

CURRICULUM VITAE

Vasily Krylov

E-mail: vkrylov@math.harvard.edu, krylovasya@gmail.com.

Website: <https://people.math.harvard.edu/~vkrylov/Index.html>

Research interests: representation theory, algebraic geometry.

Education: • 2013-2017 B.S. National Research University Higher School of Economics, Faculty of Mathematics.

- 2017-2019 M.S. program “Mathematics” National Research University Higher School of Economics.
- 2017-2019 M.S. program “Mathematical Physics” Skolkovo Institute of Science and Technology.
- 2019-2024 Ph.D. program “Mathematics” Massachusetts Institute of Technology.

Employment: • 2016-2019 Research Intern at the Laboratory of Algebraic Geometry and its Applications at HSE.

- 2024-present Benjamin Pierce fellow position in the Department of Mathematics at Harvard University, joint with the postdoctoral fellow position in the Center of Mathematical Sciences and Applications (CMSA) at Harvard University.
- 2024-present Simons Collaboration on Global Categorical Symmetries.

Preprints: • V. Krylov, K. Suzuki, “Affine Kazhdan-Lusztig polynomials on the subregular cell in non simply-laced Lie algebras: with an application to character formulae”, arXiv:2401.06605.

- R. Bezrukavnikov, I. Karpov, V. Krylov, “On a geometric realization of the asymptotic affine Hecke algebra”, arXiv:2312.10582.
- V. Krylov, I. Mashanova-Golikova, L. Rybnikov, “Bethe subalgebras in Yangians and Kirillov-Reshetikhin crystals”, arXiv:2212.11995.
- M. Cai, V. Krylov “Decomposition of Frobenius pushforwards of line bundles on wonderful compactifications”, arXiv:2209.01481 (submitted to Communications in Algebra).
- V. Krylov, P. Shlykov “Hikita-Nakajima conjecture for the Gieseker variety”, arXiv:2202.09934 (submitted to Selecta).

Publications: • V. Krylov, L. Rybnikov “Bethe subalgebras in antidominantly shifted Yangians”, International Mathematics Research Notices, 2024 (9)(2024), 7846-7869.

- R. Bezrukavnikov, V. Kac, V. Krylov “Subregular nilpotent orbits and explicit character formulas for modules over affine Lie algebras”, Pure and Applied Mathematics Quarterly, 20 (1) (2024), 81-138 (the special volume of PAMQ dedicated to Corrado De Concini’s birthday).
- I. Mirković, M. Vybornov with an appendix by V. Krylov “Comparison of quiver varieties, loop Grassmannians and nilpotent cones in type A_n ”, Advances in Mathematics, 407 (2022): 108397.
- P. Etingof, V. Krylov, I. Losev, J. Simental “Representations with minimal support for quantized Gieseker varieties”, Mathematische Zeitschrift, 297 (2021), 1-29.
- V. Krylov, I. Perunov “Almost dominant generalized slices and convolution diagrams over them”, Advances in Mathematics, 392 (3) (2021), 1-45.
- M. Finkelberg, V. Krylov, I. Mirković “Drinfeld-Gaitsgory Interpolation Grassmannian and Geometric Satake Equivalence”, Journal of Topology 13 (2) (2020), 683-729.
- V. Krylov “Integrable crystals and restriction to Levi via generalized slices in the affine Grassmannian”, Funct. Anal. Its Appl., 52 (2018), 113-133.

Prizes, awards, grants, scholarships: • MIT Presidential Fellowship (2019).

- Young Faculty Support Program (Group of Young Academic Professionals) Category “New Researchers” (2019).
- Participant of the grant “Junior Leader” by the Foundation for the Advancement of Theoretical Physics and Mathematics “BASIS” (2019-2022).
- RSF grant (2019-2021).

- RSF-DFG grant (2018).
- Dobrushin stipend (spring semester 2017).
- Golden HSE Award, nomination “Silver Nestling” (2016).
- Student Research Paper Competition held by HSE (2016) second prize.
- First prize at the 20th All-Russian Möbius Contest in the section “Undergraduates” (2016).

Research talks: • “Symplectic duality and Hikita-Nakajima conjecture” at **Cable Car Algebra Seminar at Technion** (Haifa, summer 2024).

