XXXI International workshop on high energy physics "Critical points in the modern particle physics"

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NRC "Kurchatov Institute", SRC RF IHEP, Protvino

Book of Abstracts

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Searches for Supersymmetry in ATLAS

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Evening Session / **4**

Dipole polarizabilities of pi+- meson

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The main experimental works, where dipole polarizabilities of charged pions have been determined, are discussed. Possible reasons for the differences between the experimental data are considered. In particular, it is shown that the account of the σ-meson gives a significant correction to the value of the polarizability obtained in the latest experiment of the COMPASS collaboration.

Morning session / **5**

Lattice QCD, Heavy Ion Collisions, and QCD Phase Structure

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One of the important missions of high energy heavy ion collisions is to reveal the QCD phase structure at finite temperature and baryon density. Lattice QCD simulations are expected to provide valuable information as a first principle calculation of QCD. However, lattice simulations at finite baryon density have suffered from the sign problem' and no calculations were successful except at very low density. FEFU group has developed a method,Canonical Approach', for beating the sign problem. This method was known, but not practical. We have studied origins of errors and instability, and now we are near to the final goal.

Morning session / **6**

Decay properties of the B and Bs mesons

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For study of masses of the ground, orbitally and radially excited states of heavy-light B and B_S meson using Cornell potential with $\mathcal{O}(1/m)$ correction to the potential energy term. We have also incorporated the relativistic correction to the kinetic energy term of the Hamiltonian. The spin-hyperfine, the spin-orbit and the tensor interactions as well as the effect of mixing are employed to

obtained the pseudoscalar, the vector, radially and orbitally excited states meson masses. Leptonic and radiative leptonic decay widths, their branching ratios, E1 transitions and the mixing parameters are also estimated in the present work.

Evening Session / **7**

Gravitational Waves and Spacetime Fabric

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Evening Session / **8**

Cosmology of bigravity

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Evening Session / **9**

Einstein equation for nondual field matter modifies Naiver-Stocks dynamics

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Continuous material space in the nondual field physics of Einstein and Infeld replaces the assumed emptiness between point particles in the Newton model of reality. The internal heat of circular metric flows creates the elementary mass-energy and this kinetic energy is balanced by the negative self-gravitation energy. The Einstein equation analog for nonequilibrium field densities of moving nondual matter results in the vector geodesic relations for metric mass-energy flows that modifies the Navier-Stocks equation by the 1738 Bernoulli potential. Based on arXiv 1705.04155

Evening Session / **10**

SU(2)-Gluon Propagators and the A^2_μ Asymmetry in the Postconfinement Domain

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We study numerically the chromoelectric-chromomagnetic asymmetry of the dimension two A^2 gluon condensate as well as the {\it transverse and longitudinal} gluon propagators at $T > T_c$ in the Landau-gauge $SU(2)$ lattice gauge theory with a particular emphasis on finite-volume effects. We show that previously found so called symmetric point at which asymmetry changes sign is an artifact of the finite volume effects. We find that with increasing temperature the asymmetry decreases approaching zero value from above in agreement with perturbative result. Instead of the asymmetry we suggest the ratio of the transverse to longitudinal propagator taken at zero momentum as an indicator of the boundary of the postconfinement domain and find it at $T \simeq 1.7T_c$.

Evening session / **11**

Superluminal Tunneling of a Relativistic Half-Integer Spin Particle Through a Potential Barrier

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In this talk is presented the problem of a relativistic Dirac half-integer spin free particle tunneling through a rectangular quantum-mechanical barrier. It is supposed that the energy difference between the barrier and the particle is positive and that, within the barrier, the particle behaves like a localized evanescent wave described by the Schrödinger equation. If the barrier width is large enough, there is proof that the tunneling of particle states is always superluminal. For antiparticle states, the tunneling may be either subluminal or superluminal instead, depending on the barrier width. These results derive from studying the tunneling time in terms of phase time. For particle states these are always negatives while for antiparticle states they are always positives, whatever the height and width of the barrier. The scattering also leads to an anomalous distortion of the Dirac spinor (and, consequently, of the density function) that tends to disappear as the particle velocity approaches the speed of light. Moreover, the phase time tends to zero, increasing the potential barrier both for particle and antiparticle states. This agrees with the interpretation of quantum tunneling that the Heisenberg uncertainty principle provides. This study's results are innovative with respect to those available in the literature since consider the particle within the barrier as an intermediate state where the energy is confined and released like a quantum boom. Moreover, they show that the superluminal behavior of particles occurs in those processes with high-energy confinement and might have relevant implications in cosmology.

