Abstracts of talks

3rd French-Russian Conference on Random Geometry and Physics: Sachdev-Ye-Kitaev Model and Related Topics

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Random matrices, SYK and moduli of Riemann surfaces

Igor Volovich *(Steklov Mathematical Institute of Russian Academy of Sciences)*

It has been shown by Saad, Shenker and Stanford that the genus expansion of a certain matrix integral generates the partition functions of Jackiw-Teitelboim (JT) quantum gravity on Riemann surfaces of arbitrary genus with an arbitrary fixed number of boundaries. Basically, the JT path integral is reduced to the computation of the Weil-Petersson volume of the moduli space. We explore the generating functional of boundaries in the matrix model and in JT gravity. It is shown that there is a critical point for the generating functional which corresponds to phase transition in the gas of baby universes.

The talk is based on the paper

I.Aref'eva and I.Volovich, "Gas of baby universes in JT gravity and matrix models," arXiv:1905.08207.

A many-body perspective on black-hole micro states

Julian Sonner *(University of Geneva)*

Via AdS/CFT duality, black holes in asymptotically anti de Sitter spaces are dual to thermal ensembles of well-defined quantum field theories, in principle amenable to detailed analysis. Yet many of the quantum gravitational questions they pose are still not resolved satisfactorily, owing to the impracticality of the necessary calculations in most known examples. In this talk I will give an overview of our recent work which exploits solvable models of chaotic many-body systems with holographic duals and which allow us to characterize black-hole micro states with great precision. I plan to discuss the thermal properties of pure states, as well as new results on ergodic and non-ergodic behavior of information scrambling.

(Non) equilibrium dynamics: a (broken) symmetry

Camille Aron *(Ecole Normale Supérieure, Laboratoire de Physique Theorique, Paris)*

It is fascinating that most many-body systems, if unperturbed, tend to relax towards thermal equilibrium. I will discuss a recent result showing that quantum equilibrium dynamics can be elevated to the rank of a universal (model-independent) symmetry of Keldysh field theories. This fundamental symmetry imposes strong constraints on the equilibrium correlation functions. But more importantly, this allows studying non-equilibrium dynamics as symmetry-breaking processes, providing important clues on the so-far poorly understood production of entropy in quantum mechanical systems.

Emergence of Space-Time in the SYK Model

Kenta Suzuki *(CPhT, Ecole Polytechnique, Paris)*

In this talk, we start from reviewing basis aspects of the SYK model in the large N limit, which is systematically described by a single bi-local field. We show that a propagator of the bi-local field, which is understood as a four-point function of the original fermions, predicts an infinite spectrum of the dual AdS_2 theory, but it has a divergent contribution from the zero mode at the critical IR fixed point of the model.

Next, we show that the spectrum of the four-point integration SYK model can be interpreted as that of a single scalar field coupled to gravity in 3 space-time dimension. The scalar field lives on $\mathrm{AdS}_2 \times I$, where I is a finite interval, and subject to a delta function potential at the center of the interval. Through Kaluza-Klein procedure on the third direction, this scalar generates the spectrum predicted by the SYK bi-local propagator at strong coupling.

Finally, we consider the question of identifying the bulk space-time of the SYK model. Focusing on the signature of emergent space-time of the (Euclidean) model, we explain the need for non-local (Radon-type) transformations on external legs of n-point Green's functions. This results in a dual theory with Euclidean AdS signature with additional leg-factors. We speculate that these factors incorporate the coupling of additional bulk states similar to the discrete states of 2D string theory.

Phyllotaxis and Lifshitz tails in 1D Anderson localization: what is common?

Sergei Nechaev *(Center Poncelet, CNRS, Moscow)*

We construct explicitly in terms of Eisenstein series the ultrametric landscape of potential barriers between optimal displacement of repulsive particles of a cylinder. We discuss the relation between the found landscape with the spectral statistics of random Schrödinger-like operators with the off-diagonal randomness. Our construction involves the regularization of the Riemann "raindrop" function in terms of the Dedekind eta-function. The provided description allows one to relate the spectral density of three-diagonal random operators with the beta-function of fractional quantum Hall states.

