International conference in memory of M.K. Polivanov

«Polivanov–90»

Steklov Mathematical Institute of Russian Academy of Sciences, Moscow
and Steklov International Mathematical Center

December 16—17, 2020

Mikhail Konstantinovich Polivanov (1930–1992) was an outstanding Soviet and Russian theoretical physicist who made a fundamental contribution to modern mathematical and theoretical physics. Mikhail Konstantinovich is known as one of the leading experts on quantum field theory and the theory of dispersion relations. His works on axiomatic quantum field theory and the theory of integrable systems are well known. From the very foundation of the journal "Theoretical and mathematical physics"Mikhail Konstantinovich was the Executive Secretary of the editorial Board and Deputy editor-in-chief of the journal. Since 1969 until his death, he headed the Department of quantum field theory (now the Department of theoretical physics) of Steklov Mathematical Institute. We remember Mikhail Konstantinovich not only as an outstanding scientist and teacher, but also as a wonderful person.

List of talks:

I. Arefeva
(Steklov Mathematical Institute RAS)

Non-local observables

A. Belavin
(Landau Institute for Theoretical Physics)

Periods of BHK mirrors

We consider the multiple Calaby–Yau (CY) mirror phenomenon which appears in Berglund–Hübsch–Krawitz (BHK) mirror symmetry. We show that the periods of the holomorphic non-vanishing form of different Calabi–Yau orbifolds, which are BHK mirrors of the same CY family, coincide.

V. Belokurov
(Lomonosov Moscow State University, Institute for Nuclear Researches RAS)

The relation between Wiener and Schwarzian functional integrals

The relation between Wiener and Schwarzian functional integrals is demonstrated.

D. Bykov
(Steklov Mathematical Institute RAS)

Sigma models as Gross–Neveu models

The talk is dedicated to the recently discovered equivalence between sigma models and Gross–Neveu models. This approach allows to develop a novel method of constructing supersymmetric theories, as well as to significantly broaden the class of known integrable sigma models.

L. Chekhov
(Steklov Mathematical Institute RAS)

Cluster variables for affine Lie–Poisson systems

We show that cluster variables of any directed network on a disc parameterize a symplectic leaf of the affine RTT-TTR algebra. We can extend this construction to realizations of the quantum loop algebra and to those of the quantum reflection equation.

S. Dobrokhotov
(Ishlinsky Institute for problem in mechanics RAS)

Airy functions and uniform transition from the oscillator to semiclassical approximation for one-dimensional bound states

We consider a one-dimensional Schrödinger operator with a semiclassical small parameter h with a smooth potential of the form of a potential well. We construct uniform global asymptotics of its eigenfunctions in terms of Airy functions of complex argument. We show that such asymptotics work not only for excited states with numbers $n\ sim 1/h$, but also for weakly excited states with numbers $n \sim 1/h^{\alpha}, 1 > \alpha > 0$, and in the examples the corresponding numbers n start with $n = 2$ or even with $n = 1$. We prove the proximity of such asymptotics to the eigenfunction, obtained with the help of the harmonic oscillator.

A. Filippov (JINR)

Mathematical models of cosmology

L. Fehér
(University of Szeged and Wigner RCP, Hungary)

Trigonometric real form of the spin RS model of Krichever and Zabrodin

In 1995, Krichever and Zabrodin introduced interesting spin extensions of the Ruijsenaars–Schneider system, working at the level of equations of motion. Their investigation and all earlier studies of the Hamiltonian interpretation of the model used complex holomorphic settings. Based on a joint paper with Fairon and Marshall (arXiv:2007.08388), we explain that the trigonometric real form of the model emerges from Hamiltonian reduction of a 'free particle' supported by a spin extension of the Heisenberg double of the U(n) Poisson–Lie group. Then, we characterize the Hamiltonian structure of the real trigonometric spin RS model and demonstrate its degenerate integrability.

A. Gorsky
(IITP RAS)

TT-deformation of 2d Yang-Mills theory at large N: collective field theory and phase transitions

We derive the Hamiltonian of TT-deformed 2d YM theory at large N which is deformation of Das–Jevicki Hamiltonian. The exact non-perturbative solution to the collective field theory on the sphere is found which implies the first order phase transition at the critical deformation parameter. The generalizations of the Douglas–Kazakov 3-rd order phase large N transition for the deformed theory for the different geometries are found.

D. Kazakov (JINR)

RG equations for the scattering amplitude in general theories

We demonstrate the form of RG equations for scattering amplitude in generic theories including the non-renormalizable theories.

G. Kravtsova
(Moscow State University, Physics Department)

Algebraic quantum theory

The modified Dirac theory with non-Hermitian expansion of Lagrangian is regarded. We make a classical analyses and quantization.

