Academician Andrei A. Slavnov
Memorial Conference

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Organizers

Steklov Mathematical Institute of Russian Academy of Sciences, Moscow

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— INVITED TALKS —-

E. T. Akhmedov (Moscow Institute of Physics and Technology and ITEP)

Isometry invariance of exact correlation functions in various charts of Minkowski and de Sitter spaces

We consider quantum field theory with selfinteractions in various patches of Minkowski and de Sitter space-times. Namely, in Minkowski space-time we consider separately right (left) Rindler wedge, past wedge and future wedge. In de Sitter space-time we consider expanding Poincare patch, static patch, contracting Poincare patch and global de Sitter itself. In all cases we restrict our considerations to the isometry invariant states leading to maximally analytic propagators. We prove that loop corrections in right (left) Rindler wedge, in the past wedge (of Minkowski space-time), in the static patch and in the expanding Poincare patch (of de Sitter space-time) respect the corresponding isometries of the corresponding symmetric space-times. All these facts are related to the causality and analyticity properties of the propagators for the states that we consider. At the same time in the future wedge, in the contracting Poincare patch and in global de Sitter space-time infrared effects violate the isometries.

I. Ya. Aref'eva (Steklov Mathematical Institute)

Quarkionic matter

Quarkionic matter is a new QCD phase at finite temperature and density, which differs from the confinement and deconfinement phases. Its existence is confirmed by consideration of QCD with a large number of colors, and hints of its existence for three-color QCD are given by lattice calculations and experiments with heavy ion collisions. It is expected that the hadronic matter-quarkionic matter phase transition will be of the first order. We discuss a holographic model that fits all these expectations. In the perspective of future experiments, we discuss characteristic features of the quarkionic phase transition that can be detected experimentally.

A. A. Artemev and **A. A. Belavin (Landau Institute for Theoretical Physics)**

Five-point correlation numbers in minimal Liouville gravity

We show how to use Zamolodchikov's higher equations of motion in Liouville field theory to explicitly calculate N-point correlation numbers in minimal Liouville gravity for N > 4. We find the explicit expression for the 5-point correlation numbers and compare it with calculations in the one-matrix models.

V. V. Belokurov (Moscow State University)

Path integral measure in quadratic gravity models

We propose to consider the cumbersome actions in some theories as the sophisticated actions for a true dynamical variable leading to the Gaussian functional measures. We consider path integrals in 4D Quadratic Gravity in FLRW metric as the integrals over the functional measure μ(g) = exp {−A2} dg , where A2 is the part of the action quadratic in R, and g(τ) is the dynamical variable invariant under the group of diffeomorphisms of the time coordinate τ. The rest part of the action in the exponent stands in the integrand as the "interaction" term. We prove the measure μ(g) to be equivalent to the Wiener measure, and, as an example, calculate the averaged scale factor in the first nontrivial perturbative order. In a model of 2D gravity with the action quadratic in curvature, we represent path integrals as integrals over the SL(2, R) invariant Gaussian functional measure and reduce them to the products of Wiener path integrals. As an example, we calculate the correlation function of the metric in the first perturbative order.

D. V. Bykov (Steklov Mathematical Institute and ITMP)

Supersymmetric sigma models as Gross-Neveu models

I will discuss a new formulation of sigma models with complex homogeneous target spaces (such as CP^n) in terms of algebraic variables, which establishes the equivalence of such sigma models with generalized Gross-Neveu models. Topics covered will include the SUSY setup, calculation of the beta-function, as well as applications to quantum mechanics.

L. O. Chekhov (Steklov Mathematical Institute)

Solving symplectic groupoid: quantization and integrability

We begin with the recently found solution in terms of cluster algebras of the problem of symplectic groupoid: how to describe manifolds of pairs (B,A) where B is an SL_N matrix, A is unipotent upper-triangular matrix, and BAB^T is again unipotent upper-triangular matrix. Solutions obtained possess a natural Poisson and quantum algebra structures and open a wide spectrum of possibilities: from describing Teichmuller spaces of closed Riemann surfaces of arbitrary genus $g\ge 2$ to a so far hypothetical relation to Cherednik's DAHA and conformal blocks of the Liouville theory. Based on the forthcoming joint paper with Misha Shapiro.

S. A. Frolov (Trinity College Dublin)

Dressing Factors and TBA for AdS3 x S3 x T4

New dressing factors for the world-sheet S-matrix of the RR superstrings on AdS3 x S3 x T4 are proposed. The resulting S-matrix is continued to the mirror region, and used to derive the mirror TBA equations describing the spectrum of the superstring theory in the zero winding sector.