Quantum KdV hierarchy in 2d CFTs

Anatoly Dymarsky *(University of Kentucky & Skoltech)*

Infinite-dimensional conformal symmetry in two dimensions renders conformal field theories integrable with an infinite hierarchy of quantum KdV charges being in involution. These charges govern the structure of Virasoro descendant states and provide correct formulation for the Eigenstate Thermalization in 2d theories. After covering recent results on Eigenstate Thermalization, I will talk about an ongoing progress of calculating the spectrum of quantum KdV charges and generalized partition function of two dimensional theories in the limit of large central charge. The talk is based on https://arxiv.org/abs/1903.03559 as well as https://arxiv.org/abs/1812.05108 and https://arxiv.org/abs/1810.11025.

Continuous-spin field in AdS space and conformal algebra representations

Ruslan Metsaev *(Lebedev Physical Institute of Russian Academy of Sciences)*

We use light-cone gauge approach in AdS space for studying continuous-spin field. For such field, we find light-cone gauge Lagrangian and realization of relativistic symmetries. We find a simple realization of spin operators entering our approach. Generalization of our results to the gauge invariant Lagrangian formulation is also described. We conjecture that, in the framework of AdS/CFT, the continuous-spin AdS field is dual to light-ray conformal operator. For some particular cases, our continuous-spin field leads to reducible models. We note two reducible models. The first model consists of massive scalar, massless vector, and partial continuous-spin field involving fields of all spins greater than one, while the second model consists of massive vector, massless spin-2 field, and partial continuous-spin field involving all fields of spins greater than two.

Momentum/operator size holographic correspondense and applications

Dmitry Ageev *(Steklov Mathematical Institute of Russian Academy of Sciences)*

Recently the exact holographic relation between momentum of the dual holographic probe and the operator size on the QFT side has been established by L.Susskind. This relation allows to investigate the chaotic features of the arbitrary holographic system. We study how this conjectural correspondence works in different phenomena on both holographic and the QFT side including: 1)The chaos suppression at finite chemical potential 2)"Thermalization=operator growth":Black hole collapse as operator size growth 3) The effect of "operator size decay", their holographic description. Based on arXiv:1806.05574 and current ongoing works.

Operative Formulation of the Eigenstate Thermalization Hypothesis

Oleg Inozemcev *(Steklov Mathematical Institute of Russian Academy of Sciences)*

Eigenstate thermalization hypothesis (ETH) is discussed. We argue that common formulation of ETH has three imperfections and suggest a so called operative formulation of ETH which is free from those imperfections. We show that operative formulation of ETH implies thermalization as well.

Generalized Eigenstate Thermalization in 2d CFTs

Kirill Pavlenko *(Skoltech)*

Infinite-dimensional conformal symmetry in two dimensions leads to integrability of 2d conformal field theories through an infinite tower of local conserved qKdV charges in involution. We discuss the role this integrable structure plays in equilibration of 2d CFTs.

Dynamics of Tensor and SYK Models

Igor Klebanov *(Princeton University)*

We present the simplest tensor quantum mechanical model for Majorana fermions, which has $O(N)^3$ symmetry, and compare it with the Sachdev-Ye-Kitaev model. When two tensor or SYK models are coupled by a quartic interaction, one of the operators can acquire a complex scaling dimension, which indicates an instability of the conformal phase. In fact, the energy spectrum consists of two nearly degenerate states separated by a gap from the rest of the spectrum. We also find solutions of the large N Schwinger-Dyson equations with the non-vanishing off-diagonal two-point function. The Green's functions exhibit exponential decay consistent with the gapped spectrum. All these results demonstrate that a discrete Z_2 symmetry is broken spontaneously in the large N limit.

