ_c^+ have been measured with a high accuracy. However, there are no studies of the ratios of the differential cross sections for the production of excited states from the Ξ_c^+ family such as: $\Xi_c(2645)^0$, $\Xi_c(2815)^+$ and the corresponding antiparticles. The main interest is the universality of fragmentation fractions, that is their dependence on the kinematics of the charm hadrons. The LHCb experiment has already discovered a non-universality of the fragmentation fractions for b-hadrons has already been discovered [1]. In the charmed hadron sector, there are theoretical predictions [2] indicating the non-universality of the fragmentation fractions. In addition, in the work [3] the ALICE collaboration also indicates a possible violation of non-universality in the hadronization process.

The main goal of the ongoing study is to obtain the relations of the differential cross sections for the production of excited charmed baryons: $\Xi_c(2645)^0$ and $\Xi_c(2815)^+$ with respect to their ground state. The relations of the differential production cross sections, with correction on branching ratios, are supposed to be equal to the relation of the fragmentation functions of the corresponding hadrons. The proton-proton collisions dataset obtained by the LHCb experiment at the $\sqrt{s}$ = 7 and 8 TeV during Run-I campaign is used. The decays candidates are selected by the following decay channels:

$\Xi_c^+ \to pK^-\pi^+$; $\Xi_c(2645)^0 \to \Xi_c^+\pi^-$; $\Xi_c(2815)^+ \to \Xi_c(2645)^0\pi^+$.

The rapidity as well as the transverse momentum dependencies of the cross section are studied.

1. LHCb Coll. Measurement of b hadron production fractions in 7 TeV pp collisions. Phys. Rev., D85, 2012.
2. B.A. Kniehl, G. Kramer, I. Schienbein, and H. Spiesberger, Λ_c^+ production in pp collisions with a new fragmentation function, Phys. Rev. D 101, 114021 (2020).
3. ALICE Collaboration, Charm-quark fragmentation fractions and production cross section at 4 midrapidity in pp collisions at the LHC, Phys. Rev. D 105, L011103 (2022).

Poster Session - Board: 7

New techniques for materials in high energy physics

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Present high energy physics experiments require specific materials and technologies. For example the LHC high luminosity phase implies significant changes for LHCb in the upcoming upgrade 2. For the calorimetry system our main activities are concentrated on the upcoming upgrade of the

electromagnetic calorimeter (ECAL), with changing the inner part of the present shashlik type modules in favor of the spaghetti type modules (SPACAL). Very inner part, with the highest expected radiation doses, is to be filled with radiation-hard crystal scintillating fibers (e.g. GAGG 1x1 mmˆ2 in cross-section) in pair with a Tungsten absorber, while the next region to be made of polystyrene fibers and lead-based absorber. In both cases the technology suitable for mass production is to be developed allowing precise positioning of the sensitive materials.
For the lead-based absorber the special molding technique is under development. First prototype had been produced at NUST ``MISiS'' (Moscow) and equipped with fibers and tested at CERN in 2021. Next prototype is being produced and to be tested this year.
For the tungsten absorber a 3D printing technique has been developed and currently available at NUST “MISiS”. First obtained samples meet the surface criterias for the experiment, and a prototype suitable for beam-tests to be produced soon.
Tungsten 3D printing allows various alternative applications. Currently, research is conducted on the special 3D printed anti-scattering tungsten grating – an object for the X Ray imaging, aimed to reduce background from the scattered photons. A first prototype sample with 150 um walls and with size 303030 mmˆ3 produced and tested.

Poster Session - Board: 8

Free energy and entropy in Rindler and de Sitter space-times

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We investigate the free energy and entropy of the Gaussian massive scalar field theory in the static de Sitter space-time for arbitrary temperature. For the inverse temperatures of the form $\beta = 2\pi 2^k,\ k \in \mathbf{Z}$, in curvature units, we find the explicit form of the free energy and its derivatives with respect to the temperature. There are two types of contributions to the free energy: one is of the “area type” and can be attributed to the horizon, while the other is of the “volume type” and is associated with the interior of the space-time. The latter contribution in the odd-dimensional case in the limit of the week field (large mass or small Hubble constant) significantly depends on the temperature. Namely, for $\beta < 2\pi$, the free energy behaves as $F_\beta^{bulk} \sim e^{-\beta\, m}$, while for $\beta > 2\pi$ it behaves as $F_\beta^{bulk} \sim e^{-2\,\pi\, m}$. We also show that even the leading UV contributions to the free energy significantly depend on the state of the theory, which is very unusual. We explain the origin and physical meaning of these observations. As the model example we consider the situation in the Rindler wedge of the flat space-time.

