Mikhail Kornev

Curriculum Vitae

Steklov Mathematical Institute of RAS
HSE University

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Nationality: Russian

Research interests

Geometry and topology; multivalued algebraic and formal groups; complex, symplectic cobordism and Hirzebruch genera; discriminants and projective duality; geometry and topology of manifolds; higher homotopy theory and ∞-categories.

Appointments

Mar. 2026–present	Researcher, HSE University International Laboratory for Mirror Symmetry and Automorphic Forms
Sep. 2022–present	Researcher, Steklov Mathematical Institute of RAS Department of Geometry and Topology
Sep. 2021–2025	Researcher, HSE University Laboratory of Algebraic Topology and Applications

Education

2022–2026	PhD in Mathematics, Steklov Mathematical Institute of RAS Thesis successfully defended on 17 September 2026 Thesis: *n-Valued Monoids and Groups: Algebraic Theory and Topological Applications* Supervisor: Victor M. Buchstaber
Sep. 2016–May 2022	Specialist degree in Mathematics, with honors Lomonosov Moscow State University; equivalent to a master's degree

Research grants

2026–present	Research Team Member, Russian Science Foundation Grant No. 26-11-00052 "Topology of Group Actions and Mapping Class Groups" Principal Investigator: Alexander A. Gaifullin Steklov Mathematical Institute, Russian Academy of Sciences
2023–2025	Research Team Member, Russian Science Foundation Grant No. 23-11-00143 "Problems of Group Actions in Topology, Geometry and Combinatorics" Principal Investigator: Victor M. Buchstaber Steklov Mathematical Institute, Russian Academy of Sciences
2022	Research Team Member, Russian Science Foundation Grant No. 22-71-00106 "Polyhedral Products in Topology, Geometry and Combinatorics" Principal Investigator: Ivan Yu. Limonchenko HSE University
2022–2026	Support from the Steklov International Mathematical Center Steklov Mathematical Institute, Russian Academy of Sciences

Research profile

In my PhD thesis, I described universal objects in the classes of symmetric n-algebraic n-valued groups for $n = 2, 3$, giving a new algebraic proof of the classification for $n = 2$. In this case the universal family is defined by the Buchstaber polynomial. Buchstaber, Gaiur and Rubtsov related it to their generalized Kontsevich polynomial, extending a construction from the geometric Langlands programme. I also obtained explicit polynomial addition laws for elliptic coset groups of multiplicities 2, 3, 4, 6, together with their degenerations to singular cubics. I represented the Buchstaber–Rees polynomials as determinants of generalized Wendt matrices, which specialize to the classical Wendt matrices used in the study of Fermat's Last Theorem. I described the polynomials for iterated addition using Kronecker sums of companion matrices, proving irreducibility and divisibility properties of their coefficients [BK26b].

I extended the cyclic n-valued groups $\mathbb{G}_n(\mathbb{C})$ to algebraic monoids on $\mathbb{CP}^1$. Within this family, I proved that projective duality followed by coordinatewise reciprocation transforms the addition curve for multiplicity n into the corresponding curve for multiplicity $n-1$, and extended this relation to hypersurfaces describing iterated addition [BK26c]. I obtained explicit equations for the duals of Fermat hypersurfaces. This duality also gives a geometric explanation of discriminant formulas for the addition polynomials, which Gaiur, Rubtsov and van Straten identified as equations for the singular loci of hypersurface families whose periods represent higher Bessel multiplication kernels [BK25].

I also obtained a complete classification of n-valued monoids and groups on three-element sets for arbitrary multiplicity n, completing a longstanding classification problem studied since 1996 [Kor26d], and derived exact and asymptotic growth formulas for families of coset dynamics using generalized Fibonacci recurrences [Kor24].

I introduced the Buchstaber genus and constructed its associated one-dimensional commutative formal group law F_{Bc}, whose formal inverse is $[-1]_{F_{\mathrm{Bc}}}(u) = -u$ and whose modulus square belongs to Buchstaber's two-valued family [Kor26c]. I proved that F_{Bc} is universal within this class over commutative $\mathbb{Z}[1/2]$-algebras. I computed the genus on complex projective spaces and theta divisors and established its relations to the Ochanine, Krichever and Witten genera. I constructed a complex-oriented multiplicative cohomology theory realizing the genus and identified its localization at the discriminant with a Landweber-exact elliptic cohomology theory. I also determined the minimal Hurwitz coefficient rings of the Buchstaber exponential and the Weierstrass sigma-function [Kor26b].