Remarks on the Complex SYK model

Grigory Tarnopolsky *(Harvard University)*

In this talk we describe properties of the density of states in the complex Sachdev-Ye-Kitaev model. The first part is based on numerical exact diagonalization results. The second part is devoted to a theoretical explanation. At the end we discuss some open problems.

Random tensors, a flexible tool for geometry and physics

Vincent Rivasseau *(LPT, University Paris-Sud XI, Orsay)*

I shall review how random tensor models, which generalize random matrices, have a wide range of potential applications from random geometry and quantum gravity to classical mechanics and data analysis.

Perturbative Tensor Field Theories

Reiko Toriumi *(Okinawa Institute of Science and Technology)*

I will introduce perturbative renormalization aspects of tensor field theories. Tensor field theories are quantum field theories based on tensor models, where we have put nontrivial propagators to launch the flow of the renormalization. The interactions in such tensor field theories are combinatorially nonlocal, therefore they are equipped with modifications to traditional quantum field theories. I will briefly cover the techniques used to analyze renormalizability of such theories and go through the status of renormalizability and UV behaviors of tensor field theories.

Present status of higher-spin theory

Mikhail Vasiliev *(Lebedev Physical Institute of Russian Academy of Sciences)*

We discuss the general properties of higher-spin gauge theories with emphasis on their locality properties and Coxeter generalization, which is expected to underlay the string-like higher spin theory and its further generalizations of tensor type.

Large N limit of irreducible tensor models

Sylvain Carrozza *(Perimeter Institute for Theoretical Physics)*

I will summarize the structure and scope of the large N expansion of tensor models, emphasizing recent generalizations to tensors transforming under irreducible representations. Compared to vector and matrix theories, what distinguishes this third generic family of large N models is that it is dominated by a non-trivial family of Feynman diagrams – the melon diagrams – which remains explicitly summable in a variety of situations. This provides a new analytical window into non-perturbative aspects of quantum (field) theory, with interesting connections to holography.

Functional integrals in Schwarzian theory

Vladimir Belokurov *(Moscow State University)*

We derive the general rules of functional integration in the theories of the Schwarzian type. We demonstrate that this integration appears not only in SYK model and in 2D dilaton gravity but also in the proposed polar decomposition of Wiener integrals.

Constructive Tensor Field Theory through an example

Fabien Vignes-Tourneret *(University of Lyon)*

In the last ten years, a new approach to quantum gravity has emerged. Called Tensor Field Theory, it generalizes random matrix models in a straightforward way. This talk will be the occasion the state-of-the-art of their constructive study. This is joint work with Vincent Rivasseau.

Large-N dynamics of the spiked tensor model with random initial conditions

Vasily Sazonov *(University of Graz)*

The spiked tensor model describes the estimation of a large rank-one tensor in Gaussian noise. We consider the evolution of the rank-one tensor driven by the gradient of the spiked tensor model Hamiltonian and study the corresponding correlation functions obtained by averaging with respect to the random initial conditions and Gaussian noise. Applying the functional super-symmetric formalism we derive the saddle point equation and show that the large N limit of the model is dominated by the melon diagrams.

Line of fixed points in a bosonic tensor model

Sabine Harribey *(CPhT, Ecole Polytechnique, Paris)*

Tensor models exhibit a melonic large N limit. In d dimensions, they give rise to a new family of conformal field theories and provide interesting examples of the renormalization group flow from a free theory in the UV to a melonic large N CFT in the IR.

We consider here a bosonic tensor model in rank three and $d < 4$ dimensions. I will present the renormalization group flow of this model. At leading order in $1/N$ but non perturbatively in the coupling constants, we found a real and infrared fixed point.

