Khaydar Nurligareev

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Positions held

Sorbonne University (Paris-6) **2024-present**
Laboratory of Informatics (LIP6).
Postdoc.

University of Burgundy **2023-2024**
Laboratory of Informatics (LIB).
Postdoc.

University Sorbonne Paris Nord (Paris-13) **2022-2023**
Laboratory of Informatics (LIPN).
Research and teaching assistant (ATER).

Education

University Sorbonne Paris Nord (Paris-13) **2018-2022**
Laboratory of Informatics (LIPN).
PhD in Computer Science.
Thesis: *Irreducibility of combinatorial objects: asymptotic probability and interpretation.*
Advisors: Thierry Monteil and Lionel Pournin.

Higher School of Economics (HSE) **2016-2018**
Faculty of Mathematics.
Master's degree: Mathematician.
Cumulative GPA: 9,58 of 10.
Thesis: *Non-local Correlation Functions in the Model of Spanning Trees near the Boundary.*
Advisor: Alexander Povolotsky.

Moscow State University (MSU) **2008-2011**
Faculty of Educational Studies.
Master's degree: Teacher of Higher School.
Cumulative GPA: 3,81 of 4,00 (Average Russian grades are 4,75 of 5).
Thesis: *Newton Polygon and its Application to Solving Algebraic Problems.*
Advisor: Valery Vavilov.

Moscow State University (MSU) **2003-2008**
Faculty of Mechanics and Mathematics. Chair of Higher Algebra.
Specialist's degree: Mathematician.
Cumulative GPA: 3,84 of 4,00 (Average Russian grades are 4,85 of 5).
Thesis: *On Invariant Algebras of Compact Homogeneous Spaces.*
Advisor: Ivan Arzhantsev.

Internships

1. Joint Institute for Nuclear Research, Bogoliubov Laboratory of Theoretical Physics — Dubna, Russia, 29 May – 7 June 2018.
   Topic: *Watermelon correlation functions near the boundary in the Spanning Trees Model.*
   Advisor: Alexander Povolotsky.

Papers

Mathematical papers

1. *Asymptotics of self-overlapping permutations* (with Sergey Kirgizov) — Discrete Math., vol. 348, Issue 5,

May 2025, 114400 (2025).

2. *Endhered patterns in matchings and RNA* (with Célia Biane, Greg Hampikian and Sergey Kirgizov) — J. Comput. Biol., vol. 32, N1, P. 28-46 (2025).
3. *Watermelons on the half-plane* (with Alexander Povolotsky) — J. Stat. Mech., 013101 (2023).
4. *Decompositions of functions defined on finite sets in* $\mathbb{R}^d$ (with Ivan Reshetnikov) — JKTR, vol. 31, N2, 2250011 (2022).
5. *Asymptotics for connected graphs and irreducible tournaments* (with Thierry Monteil) — Research Perspectives CRM Barcelona, Extended Abstracts EuroComb 2021, 2021, vol. 14, P. 823-828.

Preprints

1. *Asymptotic probability of irreducibles II: sequence* (with Thierry Monteil) — arXiv, 2511.23296, 2025.
2. *Asymptotic probability for connectedness* (with Thierry Monteil) — arXiv, 2401.00818, 2024.
3. *Asymptotics for strongly connected directed structures: strong digraphs and contradictory 2-SAT formulae* (with Sergey Dovgal) — arXiv, 2310.05282, 2023.

Didactic papers

1. *About Multifoliate Regular Parquets on the Plane* (rus) — Yaroslavl Pedagogical Bulletin, 2013, N3, T.3 (Natural sciences), P. 75-79.
2. *Selected Chapters of Discrete Geometry in the Optional Mathematical lessons in Specialized Schools* (rus) — Bulletin of Kostroma State University (KSU), 2012, T18, N3, P. 134-137.
3. *Multiple Regular Tilings* (rus) — Mathematical Education, 2012, N1 (61), P. 23-29.
4. *Semiregular Polygons on Regular Parquets* (rus) — Yaroslavl Pedagogical Bulletin, 2011, N3, T.3 (Natural sciences), P. 15-18.
5. *Equiangular Polygons on Regular Tilings* (rus) — Mathematical Education, 2011, N2 (58), P. 39-63.
6. *Selected Chapters of Discrete Geometry in the Course of Mathematics of Specialized Schools* (rus) — Yaroslavl Pedagogical Bulletin, 2010, N4, T.3 (Natural sciences), P. 12-17.

