

CURRICULUM VITAE

Vasily Krylov

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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-present Ph.D. program “Mathematics” Massachusetts Institute of Technology.

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

Preprints: • R. Bezrukavnikov, I. Karpov, V. Krylov, “On a geometric realization of J -ring”, 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, L. Rybnikov “Bethe subalgebras in antidominantly shifted Yangians”, arXiv:2205.04700 (submitted to IMRN).
• V. Krylov, P. Shlykov “Hikita-Nakajima conjecture for the Gieseker variety”, arXiv:2202.09934 (submitted to Selecta).

Publications: • R. Bezrukavnikov, V. Kac, V. Krylov “Subregular nilpotent orbits and explicit character formulas for modules over affine Lie algebras”, arXiv:2209.08865 (accepted to 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 vol. 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 (2020), no. 2, 683-729.
• V. Krylov “Integrable crystals and restriction to Levi via generalized slices in the affine Grassmannian”, Funct. Anal. Its Appl. (2018) 52: 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: • “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: • “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:**
- “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.
 - “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:

- 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 Advances in Mathematics.
- Refereed for Forum of Mathematics, Sigma.
- Referring for Transformation groups.
- Referring 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.
- 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.