Perturbative QFT on a Random Tree

Nicolas Delporte *(LPT, University Paris-Sud XI, Orsay)*

In this talk we discuss a systematic consideration of quantum field theory on random trees. Using precise probability estimates on their Galton-Watson branches and a multiscale analysis, we establish the general power counting of averaged Feynman amplitudes and check that they behave indeed as living on an effective space of dimension 4/3, the spectral dimension of random trees. In the "just renormalizable" case we prove convergence of the averaged amplitude of any completely convergent graph, and establish the basic localization and subtraction estimates required for perturbative renormalization. Possible consequences for an SYK-like model on random trees are briefly discussed.

Tensor models for quantum gravity from a functional Renormalization Group perspective

Astrid Eichhorn *(CP3-Origins, University of Southern Denmark)*

Tensor models provide a way to access the path integral over discrete random geometries. It is a major outstanding challenge to find a viable continuum limit in this setting. I will review how universal critical behavior at large N can be searched for with functional Renormalization Group techniques that provide a pregometric notion of coarse graining.

Replica-nondiagonal solutions in SYK

Irina Aref'eva *(Steklov Mathematical Institute of Russian Academy of Sciences)*

We study the SYK model in the large N limit beyond the replica-diagonal approximation. First we show that there are exact replica-nondiagonal solutions of the saddle point equations for $q = 2$ for any finite replica number M. We also study replica-nondiagonal solutions of the SYK in the strong coupling limit. For arbitrary q we show that besides the usual solutions of the replica-diagonal saddle point equations in the conformal limit, there are also replica-nondiagonal solutions for any value of M (including zero). The specific configurations that we study, have factorized time and replica dependencies. The corresponding saddle point equations are separable at strong coupling, and can be solved using the Parisi ansatz from spin glass theory. We compute the regularized free energy on the constructed solutions in the limit of zero replicas. It is observed that there are nondiagonal solutions with the regularized free energy lower than that of the standard diagonal conformal solution.

To verify the application of the saddle point approximation, we also consider the 0-dimensional version of the SYK model. We exactly compute the partition function in the 0D SYK_2 model and show that it is given by the Hermite polynomial, and the large N approsimation is recovered in the asymptotic of the polynomial.

Characterization of chaotic dynamics in quantum systems

Masaki Tezuka *(Kyoto University)*

Two criteria are widely used currently to characterize quantum chaos: the random-matrix-like universality of the fine-grained energy spectrum and the exponential Lyapunov growth of an out-of-time-order correlation function (OTOC). The Sachdev-Ye-Kitaev (SYK) model, a model of N fermions with all-to-all random interactions, is solvable in the large-N limit and offers a possibility to study a maximally chaotic quantum system. However, the numerical study of the SYK model is limited to small N and it remains challenging to observe the exponential growth of OTOC.

We have generalized the growth exponent of the OTOC to define a spectrum of quantum Lyapunov exponents, which exhibits random matrix behavior when the system is chaotic. [1] Also, we propose a simple characterization of quantum many-body chaos. The set of all possible two-point correlation functions between a set of simple operators can be organized into a matrix. We find that the spectral statistics of the singular values of this matrix exhibits universal features characteristic of a random matrix, if the system is in a quantum chaotic phase. [2] We demonstrate these methods by numerically studying the SYK model with an additional hopping term, [3] and a one-dimensional spin chain with random magnetic field. When these models are brought outside the chaotic regime, the spectral statistics significantly deviate from those of known random matrix ensembles and approach those of an uncorrelated distribution.

This work has been done in collaboration with Hrant Gharibyan (Stanford), Masanori Hanada (Southampton), and Brian Swingle (Maryland).

References:

[1] H. Gharibyan, M. Hanada, B. Swingle, and M. Tezuka, “Quantum Lyapunov Spectrum,” JHEP 1904, 082 (2019) [arXiv:1809.01671].

[2] H. Gharibyan, M. Hanada, B. Swingle, and M. Tezuka, “A characterization of quantum chaos by two-point correlation functions”, arXiv:1902.11086.