I. Krichever
(Skolkovo Institute of Science and Technology)

Conformal harmonic maps of two-torus to spheres and turning point of elliptic Calogero–Moser system

The theory of harmonic maps of Riemann surfaces to spheres is a classical problem of differential geometry. In this talk we present a construction for conformal harmonic maps of two-dimensional torus to spheres of arbitrary dimensions, which are multidimensional generalizations of instanton maps of two-dimensional torus to two-dimensional sphere. The crucial point of our construction is based on surprising relation of the problem to the theory of elliptic Calogero–Moser system. The talk is based on the joint paper with Nikita Nekrasov.

D. Lebedev
(Institute for Information Transmission Problems RAS, Moscow Center for Continuous Mathematical Education)

On quantum $osp(1|2\ell)$-Toda chain

The ortho-symplectic superalgebra $osp(1|2\ell)$ is the most close analog of the Lie algebras in the world of Lie superalgebras. We demonstrate that the corresponding $osp(1|2\ell)$-Toda chain turns is an instance of a BC_ℓ -Toda chain. The underlying reason for this relation is explained.

A. Mikhailov
(University of Leeds)

Quantisation of nonabelian dynamical systems. Quantisation ideals.

In my talk I'll discuss a new approach to the problem of quantisation of dynamical systems, introduce the concept of quantisation ideals and provide meaningful examples. Traditional quantisation theories start with classical Hamiltonian systems with variables taking values in commutative algebras and then study their non-commutative deformations, such that the commutators of observables tend to the corresponding Poisson brackets as the (Planck) constant of deformation goes to zero. I am proposing to depart from systems defined on a free associative algebra A. In this approach the quantisation problem is reduced to a description of two-sided

ideals J which define the commutation relations (the quantisation ideals) in the quotient algebras $A_J = A/J$ and which are invariant with respect to the dynamics of the system.

V. Pavlov
(Steklov Mathematical Institute RAS)

Transition amplitude in quantum field theory and Hilbert's 6-th problem

M.K. Polivanov is one of the co-authors of the fundamental result of the Bogolyubov axiomatics: in quantum field theory, all the amplitudes of the transition of m particles to n particles with $m + n =$const are boundary values of a single analytical function.

A. Sergeev
(Steklov Mathematical Institute RAS)

Topological insulators invariant with respect to time reversal

The talk is devoted to the theory of topological insulators which is an actively developing direction in the solid state physics. The search for new topological objects is reduced to the search of appropriate topological invariants and systems having non-trivial invariants. Such systems are characterized by wide energetic gaps stable with respect to small deformations. The quantum spin Hall insulator may be considered as a non-trivial example of such systems. It is a two-dimensional insulator invariant under time reversal. It has a non-zero topological $\mathbb{Z}_2$-invariant introduced by Kane and Mele. Our talk is devoted to the topological insulators invariant under time reversal transform. In the first part we consider the physical basics of the theory of topological insulators while in the second part we deal with its mathematical aspects.

V. Sokolov
(Landau Institute for Theoretical Physics)

Matrix Painleve-2 equations

We present several non-equivalent matrix generalizations for Painlevé II equation. Some of them are shown to possess isomonodromy Lax representations.

I. Volovich
(Steklov Mathematical Institute RAS)

Locality in quantum field theory and quantum information

An important part of M.K. Polivanov's work was a study of conditions for locality and causality in quantum field theory. In this talk we compare the locality in quantum field theory and (non-)locality in the quantum information theory in the sense of Einstein–Podolsky–Rosen–Bell.

A. Zabrodin
(NRU HSE)

KP hierarchy and Calogero–Moser hierarchy

We consider trigonometric solutions of the KP hierarchy. It is known that their poles move as particles of the Calogero–Moser model with trigonometric potential. We show that this correspondence can be extended to the level of hierarchies: the evolution of the poles with respect to the k-th hierarchical time of the KP hierarchy is governed by a Hamiltonian which is a linear combination of the first k higher Hamiltonians of the trigonometric Calogero–Moser hierarchy.

V. Zakharov
(Landau Institute for Theoretical Physics)

ZM integrable system via dressing method (relativistic invariant version)

List of participants:

- Adler Vsevolod, L.D. Landau Institute for theoretical physics
- Alekseev Georgy, Steklov Mathematical Institute RAS
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- Andrianov Vladimir, Saint-Petersburg State University
- Arbuzov Boris, SINP MSU
- Arefeva Irina, MIAN
- Atalikov Kantemir, NRC «Kurchatov Institute» – ITEP
- Belavin Alexander, Landau Institute for Theoretical Physics

- Belokurov Vladimir, Lomonosov Moscow State University, Institute for Nuclear Researches RAS
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- Kirillov Andrei, retiree
- Kravtsova Galina, MSU, Physical Department
- Krichver Igor, Skolkovo Institute of Science and Technology
- Lebedev Dmitry, Institute for Information Transmission Problems RAS, Moscow Center for Continuous Mathematical Education
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Organizing Committee:

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