In my thesis, I also expressed rational complex cobordism classes of Fermat hypersurfaces through products of theta-divisor classes, with coefficients given by weighted, signed face counts of associahedra. This generalizes the projective-space formula of Buchstaber and Veselov and connects with the Milnor–Hirzebruch problem of realizing cobordism classes by smooth irreducible algebraic varieties.

In joint work with Victor M. Buchstaber, I solved the longstanding problem of determining the exact denominators of the coefficients of the universal two-valued logarithm in complex cobordism [BK26a], complementing Buchstaber's 1970s result for the corresponding exponential. We obtained

$$B(x) = x + \sum_{n\geq 1} \frac{C_n}{d_n} x^{n+1}, \qquad d_n = \frac{n+1}{2}\,\mathrm{lcm}(1,\ldots,2n+2).$$

We proved that the numerator classes C_n are primitive and indecomposable, expressed them as integral combinations of quotient Stong-manifold classes, and determined the exact denominator $2d_n$ of the rational lift of each coefficient C_n/d_n to quaternionic cobordism modulo torsion. We also proved that the oriented extension of the Buchstaber genus is integral on closed smooth spin manifolds of real dimension below 24 and on closed smooth string manifolds of real dimension at most 24.

Jointly with Buchstaber and Vladimir Rubtsov [BKR26], I established equivalent formulations of the associativity condition for the universal symmetric 2-algebraic two-valued law in terms of the Chazy III equation, the Gauss–Manin equations characterizing the Ramanujan vector field, associativity of the corresponding three-dimensional Dubrovin–Frobenius structures, and the quantum Yang–Baxter equation for their Casimir operators. We constructed an explicit four-parameter family of 9×9 matrices $R(a, b, c, d)$ satisfying the quantum Yang–Baxter equation if and only if $a^2 - d - bc = 0$.

I obtained an n-valued analogue of Abel's theorem [Kor26a]: every associative algebraic n-valued monoid on $\mathbb{P}^1$ over a characteristic-zero field with a strong two-sided unit is commutative, as is every one-dimensional formal n-valued group over a reduced commutative $\mathbb{Q}$-algebra. Over commutative $\mathbb{Q}$-algebras that are integral domains, I proved Kholodov's classification conjecture: every such formal group is strongly isomorphic over its coefficient ring to the (n/m)-fold diagonal of the cyclic elementary m-valued law $\mathbb{G}_m$, for a unique divisor $m \mid n$.

My survey [Kor23] on homology spheres presents results on the realization of fundamental groups of homology spheres and their connections with superperfect groups, acyclic groups, universal central extensions and the Kan–Thurston construction.

My broader interests include higher homotopy theory and ∞-categories. Together with Grisha Taroyan, I co-organized the study seminar on abstract homotopy theory and its applications. I have given mini-courses on ∞-cosmoi, the ∞-category of motivic coarse spaces, and other different topics in higher homotopy theory.

Publications

Journal publications

[BK26b] V. M. Buchstaber and M. I. Kornev. "Algebraic n-valued groups, cubics and Wendt matrices". *Sbornik: Mathematics* 217.8 (2026), pp. 1101–1153. DOI: 10.4213/sm10344e. Based on preprints: arXiv:2505.04296 and arXiv:2510.14010.

[Kor26c] M. I. Kornev. "Buchstaber, Ochanine, Krichever, and Witten genera". *Journal of Geometry and Physics* 226, 105855 (2026). DOI: 10.1016/j.geomphys.2026.105855. arXiv:2603.21118.

[BK26c] V. M. Buchstaber and M. I. Kornev. "n-Valued Monoids on $\mathbb{C}P^1$ and Discriminants". *Russian Mathematical Surveys* 81.1 (2026), pp. 191–193. DOI: 10.4213/rm10280e. arXiv:2510.14010.