Evening Session / **12**

Colour particle states behaviour in the QCD vacuum

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To study the properties of colour particle states behaviour in the QCD vacuum we calculate the density matrix of the system colour particle - stochasticQCD vacuum, considered as environment, and averaged over degrees of freedom of the environment.As a result the density matrix of colour particle is depended on the Wilson loop which depends on spanned area RT. In the stochastic vacuum Wilson loop decays exponentially with RT at large distances and we obtain evident form of density matrix of colour particle moving in the stochastic QCD vacuum. Learning density matrix we obtain characteristics of colour particle: purity (closeness of a quantum state to a pure one), von Neiman entropy, information, fidelity (measure of quantum motion stability). The quantities are calculated for different initial colour states: superposition, pure, mixed, separable, non-separable (entangled), multiparticle. In the case of of stochastic (not coherent) QCD vacuum (only correlators of the second order are important) in confinement region (Wilson loop decays exponentially) we have decoherence of pure colour states into a mixed white states, while purity decays exponentially (decay rate = string tension).For multiparticles (pure separable, mixed separable and nonsepaparable (entangled) states) when RT ->∞ we obtain diagonalization of density matrix, decreasing of purity and increasing of vonNeumann entropy.

Evening session / **13**

ATLAS Top Quark Results

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The top quark is the heaviest known fundamental particle. As it is the only quark that decays before it hadronizes, this gives us the unique opportunity to probe the properties of bare quarks at the Large Hadron Collider. This talk will present highlights of a few recent precision measurements by the ATLAS Collaboration of the top quark using 13 TeV and 8 TeV collision data: top-quark pair and single top production cross sections including differential distributions will be presented alongside top quark properties measurements. These measurements, including results using boosted top quarks, probe our understanding of top quark production in the TeV regime. Measurements of the top quark mass and searches for rare top quark decays are also presented.

Evening session / **14**

QCD analysis of leading-neutron production at HERA: Determination of neutron fracture functions

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In recent years, several dedicated experiments at the $e^{-}p$ collider HERA have collected high precision data on the spectrum of leading-neutron and leading-proton carrying a large fraction of the proton's energy. In [Phys. Rev. D 95, 074011 (2017), \, arXiv:1703.04369 [hep-ph]], we propose a technique based on the fractures functions framework and extract the neutron fracture functions (neutron FFs) from global QCD analysis of leading-neutron production data measured by H1 and ZEUS collaborations. We have shown that an approach based on the fracture functions approach allows us phenomenologically parametrize the neutron FFs. In order to asses the uncertainties in the resulting neutron FFs as well as the corresponding observables, associated with the uncertainties in the data, we have made an extensive use of the well-known Hessian method. The theory predictions based on the obtained neutron FFs are in good agreement with all data analyzed, for a wide range of scaled fractional momentum variable β as well as the longitudinal momentum fraction x_L.

Evening session / **15**

Asymptotic behavior and critical coupling in the scalar Yukawa model"

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Evening session / **16**

Different ways to estimate graviton mass

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In February 2016 the LIGO \& VIRGO collaboration reported the discovery of gravitational waves in merging black holes, therefore, the team confirmed GR predictions about an existence of black holes and gravitational waves in the strong gravitational field limit. Moreover, in their papers the joint LIGO \& VIRGO team presented an upper limit on graviton mass such as $m_g < 1.2 \times 10^{-22}$˜eV (Abbott et al. 2016) analyzing gravitational wave signal as it was suggested by C. Will (1998). So, the authors concluded that their observational data do not show any violation of classical general relativity. We show that an analysis of bright star trajectories could constrain graviton mass with a comparable accuracy with accuracy reached with gravitational wave interferometers and the estimate is consistent with the one obtained by the LIGO \& VIRGO collaboration. This analysis gives

an opportunity to treat observations of bright stars near the Galactic Center as a useful tool to obtain constraints on the fundamental gravity law such as modifications of the Newton gravity law in a weak field approximation. In that way, based on a potential reconstruction at the Galactic Center we obtain bounds on a graviton mass.

