



天元數學國際交流中心
Tianyuan Mathematics Research Center

几何表示论及相关领域

Geometric Representation and Related Topics

会议手册



云南·昆明 宜良柴石滩水库库区内

2026 年 8 月 9 日-2026 年 8 月 15 日

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TMRC is a mathematics and interdisciplinary science exchange institution jointly supported by the Chinese Academy of Sciences, the National Natural Science Foundation of China, the Chinese Mathematics Society, the Academy of Mathematics and Systems Science of the Chinese Academy of Sciences, and relevant departments of Kunming City. It is located in a beautiful mountain near Kunming (1h30min from the Airport to the Institute by car).

Please find more information about TMRC at <http://tianyuan.amss.ac.cn>.

Registration Date & Location:

August 9th, 2026 (Sunday)

Address: Tianyuan Mathematics Research Center, Chaishitan Reservoir area,
Yiliang County, Kunming City, Yunnan Province

地址：云南省昆明市宜良县柴石滩风景区天元数学国际交流中心

Departure Date:

August 15th, 2026 (Saturday)

Conference Time: August 10-14, 2026

Tips:

Tianyuan Mathematics Research Center is located halfway up the mountain in the Chaishitan Reservoir area. The temperature is 2-3 degrees lower than the county town, it is cooler in the morning and evening especially; Tianyuan Mathematics Research Center is located in a national first-class public welfare forest, and there are many mosquitoes. In addition, the center is about an hour's drive from the county hospital. It is recommended to prepare some common medicines;

There is nearly 40 minutes of rural roads on the way to the center, and the road is narrow and winding. There is a three-kilometer mountain road from the reservoir gate to the center, and rockfalls occur from time to time, especially on rainy days. For safety reasons, it is recommended that the trip time should not be too late.

Breakfast: 7:30-9:00

Lunch: 11:30-13:00

Dinner: 17:30-19:00

Invited Speakers

Huanchen Bao	National University of Singapore
Tommaso Botta	Columbia University
Chenjing Bu	University of Oxford
Samuel DeHority	Yale University
Lucien Hennecart	CNRS
Sarunas Kaubrys	Kavli IPMU, The University of Tokyo
Adeel Khan	Institute of Mathematics, Academia Sinica
Tasuki Kinjo	RIMS, Kyoto University
Hiraku Nakajima	Kavli IPMU, The University of Tokyo
Tudor Padurariu	University of Bonn
Francesco Sala	University of Pisa
Peng Shan	Tsinghua University
Kaiwen Sun	University of Science and Technology of China
Eric Vasserot	Université Paris Cité
Ruotao Yang	AMSS, CAS
Yehao Zhou	SIMIS

Organizers

Yalong Cao	MCM, CAS
Andrei Okounkov	Columbia University
Yehao Zhou	SIMIS

Conference Schedule

August 10, 2026 (Monday)		
9:00-10:00	Hiraku Nakajima	Higher rank triangles in bow varieties and their applications
10:00-10:30	Break	
10:30-11:30	Huanchen Bao	Frobenius splittings and quantum symmetric pairs
11:30-14:00	Lunch	
14:00-15:00	Yehao Zhou	Critical stable envelopes, shifted Yangians, and cohomological Hall algebras
15:00-15:30	Break	
15:30-16:30	Sarunas Kaubrys	Vertex Coproducts on Cohomological Hall Algebras
August 11, 2026 (Tuesday)		
9:00-10:00	Eric Vasserot	Duality functors for Coulomb branches
10:00-10:30	Break	
10:30-11:30	Tudor Padurariu	Abelian quasi-BPS categories
11:30-14:00	Lunch	
14:00-15:00	Tasuki Kinjo	Cohomological Hall bialgebra, tautological generation and $P=W$
15:00-15:30	Break	
15:30-16:30	Adeel Khan	Equivariant elliptic cohomology
August 12, 2026 (Wednesday)		
9:00-10:00	Peng Shan	Associated varieties of simple affine vertex algebras at rational levels
10:00-10:30	Break	
10:30-11:30	Francesco Sala	COHAs and Yangians over the Bridgeland's space of stability conditions