- “Around the Hikita-Nakajima conjecture” at **Algebra Seminar at the University of Buffalo** (Buffalo, spring 2024, online).
- “Character formulas of affine Lie algebras via the geometry of the Springer resolution” at **AMS special session on Cluster algebras, Hall algebras and representation theory (at the AMS Sectional Meeting at the University of Wisconsin-Milwaukee)**, spring 2024.
- “From geometric realizations of affine Hecke algebras to character formulas” at **Caltech/USC joint algebra and geometry seminar** (Los Angeles, spring 2024).
- “From geometric realization of affine Hecke algebras to character formulas” at **Berkeley Informal String-Math Seminar** (Berkeley, spring 2024).
- “On the Hikita-Nakajima conjecture” at **Informal Mathematical Physics Seminar at Columbia University** (New York, winter 2023).
- “Subregular nilpotent orbits and explicit character formulas for modules over affine Lie algebras” at **Interactions between Mathematics and Physics conference on the occasion of V. Kac 80’s birthday** (Rome, summer 2023).
- “On Hikita-Nakajima conjecture for some quiver varieties and Slodowy slices” at **Representation and Number Theory Seminar at CUHK** (Hong Kong, spring 2023, online).
- “On Hikita-Nakajima conjecture for some quiver varieties and Slodowy slices” at **Mathematical Physics Seminar at Perimeter institute** (Waterloo, spring 2023).
- “On Hikita-Nakajima conjecture for quiver varieties and Slodowy slices” at the **conference on The Geometry of Double Affine Hecke Algebras and Coulomb Branches** (Edinburgh, spring 2023).
- “Equivariant Hikita-Nakajima conjecture for ADHM spaces” at **AMS Special Session on Resolutions of Singularities and Cohomology in Geometry and Representation Theory (at Joint Mathematics Meetings in Boston)**, winter 2023.
- “Symplectic duality and equivariant Hikita-Nakajima conjecture for ADHM spaces” at **Geometry, Symmetry and Physics at Yale University** (New Haven, fall 2022).
- “Subregular nilpotent orbits and explicit character formulas for modules over affine Lie algebras” at **MIT Infinite Dimensional Algebra Seminar** (Boston, fall 2022).
- “Equivariant Hikita-Nakajima conjecture for ADHM spaces” at **Geometric Representation Theory, Integrability, and Supersymmetric Gauge Theories workshop at Stony Brook University** (Stony Brook, fall 2022).
- “Symplectic duality and equivariant Hikita-Nakajima conjecture for ADHM spaces” at **Mathematical Physics and Representation Theory Seminar at LSU** (Baton Rouge, spring 2022).
- “Symplectic duality and equivariant Hikita-Nakajima conjecture for ADHM spaces” at **Center for Advanced Studies Seminar at Skoltech** (Moscow, spring 2022, online).
- “Drinfeld-Gaitsgory interpolation Grassmannian and geometric Satake equivalence” at **MIT Lie Groups Seminar** (Boston, spring 2021, online).
- “Affine fibrations over generalized slices and applications” at the **Seminar on Lie algebras and applications** (Moscow, fall 2020, online).
- “Generalized slices in the affine Grassmannian for minuscule cocharacters and applications” at the **UC Davis Algebraic Geometry Seminar**, spring 2020, online talk.
- “On isomorphisms between quiver varieties of type A and slices in the affine Grassmannian” at the **Geometric Representation Theory Learning Seminar** (Toronto, spring 2020, online).

- “Drinfeld-Gaitsgory interpolation Grassmannian and geometric Satake equivalence” at the **Geometric Representation Theory Seminar** (Toronto, spring 2019).
- “A geometric construction of universal enveloping algebras of maximal nilpotent subalgebras of semisimple Lie algebras via deformations of zastava spaces” at the **Seminar on Mathematical Physics at Skoltech** (Moscow, winter 2019).
- “Drinfeld-Gaitsgory interpolation Grassmannian and geometric Satake equivalence” at the **Representation Theory Seminar** (Kyoto, fall 2018).
- “On isomorphisms between quiver varieties of type A and slices in the affine Grassmannian” at the **Geometry, Physics, and Representation Theory Seminar** (Boston, fall 2017).
- “Explicit construction of the isomorphism between quiver varieties of type A and transversal slices in the affine Grassmannian” at the **Informal Representation Theory and Mathematical Physics Seminar** (Kyoto, fall 2016).

Expository talks: • “Vertex Poisson algebras and Miuraopers” I gave two talks at the learning seminar on “Representations of affine Kac-Moody algebras at the critical level” at MIT (Cambridge, spring 2024).