Poster Session - Board: 9

Likelihood fit based estimation of the background induced by the misidentification of a jet as a photon at pp collider experiment

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The background induced by misidentification of a jet as a photon is usually estimated using two-dimensional sideband method (ABCD-method). This report is devoted to an alternative method of the estimation based on maximum likelihood method using RooFit toolkit. This method doesn't require optimisation of ABCD regions definition, which results in much faster estimation. One of the main advantages of the developed method is that it takes into account data, signal and all other backgrounds distributions, which allow better estimation accuracy. The estimates of the considered method are confirmed by standard ABCD-method.

Poster Session - Board: 10

Lyapunov growth in nonlinear vector mechanics

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One of conventional measures of chaotic behavior in classical Hamiltonian systems is the Lyapunov exponent. This quantity has a nonunique generalization to quantum case. Comparison of such a different generalization has a difficulty, namely, chaotic systems are nonintegrable, so that rare system can be analyzed analytically. We compute classical Lyapunov exponent numerically in the particular model of nonlinear vector mechanics and compare it to it's quantum counterpart, calculated analytically in the limit of a large number of particles N. Then, using this example, we discuss the difficulties of the definitions of both classical and quantum exponent, namely the dependence on initial conditions and the choice of an ensemble.

Poster Session - Board: 11

Development of algorithm for prediction of parameters of secondaries in hadronic showers in highly granular calorimeters using a neural network

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Simulations play an important role in high energy physics. They help to optimize detectors for experiments. We present a neural-network-based algorithm for prediction of parameters of secondaries in a hadronic shower using calorimetric observables. The method proposed was tested for two hadronic models of the Geant4 package.

Poster Session - Board: 12

Towards new tests of cosmic-ray correlations with BL Lac type objects

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Ultra-high energy cosmic rays (UHECR) can be produced in active galaxies, and directional correlations between them were studied extensively. One puzzling result was the correlations of arrival directions of UHECR and a particular class of active galactic nuclei, BL Lacertae type objects, discovered in 2004 with the HiRes stereo data set [1,2]. If confirmed, this result would definitely mean new physics or very unconventional astrophysics because it implies neutral particles travelling for cosmological distances. However, the HiRes resolution remains unsurpassed, and the hypothesis has not yet been tested with independent data. The original correlations [1] used the catalog [3] which is not complete by any criteria. Even though statistical methods of analysis were selected to minimize the associated uncertainties, random biases still could have affected the result. That's why it is needed to repeat this analysis with the use of a complete sample of sources. This report is dedicated to the methods used in construction of such a complete and isotropic set of BL Lacs adopted for future tests of the enigmatic correlations with the new data of the Telescope Array experiment.

[1] – D. S. Gorbunov, P. G. Tinyakov, I. I. Tkachev, S. V. Troitsky, arXiv:astro-ph/0406654v1
[2] – HiRes Collaboration 2005
[3] – M. P. $Véron - Cetty$ and P. $Véron$, ESO scientific report (2000); M. P. $Véron - Cetty$ and P. $Véron$, Astron. Astrophys. 374 (2001) 92.

Poster Session - Board: 13

Renormalization group analysis of a self-organized critical system: Intrinsic anisotropy opposed to random medium

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The phenomenon of self-organized criticality (SOC) consists in the emergence of scaling in open nonequilibrium systems with dissipative transport. Unlike equilibrium systems that arrive at critical states when control parameters approach their critical values, systems with SOC evolve to critical states due to their intrinsic dynamics. Such systems are widespread in nature with SOC being observed in physical, biological, economic and social systems. Critical behavior of stochastic system can be drastically affected by turbulent motion of the environment, thus, it is important to study the motion influence on systems with SOC.

In this report, i present a field theoretic renormalization group analysis of the continuous anisotropic model of SOC introduced in (a "running sandpile") coupled to the stochastic Navier–Stokes equation. The latter describes turbulent motion of the environment; the random force correlator for the equation is chosen in the form that includes two terms. The first one is local and corresponds to shaking the fluid as a whole while the second one models "pure" turbulence.

Coordinates of the fixed points of RG equations and corresponding critical exponents are found on one loop approximation.