[Kor26d] M. I. Kornev. "On the Classification of n-Valued Monoids and Groups of Order 3". *Matematicheskie Zametki* 119.2 (2026), pp. 244–252. DOI: 10.4213/mzm14803. arXiv:2508.04454.

[Kor24] M. I. Kornev. "n-Valued Coset Groups and Dynamics". *Mathematical Notes* 116.1 (2024), pp. 66–76. DOI: 10.4213/mzm14243. arXiv:2401.12718.

[Kor23] M. I. Kornev. "Homology Spheres". *Transactions of the Moscow Mathematical Society* 84 (2023), pp. 197–239. DOI: 10.1090/mosc/352.

Preprints

[Kor26a] M. I. Kornev. "n-Valued Analogue of Abel's Theorem". 2026. arXiv:2610.14044.

[BK26a] V. M. Buchstaber and M. I. Kornev. "Logarithm of the Universal Two-Valued Formal Group". 2026. arXiv:2609.15878.

[Kor26b] M. I. Kornev. "Buchstaber, Ochanine, Krichever, and Witten genera". Version 2. 2026. arXiv:2603.21118v2.

[BKR26] V. M. Buchstaber, M. I. Kornev, and V. N. Rubtsov. "Two-Valued Groups, Chazy Equation, Dubrovin–Frobenius Structures, and QYBE". 2026. arXiv:2604.26641.

[BK25] V. M. Buchstaber and M. I. Kornev. "Algebraic n-Valued Monoids on $\mathbb{C}P^1$, Discriminants and Projective Duality". 2025. arXiv:2510.14010.

Mathematics and music

[Kor25] M. I. Kornev. "The Technique of Musical Icosahedra". *Music Academy* 3 (2025), pp. 64–83. DOI: 10.34690/479.

Conference talks

Oct. 2026 — *Logarithm of the Universal Two-Valued Formal Group*
International Conference "Algebraic Topology and Group Actions," Steklov Mathematical Institute of RAS, Moscow, Russia

Oct. 2026 — *Two-Valued Groups, Chazy Equation, Dubrovin–Frobenius Structures, and QYBE*
International Conference "Integrable Systems and Quantum Theory," dedicated to the 80th anniversary of A. K. Pogrebkov, Saint Petersburg State University, Saint Petersburg, Russia

Aug. 2026 — *Buchstaber Genus, Formal Groups, and Cohomology Theories*
6th Conference of Mathematical Centers of Russia, Kazan, Russia

May 2026 — *Buchstaber Genus and Formal Groups*
Conference "Algebraic Topology, Group Actions, and Combinatorics," Sirius, Sochi, Russia

Aug. 2025 — *n-Valued Groups, Kronecker Sums, and Wendt Matrices*
Joint work with Victor M. Buchstaber.
5th Conference of Mathematical Centers of Russia, Krasnoyarsk, Russia

May 2024 — *Homology Spheres, Acyclic Groups and Kan–Thurston Theorem*
Conference "From Analysis to Homotopy Theory," University of Greifswald, Greifswald, Germany

Mar. 2023 — *Dynamics and multivalued groups*
Conference "SIMC Youth Race," Steklov Mathematical Institute of RAS, Moscow, Russia

Oct. 2022 — *Inconcreteness of homotopy categories*
International School "Toric topology, combinatorics and data analysis," Euler International Mathematical Institute, Saint Petersburg, Russia

Apr. 2022 — *Acyclic groups and spaces*
29th International Scientific Conference for Undergraduate and Graduate Students and Young Scientists "Lomonosov," Lomonosov Moscow State University, Moscow, Russia

Nov. 2021 — *Acyclic groups and Kan–Thurston theorem*
International School "Toric Topology and Combinatorics," Sirius Mathematics Center, Sochi, Russia

Seminar talks

Sep. 2026 — *Buchstaber, Witten, Krichever, and Ochanine Genera* (two talks)
Seminar "Automorphic Forms and Their Applications," Faculty of Mathematics, HSE University, Moscow, Russia