11:30-14:00	Lunch	
14:00-16:30	Free Discussion	
August 13, 2026 (Thursday)		
9:00-10:00	Tommaso Botta	BFN Coulomb Branches and quasimaps to quiver varieties
10:00-10:30	Break	
10:30-11:30	Chenjing Bu	Semiorthogonal decompositions for stacks
11:30-14:00	Lunch	
14:00-15:00	Ruotao Yang	The Gaiotto conjecture at the root of unity
15:00-15:30	Break	
15:30-16:30	Lucien Hennecart (online)	The BPS sheaf for preprojective algebras and moduli of Higgs bundles
August 14, 2026 (Friday)		
9:00-10:00	Samuel DeHority	Quantum connection for moduli of Higgs bundles
10:00-10:30	Break	
10:30-11:30	Kaiwen Sun	VOA, Borchers product and Borchers-Kac-Moody algebras
11:30-14:00	Lunch	
14:00-16:30	Free Discussion	

Conference Schedule

	August 10th Mon	August 11th Tues	August 12th Wed	August 13th Thur	August 14th Fri
9:00-10:00	Hiraku Nakajima	Eric Vasserot	Peng Shan	Tommaso Botta	Samuel DeHority
10:30-11:30	Huanchen Bao	Tudor Padurariu	Francesco Sala	Chenjing Bu	Kaiwen Sun
11:30-14:00	Lunch				
14:00-15:00	Yehao Zhou	Tasuki Kinjo	Free Discussion	Ruotao Yang	Free Discussion
15:30-16:30	Sarunas Kaubrys	Adeel Khan		Lucien Hennecart (online)	

Titles and Abstracts

Hiraku Nakajima (Kavli IPMU, The University of Tokyo)

Higher rank triangles in bow varieties and their applications

Abstract: Bow varieties are symplectic quotients of products of ‘triangle parts’ and ‘two way parts’. Framing vector spaces appear in triangle parts. In each triangle, the framing vector space is 1-dimensional. In this talk, we introduce triangle parts with higher dimensional framings, and study correspondence bow varieties. We also explain their applications.

Huanchen Bao (National University of Singapore)

Frobenius splittings and quantum symmetric pairs

Abstract: Let G be a connected reductive group over an algebraically closed field. Such groups are classified via root data and can be parameterised via Chevalley group schemes over integers. In this talk, we shall first recall the construction of Chevalley group schemes by Lusztig using quantum groups. Then we shall discuss the construction of symmetric subgroup schemes parameterising symmetric subgroups K of G using quantum symmetric pairs. The existence of such group schemes allows us to apply characteristic p methods to study the geometry of K -orbits on the flag variety of G . This leads to a construction of Frobenius splittings via quantum symmetric pairs, generalising the algebraic Frobenius splittings by Kumar-Littelmann. This is based on joint work with Jinfeng Song.

Yehao Zhou (SIMIS)

Critical stable envelopes, shifted Yangians, and cohomological Hall algebras

Abstract: Given a symmetric quiver Q with potential W , I will describe in this talk a construction of a (shifted) Yangian $Y(Q, W)$ and its underlying Lie algebra $\mathfrak{g}(Q, W)$ using the critical stable envelopes and R -matrices. I will also talk about relation between $Y(Q, W)$ and the cohomological Hall algebra, and between $\mathfrak{g}(Q, W)$ and the BPS Lie algebra. This is based on works 2512.23929 and 2601.01518 with Cao, Okounkov, and Zhou, and work in progress with Botta, Davison, and Zhu.

Sarunas Kaubrys (Kavli IPMU, The University of Tokyo)

Vertex Coproducts on Cohomological Hall Algebras

Abstract: In this talk I will discuss vertex coproducts on cohomological Hall algebras, inspired by

the original construction of Joyce in the case of singular cohomology. In the case of tripled quivers with potential we will also discuss connections to Drinfeld coproducts on Yangians. We will also discuss how vertex coproducts are related to factorization type coproducts, recently defined in work of Davison-Hennecart-Kinjo-Schiffmann-Vasserot. This is joint work with Jindal and Latyntsev and work in progress with Latyntsev and Descombes.