- “Verma’s theorem about the embeddings of Verma modules” I gave this lecture in place of Leonid Rybnikov at his class at MIT on “Infinite-dimensional Lie Algebras” (Cambridge, fall 2023).
- “The affine Grassmannian and its equivariant homology” at the MIT summer school on “Coulomb Branches and Knot Homology” (main lecturer was Ben Webster) (Cambridge, summer 2023).
- “ADE setting: algebraic vs geometric Yangians” at the learning seminar on “Stable envelopes and quantum groups” at Northeastern University (Cambridge, spring 2023).
- “Translation functors and categories \mathcal{O} ” I gave this lecture in place of Leonid Rybnikov at his class at Harvard on “Representations of Lie algebras” (Cambridge, spring 2023).
- “Cherednik algebras and Coulomb branches” at Ben Webster’s learning seminar on Coulomb branches (winter 2021, online).
- Introductory talk at the seminar “Gaudin model and related topics” (fall 2021, online).
- “Geometry of affine Grassmannian and related objects” at the conference “Algebra and Geometry” (Yaroslavl, summer 2021).
- Series of talks at the mini-course on quantum cohomology of cotangent spaces to flag varieties (Moscow, winter 2020).
- “2-categories and Barr-Beck for module categories” at the RTG Graduate Research Seminar on Factorization homology along surfaces and quantum groups (Boston, fall 2019).
- Series of talks at the pre-seminar to the seminar by Daniel Juteau, Carl Mautner, Simon Riche and Geordie Williamson, (Russia, summer 2019).
- “Ringel duality for category \mathcal{O} ” at Seminar on Soergel Bimodules (Moscow, spring 2019).
- “Representations of symmetric groups, Fock modules and categorifications” at the seminar on geometric structures on manifolds (Moscow, winter 2019).
- “Soergel’s functor” at Seminar on Soergel Bimodules (Moscow, winter 2018).
- “Geometric, affine and GIT quotients in the algebraic geometry” at the Seminar on Representations of Quivers (Moscow, spring 2018).
- “Convolution construction of $U(\mathfrak{n})$ ” at the Seminar on Representations of Quivers (Moscow, spring 2018).
- “Convolution and Hecke algebras” at the Seminar on Representations of Quivers (Moscow, spring 2018).
- “On the Jacobson-Morozov theorem” at the seminar on algebra and model theory (Moscow, spring 2017).
- “Geometric Satake isomorphism” at the seminar on geometric structures on manifolds (Moscow, spring 2017).
- “Orbital integrals and Springer fibers” at the Arithmetic geometry seminar (Moscow, fall 2016).

Conferences: • “Arithmetic Quantum Field Theory Program” Feb. 5 - Mar. 29, 2024, Cambridge.

- “The Canada-Mexico-United States Conference on Representation Theory, Noncommutative Algebra and Categorification” August 24-28, 2023, Montréal.

- The MIT summer school on “Coulomb Branches and Knot Homology” (main lecturer was Ben Webster) (Cambridge, summer 2023).
- The Los Angeles Workshop on Representations and Geometry “3d Mirror Symmetry and 3d TQFT” June 12-16, 2023, Los Angeles.
- Victor Kac
- “The Geometry of Double Affine Hecke Algebras and Coulomb Branches”, March 20-24, 2023, Edinburgh.
- “Gauge Theory, Moduli Spaces and Representation Theory (In honor of the 60th birthday of Hiraku Nakajima)”, February 20-24, 2023, Kyoto (attended via zoom).
- “AMS Special Session on Resolutions of Singularities and Cohomology in Geometry and Representation Theory” at Joint Mathematics Meetings, January 4-5, 2023, Boston.
- “Geometric Representation Theory, Integrability, and Supersymmetric Gauge Theories”, September 26-30, 2022, Stony Brook.
- “Lie Groups Days (in honor of David Vogan)”, September 23-24, 2022, MIT.
- “Quantized symplectic singularities and applications to Lie theory” series of lectures by Ivan Losev given at MIT on June 13-17, 2022.
- “On the Crossroads of Algebra, Geometry, and Physics”, May 16-20, 2022, Yale.
- “Poisson Geometry and Representation Theory”, November 22-26, 2021, HSE (online).
- “Enumerative Geometry, Physics and Representation Theory”, July 5-16, 2021, IHES (online).
- “Virtual Workshop on Recent Developments in Geometric Representation Theory”, November 16-20, 2021 IAS (online).
- “Geometric Representation Theory”, June 22-26, 2020 Max Plank Institute in Bonn and Perimeter Institute in Waterloo (online).
- “Quantum structures in algebra and geometry”, August 26-30, 2019, Boston.
- Dacha seminar on “Representations of algebraic groups: constructible, coherent and categorical viewpoints,” July 15-21, 2019, Russia.
- “International Skoltech Summer School on Mathematical Physics”, July 1-12, 2019, Moscow.
- “Summer school on algebra and geometry”, July 25-31, 2018, Yaroslavl.
- “CIME School Geometric Representation Theory and Gauge Theory”, June 25-29, 2018, Cetraro.
- “Lie Theory without Groups: Enumerative Geometry and Quantization of Symplectic Resolutions”, January 7-12, 2018, Jerusalem.
- “Interactions between Representation Theory and Algebraic Geometry”, August 21 - 25, 2017, Chicago.
- “Summer school on algebra and geometry”, July 25-31, 2017, Yaroslavl.
- “Current topics in the theory of algebraic Groups”, July 3-7, 2017, Dijon.
- “Geometric Representation Theory”, October 10-14, 2016, Kyoto.
- “Summer school on algebra and geometry”, July 25-31, 2016, Yaroslavl.
- “Summer school on algebra and geometry”, July 25-31, 2015, Yaroslavl.
- “The 25th Annual PCMI Summer Session, Geometry of moduli spaces and representation theory”, June 28-July 18, 2015, Utah.