[3] A. M. García-García, B. Loureiro, A. Remero-Bermudez, and M. Tezuka, "Chaotic-Integrable Transition in the Sachdev-Ye-Kitaev Model", Phys. Rev. Lett. 120, 241603 (2018) [arXiv:1707.02197].

Towards a full solution of the large N double scaled SYK model

Micha Berkooz *(Weizmann Institute of Science)*

We compute the exact, all energy scale, 4-point function of the large N doublescaled SYK model, by using only combinatorial tools and relating the correlation functions to sums over chord diagrams. We apply the result to obtain corrections to the maximal Lyapunov exponent at low temperatures. We present the rules for the non-perturbative diagrammatic description of correlation functions of the entire model. The latter indicate that the model can be solved by a reduction of a quantum deformation of $SL(2)$, that generalizes the Schwarzian to the complete range of energies.

Probing nonperturbative structures in gravity with SYK

Mikhail Khramtsov *(Steklov Mathematical Institute of Russian Academy of Sciences)*

In this talk I discuss the novel large N solutions of the SYK model, which are responsible for the nonperturbative effects in the $1/N$ expansion of the model. First, I describe the analytic solutions in the SYK_2 model with M replicas and their numerical counterparts in the SYK_4 version of the model. Then I explain how some of these nonperturbative effects can be elevated to thermodynamic phases with nontrivial physics, if one turns on a certain nonlocal interaction between SYK replicas. As we point out, this interaction between replicas is intrinsically connected to the spontaneous symmetry breaking by replica-nondiagonal solutions in pure SYK, by the notion of quasi-averaging. Lastly, I discuss the holographic connection of the subleading SYK saddle points to the nontrivial topologies in the bulk gravity, and I explain how it could be possible to reconstruct the nonperturbative quantum geometry in the bulk gravity from the corresponding SYK saddle point.

The talk is based on papers 1811.04831, 1905.04203 in collaboration with I. Aref'eva, M. Tikhanovskaya and I. Volovich, and on work in progress.

Special Kähler geometry, Localization and Mirror symmetry

Alexander Belavin *(Landau Institute of Theoretical Physics)*

I will talk about the connection between our computations of Special geometry on Complex moduli space and Localization computations of the Partition functions of the $N = (2,2)$ SUSY Gauge Linear Sigma Models (GLSM) on S^2. To do this we use the Mirror symmetry and the duality of the Batyrev's reflexive polytopes.

Entanglement entropy in 2d gravity

Daniel Jafferis *(Harvard University)*

I'll talk about some Lorentzian aspects of the dual gravitational description of nearly conformal quantum mechanics like the SYK model. In a double copy of a single instantiation of the disordered model, the thermofield double state is dual to the eternal black hole. The factorization of the microscopic theory is not apparent in JT gravity. I'll discuss the how that is consistent with the (correct) euclidean gravity calculation of the entanglement entropy across the black hole.

Quantum Chaos in a (Coupled) Sachdev-Ye-Kitaev Model

Jacobus Verbaarschot *(Stony Brook University)*

It has been known for at least forty years that the Sachdev-Ye-Kitaev Model is quantum chaotic as measured by the correlations of the eigenvalues of the SYK Hamiltonian. Since this model was first formulated as a model of a (compound) nucleus, this complements Wigner's original observation that the nuclear levels are correlated according to Random Matrix Theory. Since the SYK model for N particles is a many body model, it has to scales, N and $\exp N$. We show that spectral correlations, after subtraction of collective ensemble fluctuations, remain universal up to a fraction of the large scale of $\exp N$. We also investigate the spectral correlations of a model of two SYK models coupled by a spin-spin interaction (the Maldacena-Qi model) which describes an eternal traversable wormhole. The first surprise of this study was that it has an additional discrete symmetry which could identify as the square root of the chirality operator. The ground state(s) of this model is separated from the rest of the spectrum by a gap with a wave function that in spite of having a large overlap with a Thermo Field Double state (TFD), shows strong deviations from the thermal behavior of this state. The existence of a gap is the origin of the Hawking-Page phase transition which can also be seen as an order-chaos phase transition.