Eric Vasserot (Université Paris Cité)

Duality functors for Coulomb branches

Abstract: The goal of this talk is to describe a new relation between quiver Hecke algebras and Coulomb branches. We define an exact functor from the category of finite dimensional modules over quiver Hecke algebras (of affine type ADE) to the Coulomb category of Koszul-perverse coherent sheaves constructed by S. Cautis and H. Williams. This functor factors through a certain localization of the module category studied by Kashiwara-Kim-Oh-Park and categories an isomorphism on the Grothendieck groups.

Tudor Padurariu (University of Bonn)

Abelian quasi-BPS categories

Abstract: I will report on joint works in progress with Sabin Cautis, and with Sabin Cautis and Yukinobu Toda. In previous work, we constructed semiorthogonal decompositions of categories of coherent sheaves on many examples of stacks into quasi-BPS categories. For the further study of these summands and their computation in explicit examples, it is important to construct t-structures on them. We construct such t-structures for equivariant quasi-BPS categories of preprojective algebras. I will discuss applications to the computation of quasi-BPS categories for the Jordan quiver and to the identification of their generators with simple objects in the abelian Hall category constructed by Cautis. I will also discuss a comparison between quasi-BPS categories for finite-type quivers and categories of modules over KLR algebras.

Tasuki Kinjo (RIMS, Kyoto University)

Cohomological Hall bialgebra, tautological generation and $P=W$

Abstract: I will explain that the cohomological Hall algebra for surfaces, as constructed by Kapranov and Vasserot, extends to a bialgebra when the surface is holomorphic symplectic. This has many applications to the topology of the moduli stack of coherent sheaves on such surfaces, including Toda's χ -independence conjecture, a generalization of Markman's tautological generation theorem to non-primitive degrees, and the $P=W$ phenomenon for the Hitchin system in non-coprime degrees. The key ingredients are cohomological Donaldson-Thomas theory and factorization algebra

techniques. This talk is based on joint work with Ben Davison, Lucien Hennecart, Olivier Schiffmann, and Eric Vasserot.

Adeel Khan (Institute of Mathematics, Academia Sinica)

Equivariant elliptic cohomology

Abstract: I will explain a construction called A -loop cohomology, defined uniformly and functorially in any 1-dimensional commutative group scheme A . For $A=E$ an elliptic curve, it takes G -equivariant algebraic varieties as input and produces translation-equivariant sheaves on the moduli stack of G -bundles on the dual elliptic curve. Existing avatars of elliptic cohomology, like Grojnowski's theory over the complex numbers and the periodic spectrum of topological modular forms, can be regarded as two dual shadows of this one theory. This is joint work with Emile Bouaziz.

Peng Shan (Tsinghua University)

Associated varieties of simple affine vertex algebras at rational levels

Abstract: I will discuss a conjecture for associated varieties of simple affine vertex algebras attached to a simple Lie algebra for all rational levels greater than the critical level, and some applications to W -algebras. This is based on joint work with Wenbin Yan and Qixian Zhao.

Francesco Sala (University of Pisa)

COHAs and Yangians over the Bridgeland's space of stability conditions

Abstract: In this talk, I will explain the construction of nilpotent cohomological Hall algebras (COHAs) associated with Bridgeland stability conditions on the bounded derived category of nilpotent representations of the preprojective algebra of an affine ADE quiver. I will then describe how these COHAs are related to the negative half of the corresponding affine Yangian. Finally, I will discuss possible extensions of this picture to the full affine Yangian. This is based on the joint work with Olivier Schiffmann and Parth Shimpri, arXiv:2511.08576.