TAing:

- Course administrator, MIT:
 - 18.02A..., winter 2024.
- Teaching assistant, MIT:
 - Lie Groups and Lie Algebras I, fall 2022.
 - Number Theory I, fall 2022.
 - Lie Groups and Lie Algebras II, spring 2021.
 - Theory of Numbers, spring 2021.
 - Lie Groups and Lie Algebras I, fall 2021.

- Algebraic Geometry I, fall 2021.
- Lie Groups and Lie Algebras II, spring 2021.
- Commutative Algebra, fall 2020.
- Teaching assistant, HSE:
 - Lie groups and Lie algebras, and their representations, fall 2017.
 - Algebra, fall 2017.
 - Discrete Mathematics, spring 2016.
 - Logic and Algorithms, fall 2014.
- Recitation leader, MIT:
 - Linear algebra, fall 2023.
 - Linear algebra, spring 2023.

Service: • Refereed for *Selecta*.

- Refereed for *Advances in Mathematics*.
- Refereed for *Forum of Mathematics, Sigma*.
- Refereed for *Transformation groups*.
- Refereed for *IMRN*.
- Edited notes of the class on “Noncommutative algebra”:
<https://ocw.mit.edu/courses/18-706-noncommutative-algebra-spring-2023/> given by Roman Bezrukavnikov, spring 2023.
- Mentor of the UROP project at MIT (under the guidance of Roman Bezrukavnikov) “Orbit of the Real Components in the Springer Representation”, spring 2021.
- Mentor of the UROP reading course at MIT on algebraic geometry based on the “Red book on varieties and schemes” by D. Mumford, summer 2021.
- Mentor of the UROP reading course at MIT on moduli spaces, fall 2021.
- Mentor of the UROP project at MIT (under the guidance of Roman Bezrukavnikov) on Hochschild homology and Chern characters via Cech complexes, spring 2022.
- Mentor of the SPUR project at MIT (under the guidance of Roman Bezrukavnikov) on decomposition of Frobenius pushforwards of line bundles on wonderful compactifications, summer 2022.
- Mentor of the “Yulia’s dream” project: online reading course at MIT on combinatorics based on the book “Concrete Mathematics” by Ronald L. Graham, Donald E. Knuth and Oren Patashnik, summer 2022.
- Mentor of the UROP project at MIT (under the guidance of Roman Bezrukavnikov) on “Cocycles in Hochschild Homology of Toric Varieties”, fall 2022.
- Mentor of the UROP+ project at MIT (under the guidance of Roman Bezrukavnikov) on affine Kazhdan-Lusztig polynomials, representations of affine Lie algebras and subregular Springer fiber in type C , summer 2023.
- Mentor of the UROP project at MIT (under the guidance of Roman Bezrukavnikov) on affine Kazhdan-Lusztig polynomials, representations of affine Lie algebras and subregular Springer fibers in non-simply-laced types, fall 2023.
- Suggested an idea (jointly with Dmytro Matvieievskiy) for the “Yulia’s dream” project on Combinatorial Hikita Conjecture for parabolic type A Slodowy slices, 2022-2023.
- Mentor of the DRP reading course at MIT based on the book “Introduction to representation theory” by Pavel Etingof and coauthors. winter 2023?
- Suggested problem for PRIMES 2024 (jointly with Kenta Suzuki) resulted in paper?
- Curator at the “Mathematical Physics School” (Dubna, spring 2019). My topic was on “Gieseker, Slodowy varieties and slices in affine Grassmannian, isomorphisms in type A ”.
- Co-organizer of the minicourse “Quantum cohomologies of flag varieties and their cotangent spaces”, Moscow, winter 2020.

- Co-organizer of the (online) learning seminar “ W -algebras and related topics”, Moscow, 2020-2021.
- Co-organizer of the (online) learning seminar “Gaudin model and related topics”, Moscow, 2021-2022.

Other: Nominantion: 2022 Outstanding UROP Mentor awards.

Personal information: Born in Moscow, Russia, October 17, 1995. Israel and Russian citizenship. Married.