Resummation of instantons near poles and AdS_3 geometry

Alexander Gorsky *(IITP RAS & MIPT)*

It is known that there are naive poles in the partition function of $SU(2)$ Ω-deformed SYM theory which according to the AGT get transformed into the poles of the conformal blocks in Liouville theory. We show how the resummation of the instantons near the poles transform them intp cuts and the superpotential of the mirror to CP_1 manifold gets emerged. Using the holography for conformal blocks we relate the instanton resummation to the peculiar behavior of the geodesics in perturbed AdS_3.

Non Gaussian average in the Sachdev-Ye Kitaev model

Thomas Krajewski *(Aix-Marseille Université)*

The Sachdev-Ye-Kitaev model involves a quenched average over a random coupling J_{ijkl} that is usually taken from a Gaussian ensemble. Treating this coupling as a random tensor, we use Guraus Gaussian universality to show that, at leading order, the effect of non Gaussian fluctuations can included in a modification of the covariance. We also discuss the effect of subleading terms. This is based https://arxiv.org/abs/1812.03008, in collaboration with M. Laudonio, R. Pascalie and A. Tanasa.

Quantum resonant systems

Oleg Evnin *(Chulalongkorn University, Bangkok & Solvay Institute, Brussels)*

Quantum resonant systems are a large class of deterministic bosonic models closely related to the SYK Hamiltonian, and including both integrable and chaotic representatives. Unlike the corresponding fermionic models, these systems admit semiclassical limits, which are known to possess rich and interesting dynamics. At the same time, their quantum spectra can be analyzed to a remarkable degree. Ill report on recent investigations of these matters, specifically keeping the questions of quantum integrability and chaos in mind.

$N = 2^*$ super-Yang-Mills theory: from holography to random matrices

Konstantin Zarembo *(NORDITA Institute, Stockholm)*

The $N = 2^*$ SYM is the simplest theory for which holographic duality can be formulated in the non-conformal setting. A wealth of exact results unveil an intricate phase structure of this theory with infinitely many quantum phase transitions.

Matrix models for Hurwitz numbers for Klein surfaces

Aleksandr Orlov *(NRU Higher School of Economics & Institute of Oceanology RAS)*

I will consider matrix models with sources labeled with chord diagrams which generate Hurwitz numbers for arbitrary base Klein surfaces without boundaries and for arbitrary profiles in critical values.

Limit distributions of compositions of independent random semigroups of linear operators

Vsevolod Sakbaev *(Moscow Institute of Physics and Technology)*

The properties of the sequence comositions of independent random one-parametric families of linear operators are studied.The analogs of the law of large numbers for the compositions of independent identicaly distributed random semigroups are obtained.

On integrable holographic RG flows with one and several running couplings

Anastasia Golubtsova *(BLTP, Joint Institute for Nuclear Research)*

We consider a 5d holographic model with a dilaton potential representing a sum of exponential functions. We construct Poincaré invatiant and black brane solutions with AdS and non-AdS boundaries. Under the holographic duality these solutions can be interpreted as RG flows. We discuss the dependence of the running coupling on the energy through the constructed solutions.

Entanglement entropy in strongly correlated systems with phase transition and anisotropy

Alexander Patrushev *(Bauman Moscow State Technical University)*

Experiment results show that the quark-gluon plasma (QGP) in the RHIC experiment exhibits strong-coupling dynamics which does not have a proper description in terms of standard perturbative methods. Another difficulty in description of QGP is the anisotropy. We use the holographic approach to description QGP, which has been widely used for the description of plasma transport and thermalization. We continue studying the holographic model proposed by I. Aref'eva and K. Rannu that is the gravitational theory dual to the anisotropic field theory defined by the Einstein-Dilaton-two-Maxwell action. The main focus of our work is the description of entanglement in the anisotropic holographic model. The entanglement entropy can be useful to probe correlations in the background. In this model we investigate the behavior of the entanglement entropy near criticality. Our main goal is to relate QGP observables such as multiplicity and its angular dependence with entanglement characteristics of the model.