May 2026 — *Buchstaber genus and formal groups*
Seminar "Toric Topology, Combinatorics, and Homotopy Theory," jointly with the Laboratory of Topology and Complex Networks, Faculty of Mathematics, HSE University; Moscow Center for Continuous Mathematical Education (MCCME), Moscow, Russia

Dec. 2025 — *Fermat hypersurfaces, projective duality, and algebraic n-valued monoids*
Department of Geometry and Topology seminar "Geometry, Topology and Mathematical Physics" (Novikov Seminar), Steklov Mathematical Institute of RAS, Moscow, Russia

Dec. 2025 — *Discrete and Algebraic n-Valued Groups*
Seminar on Discrete Geometry and Geometry of Numbers, Moscow State University, Moscow, Russia

Nov. 2025 — *n-Valued Algebraic Monoids, Cubics, and Discriminants*
Seminar of the International Laboratory of Algebraic Topology and Its Applications, HSE University, Moscow, Russia

May 2025 — *n-Valued Groups, Kronecker Sums, and Wendt Matrices*
Joint work with Victor M. Buchstaber.
Department of Geometry and Topology seminar "Geometry, Topology and Mathematical Physics" (Novikov Seminar), Steklov Mathematical Institute of RAS, Moscow, Russia

Apr. 2023 — *Acyclic groups and Kan–Thurston theorem*
Geometric Group Theory Seminar, organized by I. G. Lysenok and A. L. Talambutsa, Steklov Mathematical Institute of RAS, Moscow, Russia

Dec. 2022 — *Fundamental groups of homology spheres*
Seminar "Geometry, Topology and their Applications," Sobolev Institute of Mathematics; online

Teaching

May 2022–2024 — **Mathematics tutor**, Profi platform
Courses including algebraic geometry, algebraic topology, abstract algebra, differential geometry, linear algebra, probability theory, discrete mathematics and calculus
profi.ru/profile/KornevMI3/

Sep. 2016–2022 — **Little Mech-Math courses**, Lomonosov Moscow State University
Olympiad mathematics classes

Service

Jun. 2021–2024 — **Co-organizer**, "Homotopy Theory and Applications" study seminar
Independent University of Moscow.
researchseminars.org/seminar/HomotopyTheoryAndApps

Study seminar talks and mini-courses

Texas Tech Quantum Homotopy Seminar

Dec. 2024 — *An Introduction to Cartan Geometries*

Mar. 2024 — *Euler–Lagrange dynamics via the ∞-jet bundle* (two talks)

Homotopy Theory and Applications, Independent University of Moscow

Dec. 2023 — *Principal ∞-bundles*

Apr.–May 2023 — *The ∞-category of motivic coarse spaces* (four-talk mini-course)

Apr. 2023 — *Elements of unstable motivic homotopy theory*

Feb.–Apr. 2023 — *∞-cosmoi* (four-talk mini-course)

Dec. 2022 — *Applications of Reedy theory*

Nov. 2022 — *Weighted (co)limits, Gambino's theorem, Reedy model structures*

Nov. 2022 — *Homotopically final functors and examples of calculations with homotopy (co)limits*

Nov. 2022 — *Nerve–realization adjunction and bar construction*

Apr. 2022 — *Sheaves of sets* (four-talk series)