D. V. Gal’tsov (Moscow State University)

Yang-Mills solitons in models with conformal symmetry breaking

Finite energy particle-like solutions of conformally invariant theories in flat space are ruled out by Coleman, Deser and Pagels arguments, so there are no purely Yang-Mills solitons for usual YM action in flat space. Meanwhile, such solitons do exist, if the YM fields are governed by the non-Abelian Born-Infeld effective action arising in string theory. These are similar to Bartnik McKinnon particle-like solutions in Einstein-Yang-Mills theory. Both theories break conformal symmetry of the classical action thus avoiding the above no-go result. Topologically they are similar to sphalerons of the electroweak theory, where breaking of conformal symmetry is due to the Higgs field. We review these and others solutions including Einstein-Yang-Mills vortices, and discuss some other effects of breaking of conformal symmetry on classical YM fields: stabilization of chaos and cosmological inflation.

S. E. Derkachov (St. Petersburg branch of Steklov Mathematical Institute)
and
A. P. Isaev (Bogoliubov Laboratory of Theoretical Physics, Joint Institute for Nuclear Research and Moscow State University)

Conformal triangles and zig-zag diagrams

A convenient integral representation for zig-zag four-point and two-point planar Feynman diagrams relevant to the bi-scalar D-dimensional fishnet field theory is obtained. This representation gives a possibility to evaluate exactly diagrams of the zig-zag series in special cases. In particular, we give a fairly simple proof of the Broadhurst-Kreimer conjecture about the values of zig-zag multi-loop two-point diagrams which make a significant contribution to the renormalization group beta-function in 4-dimensional phi^4 theory.

E. A. Ivanov (Bogoliubov Laboratory of Theoretical Physics, Joint Institute for Nuclear Research)

Higher Spins in Harmonic Superspace

We review an off-shell formulation of ${\cal N}=2$ higher spin supermultiplets within the harmonic superspace approach. Each supermultiplet is encompassed by a triple of unconstrained harmonic analytic gauge superfield potentials and at the linearized level is described by a universal gauge-invariant and ${\cal N}=2$ supersymmetric action. To the first order in gauge superfields, we present their off-shell cubic couplings to ${\cal N}=2$ matter hypermultiplets and define the higher-spin gauge transformations of the latter. This new direction of applications of the harmonic superspace method is potentially rather prospective, both in the classical and quantum domains, and we discuss in brief its some nearest uses.

The talk is based on two recent published works with Ioseph Buchbinder and Nikita Zaigraev (JHEP 2021, 2022) and a work in progress.

D. I. Kazakov (Bogoliubov Laboratory of Theoretical Physics, Joint Institute for Nuclear Research)

Квантовые поправки в эффективный потенциал в обобщенных моделях со скалярным полем

Построено ренормгрупповое (РГ) уравнение для эффективного потенциала в приближении лидирующих логарифмов, которое справедливо для произвольной скалярной теории поля в четырёх измерениях. Данное уравнение воспроизводит стандартное уравнение РГ для теории $\varphi 4$, а также позволяет изучить более сложные потенциалы скалярного взаимодействия. В общем случае полученное уравнение не удается решить аналитически, однако в некоторых случаях оно сводится к обыкновенным дифференциальным уравнениям, которые можно изучать численно.

A. Quadri (INFN, Sez. di Milano)

Gauge-invariant variables and Slavnov-Taylor decomposition in spontaneously broken theories

A renormalizable extension of the Abelian Higgs-Kibble (HK) model supplemented by a dimension 6 derivative-dependent operator is presented. The dim.6 operator is controlled by the parameter z and violates power-counting renormalizability. At z = 0 one recovers the usual power-counting renormalizable Abelian HK model. A field-theoretic representation of the physical Higgs scalar by a gauge-invariant variable is used in order to formulate the theory by a novel differential equation controlling the dependence of the quantized theory on z. We show that the Slavnov-Taylor identities hold true separately in the grading induced by the number of internal physical Higgs propagators. This is at variance with the ordinary formalism and is crucial to the consistent definition of the quantum field theory at z \neq 0 via the solution to the differential equation.

K. Stelle (Imperial College London)

Concentrating Gravity on Branes

There is a taxonomy of different kinds of lower-dimensional effective field theory on brane configurations, depending on the boundary conditions imposed near the brane worldvolume. Branes with a certain degree of unbroken supersymmetry can embody consistent Kaluza-Klein truncations to braneworld supergravity theories with that degree of supersymmetry, and arbitrarily nonlinear solutions of such lower-dimensional braneworld supergravities can be found. This applies only to solutions purely within that pure supergravity, however — external sources give rise to responses in structure characteristic of the higher dimensional theory. There exists another taxonomic type, however, in which a genuine concentration of gravity can occur for more general sources, depending on details of the wave equation for modes transverse to the brane worldvolume, implemented by a set of boundary conditions different from the standard Kaluza-Klein ones. Such a genuine concentration does not correspond to a KK consistent truncation, but does give rise to an effective lower-dimensional gravitational theory -- revealed, for example, in a transition from higher-dimensional near-field behaviour to lower-dimensional far-field behaviour.