3d gauge theories, matrix models and superalgebras

Yegor Zenkevich *(Milano Bicocca University & ITEP)*

We consider a class of 3d theories, associated to superalgebras. These theories arise naturally as intertwiners of quantum toroidal algebras. We will show their connection with multi-matrix models, which in turn provide integral representations for eigenfunctions of supersymmetric generalization of Ruijsenaars Hamiltonians.

Nuclear decay oscillations and bilocal quantum gravity

Sergey Mayburov *(Lebedev Physical Institute of Russian Academy of Sciences)*

Recently, several experiments reported temporary decay rate and life-time variations for alpha and beta-decay of heavy nuclei [1,2]. Beside standard exponential time dependence of nuclei decay rate, they found additional periodic terms of the order .05% corresponding to annual and daily decay rate oscillations. These results suppose that decay rate variation can be related to temporary l variation of Sun gravitation potential U in lab., resulting from elliptic form of Earth orbit and its daily rotation [1]. We argue that emergent gravity theory, in which gravity effects induced by scalar bilocal field Φ, can describe such effects [3, 4]. It's shown that Φ interaction with bilocal nucleus operators can influence its state evolution. For Gamow alpha-decay theory, such nonlinear Hamiltonian induces significant nucleus decay rate variations which agree with experimental results for heavy nuclei alpha-decay.

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2. E. Alekseev et al. , Phys. Part. Nucl. 47, 1803 (2016), ibid.. 49, 557 (2018)

3. P. Diaz, S. Das, M. Walton, Int. J. Mod. Phys. D27, 1850090 (2017)

4. S.Das, A.Jevicki, Phys. Rev. D68, 044011 (2003)

Eigenvalue hypothesis and $6j$-symbol symmetries

Andrey Morozov *(IITP RAS & ITEP)*

Racah or $6-j$ symbols has a wide variety of uses in different fields of physics and mathematics. However there are only a few distinct cases where we have the general formula for them. In this talk we will discuss a new approach to describing symmetries of the Racah symbols of quantum groups. It is based on the so-called eigenvalue conjecture which originates from the knot theory and relates Racah coefficients with the quantum R-matrices. We describe which symmetries appear from this conjecture and how does it apply to the known $SU(2)$ case.

4d Superconformal indices and 2d statistical mechanics

Vyacheslav Spiridonov *(BLTP, Joint Institute for Nuclear Research)*

We discuss a particular 4d/2d field theoretical correspondence. Elliptic hypergeometric integrals coincide with superconformal indices of 4d $N = 1$ supersymmetric field theories. Their symmetries describe Seiberg dualities. The simplest such exactly computable integral corresponds to $SU(2)$ gauge theory exhibiting s-confinement. Simultaneously it describes the star-triangle relation for a 2d lattice spin system. Full lattice 2d partition function describes superconformal index of a 4d quiver gauge theory.

On representations of Yangians and Quantum Loop Superalgebras

Vladimir Stukopin *(Don State Technical University & MIPT)*

We describe connection between Yangian of special linear Lie superalgbra and Quantum loop superalgebra and its representation categories

Chern-Simons action in the geometric theory of defects

Mikhail Katanaev *(Steklov Mathematical Institute of Russian Academy of Sciences)*

The Chern-Simons action is used in the geometric theory of defects. The equilibrium equations with δ-function source are explicitly solved with respect to the $SO(3)$ connection. This solution describes one straight linear disclination and corresponds to the new kind of geometrical defect: it is the defect in the connection but not the metric which is the flat Euclidean metric. This is the first example of a disclination described within the geometric theory of defects. The corresponding angular rotation field is computed.

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