Apr. 2022 — *Kan extensions. Additional topics*

Oct. 2021 — *The categorical meaning of the Kan–Thurston theorem*

Jul.–Aug. 2021 — *Quillen's theorem, a closed model structure on sSet*

Study and Scientific Seminar "Geometry and Topology," Moscow State University

Sep. 2020 — *Andreev's theorem on hyperbolic polyhedra*

Nov. 2019 — *The intersection form of 4-manifolds*

May 2019 — *Nilmanifolds and Massey product in bigraded cohomology rings*

Conferences, workshops and schools

Oct. 2026	International Conference "Algebraic Topology and Group Actions" Steklov Mathematical Institute of RAS, Moscow, Russia
Oct. 2026	International Conference "Integrable Systems and Quantum Theory," dedicated to the 80th anniversary of A. K. Pogrebkov Saint Petersburg State University, Saint Petersburg, Russia
Sep. 2026	Conference "Modern Algebraic Geometry," dedicated to the 60th anniversary of Dmitri Orlov Steklov Mathematical Institute of RAS, Moscow, Russia
Aug. 2026	6th Conference of Mathematical Centers of Russia Kazan Federal University, Kazan, Russia
Jul.–Aug. 2026	International Summer Mathematical School and Conference "Algebra and Geometry" HSE University, Steklov Mathematical Institute of RAS, Suzdal, Russia
Jul. 2026	Summer School "Categorical Constructions in Geometry" Centre of Pure Mathematics, Moscow Institute of Physics and Technology, Dolgoprudny, Russia
May 2026	School "Toric Topology, Hyperbolic Geometry, and Combinatorial Group Theory" Sirius Mathematics Center, Sochi, Russia
May 2026	Conference "Algebraic Topology, Group Actions, and Combinatorics" Sirius Mathematics Center, Sochi, Russia
Aug. 2025	5th Conference of Mathematical Centers of Russia Siberian Federal University, Krasnoyarsk, Russia
Jun.–Jul. 2025	Summer School "Fundamental Aspects of Geometry and Topology" Centre of Fundamental Mathematics, Moscow Institute of Physics and Technology, Dolgoprudny, Russia
Jul. 2024	Summer School "Classical, Derived, and Condensed Geometry" Centre of Fundamental Mathematics, Moscow Institute of Physics and Technology, Dolgoprudny, Russia; participation continued online
May 2024	Conference "From Analysis to Homotopy Theory" University of Greifswald, Greifswald, Germany
Jul. 2023	Summer School "Algebra and Geometry" HSE University, Steklov Mathematical Institute of RAS, Suzdal, Russia
Jul. 2023	Summer School on non-commutative and derived geometry of matrix factorisations Centre of Pure Mathematics, Moscow Institute of Physics and Technology, Dolgoprudny, Russia
Jun.–Jul. 2023	Second Summer School "Algebra and Number Theory" HSE University, Voronovo, Russia
Jun. 2023	Conference on algebra, algebraic geometry, and number theory on the occasion of the 100th birthday of academician Igor Rostislavovich Shafarevich Steklov Mathematical Institute of RAS, Moscow, Russia
Apr. 2023	Conference "Geometry, topology and mathematical physics," on the occasion of the 85th anniversary of S. P. Novikov and the 80th anniversary of V. M. Buchstaber Steklov Mathematical Institute of RAS, Moscow, Russia
Mar. 2023	Conference "SIMC Youth Race" Steklov Mathematical Institute of RAS, Moscow, Russia
Oct. 2022	International School "Toric topology, combinatorics and data analysis" Euler International Mathematical Institute, Saint Petersburg, Russia
Jul. 2022	Summer School "Algebra and Geometry" HSE University, Steklov Mathematical Institute of RAS, Suzdal, Russia

Apr. 2022	29th International Scientific Conference for Undergraduate and Graduate Students and Young Scientists “Lomonosov” Lomonosov Moscow State University, Moscow, Russia
Nov. 2021	International School “Toric Topology and Combinatorics” HSE University, Sirius Mathematics Center, Sochi, Russia
Nov. 2020	Topology and Geometry of Group Actions HSE University; online
Jul. 2020	7th Summer School-Conference on Geometric Methods of Mathematical Physics Online
Sep. 2019	Geometry, Topology and Mathematical Physics Landau Institute for Theoretical Physics, Lomonosov Moscow State University, Chernogolovka, Russia
Nov. 2018	Geometry, Topology and Mathematical Physics Landau Institute for Theoretical Physics, Lomonosov Moscow State University, Chernogolovka, Russia
Jul. 2018	Summer School “Modern Mathematics” HSE University, Lomonosov Moscow State University, Independent University of Moscow, Dubna, Russia
Jul. 2017	Summer School “Modern Mathematics” HSE University, Lomonosov Moscow State University, Independent University of Moscow, Dubna, Russia

Mathematics Olympiad Awards

2019	Winner, Partial Differential Equations Olympiad Lomonosov Moscow State University
2018	Winner, Ordinary Differential Equations Olympiad Lomonosov Moscow State University

Languages

Russian (native); English (fluent); French (intermediate); Latin (basic).

Reference

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