Tommaso Botta (Columbia University)

BFN Coulomb Branches and quasimaps to quiver varieties

Abstract: From 3d mirror symmetry, any Nakajima quiver variety comes with a dual variety known as the Coulomb branch. A conjecture proposed by Bullimore–Dimofte–Gaiotto–Hilburn–Kim and,

independently, by Okounkov asserts that the cohomology of the moduli space of quasimaps to a quiver variety admits a canonical action by the quantized coordinate ring of the dual BFN Coulomb branch. In this talk, I will propose a refinement of this conjecture and discuss its proof. The construction relies on a -1 shifted symplectic structure on the moduli space of quasimaps and a compatible critical description of the BFN Coulomb branch. Time permitting, I will discuss the relation to critical Hall algebras and shifted Yangians. Joint work with Spencer Tamagni.

Chenjing Bu (University of Oxford)

Semiorthogonal decompositions for stacks

Abstract: I will explain a construction of semiorthogonal decompositions of derived categories of coherent sheaves on derived algebraic stacks, generalizing the fact that finite-dimensional representations of complex reductive groups are completely reducible. This can be seen as a categorification of a decomposition theorem in cohomology obtained in an earlier joint work, motivated by Donaldson–Thomas theory. I will also discuss its applications to the geometric Langlands programme and to coherent categorification of quantum groups. This talk is based on a joint work with Tudor Pădurariu and Yukinobu Toda.

Ruotao Yang (AMSS, CAS)

The Gaiotto conjecture at the root of unity

Abstract: Motivated by the study of the boundary conditions in the supersymmetric Yang–Mills theory, David Gaiotto proposed a conjecture about the geometrization of the category of representations of the quantum supergroup (including representations of small quantum supergroup, Lusztig/big quantum supergroup, and the quantum category $\mathcal{O}$). In this talk, I will discuss the progress on the study of the Gaiotto conjecture in the root of unity case, and its application to the representation theory of the quantum supergroups. This is based on the upcoming work joint with Roman Travkin.

Lucien Hennecart (CNRS) (online)

The BPS sheaf for preprojective algebras and moduli of Higgs bundles

Abstract: The BPS sheaf associated with the preprojective algebra of a quiver is a perverse sheaf on the moduli space of representations, endowed with a Lie algebra structure, which encodes the Kac polynomials of the quiver. Its structure is described in terms of generators and relations in joint work with Davison and Schlegel Mejia. This description is formulated in terms of a generalized Kac–Moody algebra. I will explain how this description makes it possible to determine the supports and local systems of the direct summands of the BPS sheaf. This description involves the geometry of

hypertoric varieties in general, and can in certain cases (for example in the totally negative case) be simplified. Applying these results to the Hitchin fibration, one recovers results due to de Cataldo, Heinloth, Migliorini, and also Mauri, concerning the effective decomposition theorem for the Hitchin morphism involving Ngo strings. This is all based on various discussions with Ben Davison.

Samuel DeHority (Yale University)

Quantum connection for moduli of Higgs bundles

Abstract: The moduli space of semistable Higgs G -bundles on a curve C can be interpreted as a Coulomb branch of $4d$ $N = 2$ supersymmetric gauge theory compactified on a circle. I will describe a conjecture relating the quantum differential equation of moduli of semistable Higgs G -bundles and the same equation for the Langlands dual group, as well as evidence for the conjecture provided by concrete examples in low dimensions. The conjecture provides an enumerative interpretation of the Dolbeault geometric Langlands correspondence. Relatedly, the physics origin of the relevant formula also suggests a relationship between a modified version of the quantum cohomology ring of the moduli space of Higgs bundles and the chiral homology as defined by Beilinson and Drinfeld of a certain Poisson VOA, with relations to $P = W$ phenomena.

Kaiwen Sun (University of Science and Technology of China)

VOA, Borcherds product and Borcherds-Kac-Moody algebras

Abstract: I will report some recent works joint with Haowu Wang and Brandon Williams on the classification of hyperbolization of affine Lie algebras and affine Lie superalgebras. This is to classify the Borcherds-Kac-Moody algebras whose denominator is a reflective Borcherds product of singular weight. We prove there are in total 81 affine Lie algebras and 4 affine Lie superalgebras that allow hyperbolization. We find the classification is closely related to $c=24$ holomorphic VOAs, $c=12$ holomorphic VOSAs and some peculiar VOSAs with exceptional modular invariants.

List of Participants

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