

Mathematical and Theoretical Physics, dedicated to Ludwig Faddeev

28 May 2024, 09:45 → 31 May 2024, 18:30 Europe/Moscow

PDMI/--- - 311 (PDMI)

TUESDAY, 28 MAY

09:45 → 10:15 **Registration/coffee** ⌚ 30m

10:15 → 10:30 **Opening** ⌚ 15m

📍 PDMI/--- - 311

10:30 → 11:30 **Об одной проблеме, возникающей при вычислении корреляционных функций для восьмивершинной модели** ⌚ 1h

📍 PDMI/--- - 311

Работа о восьмивершинной модели, написанная Л.Д.Фаддеевым совместно с Л.А.Тахтаджяном, служит важнейшим источником квантового метода обратной задачи. В частности, результаты этой работы использовались Е.К.Скляниным для определения его знаменитой алгебры. Разработанный в результате математический аппарат мы использовали , совместно с Боосом, Джимбо и Мивой, для вычисления корреляционных функций. В нашем подходе их вычисление использует следы над алгеброй Склянина, алгоритмическое вычисление которых до сих пор не до конца понятно.

Цель настоящего доклада состоит в привлечении внимания к этой интересной , на мой взгляд, проблеме.

Speaker: Fedor Smirnov (LPTHE)

11:30 → 12:00 **Coffee break** ⌚ 30m

12:00 → 13:00 **New linearization formula for q-ultraspherical polynomials** ⌚ 1h

📍 Zoom

For the product $C_m(x; \beta|q)C_n(x; \beta'|q)$ of two continuous q-ultraspherical polynomials with different parameters β and β' , explicit formulae are presented for the coefficients of its expansion in the basis $C_k(x; \beta|q)$ in the case $\beta' = q\beta - 1$. We also discuss a generalization to multivariate Jack and Macdonald polynomials and its relation to Pieri formulas and Q-operators.

Speaker: Evgeny Sklyanin (UNiversity of York, UK)

13:00 → 15:00 Lunch 🕒 2h

15:00 → 16:00 **Applications of the quantum dilogarithm** 🕒 1h

📍 Zoom

The quantum dilogarithm is a special function of two variables that finds various applications, including quantum topology and lattice integrable models of quantum field theory and statistical mechanics. Although a special case of that function was introduced in 1886 by Hölder, its deep connections to quantum world were revealed only in early 1990's after the discovery of the quantum five term identity by Ludwig Faddeev. I will review some of the properties of the quantum dilogarithm, its generalizations to the context of locally compact Abelian groups, and applications in spectral theory, quantum integrable systems and quantum topology.

Speaker: Rinat Kashaev (Geneva U., Switzerland)

16:00 → 16:30 Coffee break 🕒 30m

16:30 → 17:30 **Zamolodchikov-Faddeev algebra in Ruijsenaars hyperbolic model** 🕒 1h

📍 Zoom

Ruijsenaars hyperbolic model was discovered in the mid-1980s as a many-body interacting system describing solitons trajectories for the famous sine-Gordon equation. The Hamiltonians of the quantum problem are multi-dimensional difference operators with shifts of coordinates in imaginary direction, and in 2012 Hallnäs and Ruijsenaars managed to explicitly construct their eigenfunctions. Recently in the joint work with Derkachov, Kharchev and Khoroshkin we proved several properties of these eigenfunctions, including orthogonality, completeness and some symmetries. In the talk I will discuss the main tools we used and how they are related to the famous Zamolodchikov-Faddeev algebra.

Speaker: Nikita Belousov (Steklov Mathematical Institute, St. Petersburg)

17:30 → 18:30 **Homogenization of the periodic Schrödinger-type equations** 🕒 1h

📍 PDMI/--- - 311

In $L_2(\mathbb{R}^d; \mathbb{C}^n)$, we consider a selfadjoint strongly elliptic second-order differential operator A_ε . It is assumed that the coefficients of A_ε are periodic and depend on x/ε , where $\varepsilon > 0$ is a small parameter. We study the behavior of the operator exponential $e^{-(iA_\varepsilon \tau)}$ for small ε and $\tau \in \mathbb{R}$. The results are applied to study the behavior of the solution of the Cauchy problem for the Schrödinger-type equation $i\partial_\tau u_\varepsilon(x, \tau) = (A_\varepsilon u_\varepsilon)(x, \tau)$ with the initial data from a special class.

Speaker: Tatiana Syslina (St. Petersburg State University)

18:30 → 20:25 Welcome Party 🕒 1h 55m

WEDNESDAY, 29 MAY

10:30 → 11:30 **On stratified structure of integrable dynamics** ⌚ 1h 📍 PDMI/--- - 311
Speaker: Nicolai Reshetikhin (Tsinghua University)

11:30 → 12:00 Coffee break ⌚ 30m

12:00 → 13:00 **Calculation of multiloop Feynman diagrams and diagonalization of commuting operators** ⌚ 1h 📍 PDMI/--- - 311

We consider calculation of two families of multiloop Feynman diagrams: zig-zag diagrams and Basso-Dixon diagrams. The first family gives contribution to the beta-function of standard ϕ^4 theory, and the second family appear as leading contribution in fishnet field theory introduced by V.Kazakov and O.Gurdogan. The problem of calculation of such type of diagrams can be reformulated as problem of diagonalization of some family of commuting operators. Diagonalization can be performed using methods of quantum integrable systems.