Poster Session - Board: 14

A Tale of Invisibility: Constraints on New Physics in b -> sνν

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Semileptonic flavor changing neutral current transitions with a pair of neutrinos in the final state are very accurately determined in the standard model (SM) and thus provide an accurate and sensitive probe for physics beyond the SM. Until recently, the poor tagging efficiency for the B -> K(∗)νν modes made them less advantageous as a probe of new physics (NP) compared to the charged lepton counterparts. The most recent Belle II result on B -> Kνν uses an innovative inclusive tagging technique resulting in a higher tagging efficiency; this together with previous BaBar and Belle results indicates a possible enhancement in the branching fraction of B+ ->K+νν. A reanalysis of the full Belle dataset together with upcoming Belle II dataset is expected to result in a much more precise measurement of this mode. If the branching ratio is indeed found to be enhanced with improved measurements, this would provide an unambiguous signal of NP without uncertainties due to long-distance non-factorizable effects or power corrections (in contrast to B-> Kll). We have explored the possibilities of such an enhancement as a signal of NP in scenarios with additional Z'-boson, which can also explain some of the other tensions observed in neutral as well as charged current B-decays. In an effective field theory approach, with the most general dimension-six Hamiltonian including light right-handed neutrinos, we explore the parameter space possible with a generic vector gauge boson Z' model assuming minimal new particle content. While being consistent with all data, correlations between the observed intriguing discrepancies in B-decays are also obtained, which will discriminate between the various NP scenarios.

Poster Session - Board: 15

Self-Tuning Inflation

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We develop an inflationary model without small parameters on the basis of multidimensional $f(R)$ gravity with a minimally coupled scalar field. The model is described by two stages. The first one begins at energy scales about the D-dimensional Planck mass and ends with the de Sitter metric of our space and the maximally symmetric extra dimensions. In the following, the quantum fluctuations produce a wide set of inhomogeneous extra metrics in causally disconnected regions quickly generated in the de Sitter space. We find a specific extra space metric that leads to effective Starobinsky model that fits the observational data.

Poster Session - Board: 16

Modification of AdS/CFT correspondence in top-down approach to near-throat D3-black brane geometry.

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The AdS/CFT correspondence formulated by Juan Maldacena has inspired the construction of numerous models in the theory of strong interactions, condensed matter physics and some other areas where the problem of strong coupling arises. The AdS/CFT correspondence hypothesis states, in particular, that 4-dimensional CFT in flat space in the strong-coupling regime can be described in terms of the dual theory of gravity in AdS5 space. This hypothesis has been well tested only in the so-called strong formulation when the bulk is AdS5 space. In this paper, an attempt is made to analyze the modifications of the AdS/CFT matching recipes, outside the strong hypothesis.
To this end, a method for directly shifting the cutoff boundary to the UV region for the AdS/CFT correspondence is constructed and a modification of the bulk-normalized solutions of the zero mode of the dilaton field on the space AdS5(mod) is proposed, which arises as a result of taking into account the second order of smallness of r/R in the metric created by the stack D3 -branes in type IIB supergravity. A direct factorization of corrections to the solution against the background of AdS5 is performed. For the obtained corrections, the equation of motion, recipes for modifying the bulk-bulk and bulk-boundary propagators, as well as the correlator of two primary operators corresponding to the Lagrangian N=4 SYM, are obtained. It is also shown how this construction can be related to the correction in terms of the t'Hooft constant in the dual gauge theory.

Poster Session - Board: 17

Relativistic GL(NM, C) Gaudin models on elliptic curve

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We present a classification for relativistic Gaudin models on GL-bundles over elliptic curve. We describe the most general GL(NM) classical elliptic finite-dimensional integrable system, in which Lax matrix has n simple poles on elliptic curve. Also, we provide a description of this model through R-matrices satisfying associative Yang-Baxter equation. Finally, we describe the inhomogeneous Ruijsenaars chain and show that it can be considered as a particular case of multispin Ruijsenaars-Schneider model.

Poster Session - Board: 18

N=2 higher spin theory in harmonic superspace

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The report will be devoted to the description of the N=2 theory of higher spins and their interactions with the hypermultiplet. To formulate the theory, the language of harmonic superspace is used. The structure of the corresponding N=2 supercurrents will also be discussed.