K. V. Stepanyantz (Moscow State University)

The structure of quantum corrections and exact results in supersymmetric theories revealed by the higher covariant derivative regularizaton

Some recent results of investigating quantum corrections in supersymmetric theories revealed with the help of the Slavnov's higher covariant derivative regularization are reviewed. In particular, we demonstrate that the beta-function of N=1 supersymmetric theoires is related to the anomalous dimensions of the matter superfields by the NSVZ relation if a theory is regularized by higher covariant derivatives and the renormalization group functions are defined in terms of the bare couplings, because the corresponding loop corrections are given by integrals of double total derivatives in the monentum space. For the standard renormalization group functions we show that an all loop NSVZ renormalization scheme is given by the HD+MSL renormalization prescription, when the higher covariant derivative regularization is supplemented by minimal subtraction of logarithms.

Applications of these results to the precise calculations in various supersymmetric theories are briefly described.

A. A. Tseytlin (Imperial College London and ITMP)

Comments on 4-derivative scalar theory in 4 dimensions

We review and elaborate on some aspects of classically scale-invariant renormalizable 4-derivative scalar theory $L= \p \del^4 \p + g (\del \p)^4$ in 4 dimensions. Similar models appear, e.g., in the context of conformal supergravity or in the description of crystalline phase of membranes. Considering this theory in Minkowski signature we discuss how to define consistent (Lorentz-invariant) scattering amplitudes by assuming that only oscillating (non-growing) modes appear as external states. In the shift-symmetric interacting theory the corresponding S-matrix is IR-soft despite having $1/p^4$ internal propagators. We demonstrate how non-unitarity of this theory manifests itself at the level of the one-loop scattering amplitude.

M. A. Vasiliev (Lebedev Physical Institute)

Locality and Spin-Locality in Higher-Spin Theory

Peculiarities of the concept of locality in models with an infinite number of fields are discussed using example of the higher-spin gauge theory. In particular, the notions of spin-locality and compact spin-locality will be introduced.

K. L. Zarembo (Nordita)

Generalized eigenvalue models

Matrix models arise in many branches of mathematical physics, with powerful tools to solve them at large-N developed over the years. I will talk about their generalization with an arbitrary difference-type measure for the eigenvalues. These models arise naturally in supersymmetric localization and, even if not solvable in general, can be efficiently treated at weak and strong coupling with the help of the loop equations. Applications include holographic duality beyond AdS/CFT.

— POSTERS —

Y. A. Ageeva (Moscow State University)
Generating cosmological perturbations in non-singular Horndeski cosmologies

P. A. Anempodistov (Moscow Institute of Physics and Technology, ITEP)
Loop corrections to a cosmological particle creation

L. N. Astrahantsev (Moscow Institute of Physics and Technology and ITEP and ITMP)
Non-abelian fermionic T-duality in supergravity

N. M. Belousov (St.Petersburg branch of Steklov Mathematical Institute)
Backlund transformation for the nonlinear Schrodinger equation

A. V. Chukhnova (Moscow State University)
T-violation in neutrino spin-flavor transition probabilities in the case of real mixing matrix

A. A. Grechko (Moscow State University) / **A. A. Sheykin** (St.Petersburg State University)
Lower-dimensional Regge-Teitelboim gravity

M. V. Markov (Moscow State University; Steklov Mathematical Institute)
Asymptotic symmetries of general relativity in the BV-BRST formalism

V. E. Maslov (Institute for Nuclear Research; Moscow State University)
An Effective Field Theory for Large Oscillons

T. A. Rusalev (Steklov Mathematical Institute)
Entanglement entropy of finite regions in spherically symmetric black hole

I. E. Shirokov (Moscow State University)
Символьные вычисления в N=1 суперсимметричной электродинамике, регуляризованной высшими производными

B. R. Farkhtdinov (Institute for Nuclear Research)
Suppression exponent for multiparticle production in ϕ^4 theory

M. K. Usova (Steklov Mathematical Institute)
Holographic RG flows in 3d supergravity

N. M. Zaigraev (Joint Institute for Nuclear Research; Moscow Institute of Physics and Technology)

N=2 cubic higher spin vertices and rigid symmetries of hypermultiplet