Evening session / **17**

Is There a Hollow Inside the Proton?

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Evening session / **18**

Round table discussion "Critical points. Can we trust the experimental data?"

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Moderator: Vladimir Petrov
Participants: V. Ezhela, B. Stugu, K. Black, A. Cerveli, O. Zenin, L. Nanni, O. Selyugin

Morning session / **19**

Measurement of Cross Sections and Couplings of the Higgs Boson using the ATLAS Detector

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ATLAS results on cross sections and couplings of the higgs boson will be reviewed. Results from the LHC Run1 will be presented followed by available updates using data from Run 2

Morning session / **20**

Inclusive hadron production in pp and AA collisions

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Morning session / **21**

The Effects of Majorana Phases in Estimating the Masses of Neutrinos

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Majorana CP violating phases coming from heavy right-handed Majorana mass matrices (MRR) are considered to estimate the masses of neutrinos.The effects of phases on quasi-degenerate neutrinos mass matrix obeying μ-τ symmetry predicts the results consistent with observations for (i) solar mixing angle(θ12) below TBM, (ii) absolute neutrino mass parameters[mee] in neutrinoless double beta ($0\nu\beta\beta$) decay, and (iii) cosmological upper bound (summation of neutrinos three masses). Analysis is carried out through parameterization of light left-handed Majorana neutrino matrices (mLL) using only two unknown parameters (ϱ, η) within μ-τ symmetry. We consider the charge lepton and up quark matrices as diagonal form of Dirac neutrino mass matrix (mLR), and mRR are generated using mLL through inversion of Type-I seesaw formula. The analysis shows that the masses of neutrinos are in agreement with the upper bound from cosmology and neutrinoless double beta decay. The results presented in this article will have important implications in discriminating the neutrinos mass models.

Morning session / **22**

Lattice QCD at finite baryon density

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New approach to computation of canonical partition functions in Nf = 2 lattice QCD is presented. Results obtained by the new method are compared with results obtained by known method of hopping parameter expansion.
Results for the number density and canonical partition functions obtained in the confining and deconfining phases at imaginary chemical potential are used to compute physical quantities at the real chemical potential.

Evening session / **23**

Observing Geometrical Torsion

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Evening session / **24**

Quartet-metric gravity and dark components

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Evening session / **25**

Constraint of an attractor Model in Braneworld context

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Evening Session / **26**

Charged pion condensation in chirally asymmetric dense quark matter: Consideration of an NJL2 model with spatially inhomogeneous condensates

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In this talk we investigate the phase structure of a (1+1)-dimensional schematic quark model with four-quark interaction and in the presence of baryon (μB), isospin (μI) and chiral isospin (μI5) chemical potentials. Spatially inhomogeneous chiral density wave (for chiral condensate) and single wave (for charged pion condensate) approaches are used. It is established that in the large-Nc limit (Nc is the number of colored quarks) there exists a duality correspondence between the chiral symmetry breaking phase and the charged pion condensation (PC) one. Moreover, it is shown that inhomogeneous charged PC phase with nonzero baryon density is induced in the model by arbitrary small values of the chemical potential μI5 (for a rathwer large region of μB and μI).

Evening session / **27**

Summa Summarum

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Morning session / **28**

The general parton distributions (GPDs) and structure of th e hadrons

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Morning session / **29**

Overview of ALICE results

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The ALICE experiment at the LHC performs comprehensive studies of the QCD matter with pp, p-Pb and Pb-Pb collisions. A complete set of observables measured by ALICE allows one to study particle production in QCD vacuum in pp collisions, investigate initial-state and possible collective effects in p-Pb collisions and explore properties of the deconfined quark-gluon matter at high temperature and energy density in Pb-Pb collisions. In this talk, an overview of the recent results obtained by the ALICE collaboration from the data collected during the LHC Run1 and ongoing Run2 is given. Upgrade program for Run3 will be also presented.

Morning session / **30**

QCD and Electroweak Measurements with the ATLAS detector

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Morning session / **32**

Searches in ATLAS

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Recent results of searches for TeV-scale BSM phenomena in proton-proton collisions at $\sqrt{s} = 13$˜TeV with ATLAS detector are presented.
The report covers searches for objects and signatures originating from a variety of SM extensions:extended Higgs sector, extra gauge bosons, heavy and excited quarks leptoquarks, extra dimensions, contact interactions.