Poster Session - Board: 19

Model A of critical dynamics: 5-loop ε expansion study

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The second order phase transitions and critical phenomena are accompanied by anomalous increase of correlation radius and relaxation time. On the approach of a system to its critical point, these values are described by power law and characterized by critical exponents. These universal constants depend on the dimension of the space and the number of components of the order parameter, but remain the same for all matter. The renormalization group method allows to obtain an asymptotic ε-expansion for the critical exponent, where ε=4-d is formally small parameter, which shows the deviation of the dimension of the space from its critical value dc=4.
We have calculated the five-loop RG expansions of the n-component A model of critical dynamics in dimensions d = 4−ε within the Minimal Subtraction scheme. This is made possible by using the advanced diagram reduction method and the Sector Decomposition technique adapted to the problems of critical dynamics. The ε expansions for the critical dynamic exponent z for an arbitrary value of the order parameter dimension n are derived. Based on these series, the numerical estimates of z for different universality classes are extracted and compared with the results obtained within different theoretical and experimental methods.
This work is focused on using resummation techniques for recently calculated 5-loop ε-expansion. For this purpose, Pade approximation and new modification of Borel resummation method proposed in were applied. Accounting the parameter which is in control of the asymptotics of the strong coupling along with the exact value of critical exponent for certain dimension [3] significantly increases result precision. However, both of these quantities are unknown for exponent z. The idea of the modification is to use the convergence criterion for determining optimal values of these parameters from the condition of the fastest convergence of the summation procedure.
Overall, obtained results demonstrate that account of new 5-loop term of ε-expansion for critical exponent z provides a rapprochement of RG estimations with other results of Monte-Carlo simulations.

Poster Session - Board: 20

T-violation in neutrino spin-flavor oscillation probabilities due to influence of matter and electromagnetic field

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T violation in neutrino oscillations in vacuum is a well known fact. Due to the CPT theorem this fact is strictly connected with the CP violating phase in the neutrino mixing matrix. Since neutrino interaction with matter or external electromagnetic field violates Lorentz invariance, influence of external conditions can lead to T violation even in the model with real mixing matrix, e.g. in the two-flavor model. We study neutrino propagation in dense matter and electromagnetic field taking into account both neutrino oscillations and spin rotation. We obtain a sufficient condition of T violation in the general case. In the two-flavor model we derive neutrino spin-flavor transition probabilities and discover a T-violating term, which arises due to simultaneous influence of electromagnetic field and moving matter.

Poster Session - Board: 21

Modeling gravitational wave emission in the post-inflationary universe

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The existence of gravitational waves is a consequence of the general theory of relativity.
Despite the fact that gravitational waves were predicted more than 50 years ago, they were measured relatively recently - in 2015 on the LIGO detector. The received signal came from the event of the merger of two black holes. The main problem in measuring such signals is their small amplitude. Therefore, despite the fact that in September 2015 it was possible to measure the gravitational wave, measuring the same signals from weaker sources is not yet possible.
Nevertheless, the study of gravitational signals has great potential: this information can be used not only in cosmology, for example, to detect new astrophysical objects, but also to test the theories of fundamental physics. Also, gravitational waves may be the key to understanding what happened in the early The universe. The gravitational waves that appeared then due to the interaction of various astrophysical objects can still be measured. This means that gravitational waves carry unique information about the processes that generated them and, consequently, about the state of the universe in an epoch unattainable by any other means.
In my work, we study the radiation of relic gravitational waves that were emitted as a result of the evolution of the inflanton field. The formation of structures is being modeled and in the future it is planned to calculate the spectrum of gravitational waves that were emitted as a result of nonlinear evolution.

Poster Session - Board: 22

The Diffuse Supernova Neutrino Background in the Standard and Double Collapse Models

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The diffuse supernova neutrino background (DSNB) is a powerful future tool to constrain core-collapse explosion mechanisms without observation of a nearby event, and the corresponding signal has been calculated for a variety of collapse models. For Supernova (SN) 1987A, a peculiar double neutrino burst was detected, but models for the double collapse have never been studied in the DSNB context. Here, we fill this gap and compare the DSNB signal expected in the Standard Collapse (SC) and the Double Collapse (DC) models in various future detectors, including Hyper-Kamiokande, JUNO, DUNE and the Large Baksan Neutrino Telescope (LBNT). We calculate the spectra of diffuse neutrinos and antineutrinos in the DC model and determine the rate of registered events as a function of energy of the detected particle, taking into account detector parameters. For each detector, we estimate the corresponding uncertainties and the background and compare the signals expected for the SC and DC models. We conclude that the combination of DUNE and LBNT data will have the highest sensitivity to discriminate between the SC and DC models.