Speaker: Sergey Derkachev (PDMI , St. Petersburg Department of Steklov Mathematical Institute of Russian Academy of Sciences)

13:00 → 15:00 Lunch ⌚ 2h

15:00 → 16:00 **Can one hear the shape of the Archimedean prime?** ⌚ 1h 📍 Zoom
Speaker: Alain Connes (College de France)

16:00 → 16:30 Coffee break ⌚ 30m

16:30 → 17:30 **Scale Invariance, Conformal Invariance, and Ricci Flow** ⌚ 1h 📍 Zoom
Speaker: Edward Witten (IAS, Princeton)

17:30 → 18:30 **Transcendental Numbers in Spin Chains** ⌚ 1h 📍 Zoom
Speaker: Vladimir Korepin (Stony Brook University)

THURSDAY, 30 MAY

10:30 → 11:30 **Обобщения гамильтоновой динамики Дирака** ⌚ 1h 📍 PDMI/--- - 311
Speaker: Valery Kozlov (Steklov Mathemarical Institute, Moscow)

11:30 → 12:00 Coffee break ⌚ 30m

12:00 → 13:00 **Скрученное тензорное произведение, гладкие алгебры и некоммутативное разрешение особых кривых** ⌚ 1h 📍 PDMI/--- - 311
Speaker: Dmitri Orlov (Steklov Mathematical Institute, Moscow)

13:00 → 15:00 Lunch ⌚ 2h

15:00 → 16:00 **Teichmuller spaces, cocycles, and second class constraints** ⌚ 1h 📍 Zoom
Speaker: Anton Alekseev (University of Geneva)

16:00 → 16:30 Coffee break ⌚ 30m

16:30 → 17:30 **Wronski map and positive Grassmannians** ⌚ 1h 📍 PDMI/--- - 311

The B. and M.Shapiro conjecture states that if the Wronskian of polynomials with complex coefficients have only real roots, then the span of those polynomials has a basis given by polynomials with real coefficients. The conjecture has several important reformulations in real algebraic geometry. The conjecture was proved (also for quasi-exponentials, products of polynomials and exponentials of linear functions) by E.Mukhin, A.Varchenko and myself using the completeness of the Bethe ansatz for the $gl(N)$ Gaudin model and the symmetry of the Gaudin Hamiltonians with respect to the tensor Shapovalov form. Recently, S.Karp and K.Purbhoo showed that the span of polynomials in question belongs to the totally positive part of the Grassmannian define by the Taylor expansion at a real point greater than all roots of the Wronskian. In a joint work with S.Karp and E.Mukhin we extended this statement to quasi-exponentials and showed that this positivity statement corresponds to the positivity of higher transfer-matrices of Gaudin model corresponding to polynomial irreducible representations of $gl(N)$ introduced by A.Alexandrov, S.Leurent, Z.Tsuboi, and A.Zabrodin.

Speaker: Vitaliy Tarasov (Steklov Mathematical Institute, St. Petersburg)

17:30 → 18:30 **Combinatorial 2d topological conformal field theory from a local cyclic A-infinity algebra** ⌚ 1h 📍 Zoom

I will explain a construction of a combinatorial 2d TCFT, assigning partition functions to triangulated cobordisms (as chain maps between spaces of states), in such a way that a Pachner flip induces a Q-exact change. More generally, the partition function becomes a nonhomogeneous closed cochain on the “flip complex.” One has a combinatorial counterpart of the BV operator $G_{\{0,-\}}$ arising from evaluating the theory on a special 1-cycle on the flip complex of the cylinder. The local input for the model is a cyclic A-infinity algebra, with the operation m_3 playing the role of the BRST-primitive G of the stress-energy tensor $T=Q(G)$.

I will also describe a way to incorporate invariance-up-to-homotopy with respect to the second 2d Pachner move (stellar subdivision/aggregation). This version of the model is based on secondary polytopes of Gelfand-Kapranov-Zelevinsky and uses a certain enhancement (by extra homotopies) version of a cyclic A-infinity algebra as input

The talk is based on a joint work with Andrey Losev and Justin Beck, <https://arxiv.org/pdf/2402.04468.pdf>.

Speaker: Pavel Mnev (University of Notre Dame)

19:00 → 22:00 Banquet 🕒 3h

FRIDAY, 31 MAY

10:30 → 11:30 **Lie algebras of multidimensional Schrodinger operators** 🕒 1h

Speaker: Viktor Buchstaber (Steklov Mathematical Institute, Moscow)

📍 PDMI/--- - 311

11:30 → 12:00 Coffee break 🕒 30m

12:00 → 13:00 **Correlation Functions of Heisenberg XX Chain and Enumeration of Constrained Plane Partitions** 🕒 1h

Speakers: Nikolai Bogoliubov (Steklov Mathematical Institute, St. Petersburg), Cyril Malyshev (Steklov Mathematical Institute, St. Petersburg)

📍 PDMI/--- - 311

13:00 → 15:00 Lunch 🕒 2h

15:00 → 16:00 **Quantum effects in classical dynamics** 🕒 1h

Speaker: Andrei Pogrebkov (Steklov Mathematical Institute; Skoltech)

📍 PDMI/--- - 311

16:00 → 16:30 Coffee break 🕒 30m

16:30 → 17:30 **On Determinants of Integrable Operators with Shifts** 🕒 1h

In the talk, some recent results of the asymptotic analysis of the Fredholm determinants of integral operators appearing in the study of the correlation functions in non-free fermion exactly solvable quantum field models will be presented. Specially, we shall consider the shifted sine-kernel as a case study. The talk is based on the earlier works of the speaker with V. Korepin, A. Izergin, N. Slavnov and K. Koslowski and on the ongoing project with T. Bothner, A. Simon and K. Kozlowski.

Speaker: Alexander Its (Indiana University Indianapolis)

📍 PDMI/--- - 311

17:30 → 18:30 **On a cutoff regularization in the coordinate representation** 🕒 1h

Speaker: Aleksandr Ivanov (Steklov Mathematical Institute, St. Petersburg)

📍 PDMI/--- - 311