Popular papers

1. Popular journal articles.
   a. *Aperiodic tile* (rus) — Kvant, 2025, N4, P. 2-8.
   b. *Aperiodic tile* (rus) — Kvantik, 2024, N11, P. 2-7.
   c. *Robinson tiling* (rus) — Kvantik, 2020, N10, P. 18-23.
   d. *Tiles and Heesch numbers* (rus) — Kvantik, 2019, N10, P. 11-15.
   e. *Gauss Debut* (rus) — Potential, 2010, N6, P. 23-29.
   f. *Mathematics Teacher Étienne Bézout* (rus) — Potential, 2009, N3, P. 15-19.

2. Articles for the WebSite elementy.ru (mathematical problems, pictures and news; rus).

2023.04: "Einstein problem" solved	2023.04: Socolar-Taylor tiling (with Mikhail Gruntov)
2021.08: Heesch's record polygon	2019.08: Sierpinsky Carpet
2019.08: Different dimensions	2018.11: Colored cubes
2018.10: Self-similar tilings	2018.09: Robinson tilings
2018.04: Rigid tilings	2017.08: Strips of domino tiles
2016.04: Figure surrounding (Heesch problem)	2015.10: How many marbles?
2015.04: Tilings with polyominoes	2014.06: A monkey and coconuts
2012.12: Platonic solids and honeycombs	2012.11: Letters problem
2012.02: Circles on the squared paper	2011.12: Cuttings and setting-ups
2011.09: Regular polygons	2011.03: Tilings

3. Articles for Modern Illustrated Encyclopedia (Mathematics. Informatics): *Algebraic expression*, *Definite integral*, *Similar terms*, *Divergent series*, *Trihedral angle* (rus) — Mathematics. Informatics (Modern Illustrated Encyclopedia), Moscow, ROSMAN, 2007.

Participation in International Schools

1. Summer school in Algebraic, Asymptotic and Enumerative Combinatorics (SSAAEC), — Będlewo, Poland, August 2023.
   Talk topic: *Irreducibility of combinatorial objects: asymptotic probability and interpretation.*
2. Spring school in Mathematical Computer Science (EJCIM), — Limoges, France, June 2021 (online).
   Talk topic: *Asymptotic probability of connected labeled objects and virtual species.*
3. Spring school in Mathematical Computer Science (EJCIM), — LaBRI, University of Bordeaux, Talence, France, June 2020 (online).
   Talk topic: *Asymptotics for the probability of labeled objects to be connected.*
4. Spring school in Mathematical Computer Science (EJCIM), — CIRM, Marseille, France, March 2019.
   Talk topic: *Non-local correlation functions in the Spanning Tree Model near the boundary.*
5. Summer school "Transversal Aspects of Tilings", — Oléron, France, June 2016.

Invited Talks

Presentation of mathematical research results, conferences and workshops

1. Workshop JGA 2025, — IPGP, Paris, France, November 2025.
   Topic: *Growing binary trees.*
2. Workshop PAnDAG 2025, — LIP6, Sorbonne University, Paris, France, May 2025.
   Topic: *Growing binary trees.*
3. Workshop ALEA 2025, — CIRM, Marseille, France, March 2025.
   Topic: *Brick wall excursions.*
4. Workshop ALEA 2024, — CIRM, Marseille, France, March 2024.
   Topic: *Asymptotics of endhered patterns in perfect matchings.*
5. Workshop JGA 2023, — University Lyon 1, Villeurbanne, France, November 2023.
   Topic: *Asymptotics for graphically divergent series.*
6. Workshop ALEA 2023, — CIRM, Marseille, France, March 2023.
   Topic: *Asymptotics for graphically divergent series.*
7. Conference EUROCOMB 2021 — Barcelona, Spain, September 2021 (online).
   Topic: *Asymptotics for connected graphs and irreducible tournaments.*
8. Workshop CQIS 2021 — SMC, Sochi, Russia, July 2021.
   Topic: *Watermelon correlation functions near the boundary in the Spanning Trees Model.*
9. Workshop ALEA 2021, — CIRM, Marseille, France, March 2021 (online).
   Topic: *Asymptotics for the probability of labeled objects to be irreducible.*
10. Workshop ALEA Young, — Domaine de la Tour, Normandy, France, May 2019.
    Topic: *Tiling translation surfaces with Wang tiles.*

Presentation of mathematical research results, seminars and webinars

1. Seminar LIB, — LIB, University of Burgundy, Dijon, France, December 2026.
   Topic: *Growing binary trees.*
2. Seminar of the Probability, Ergodic Theory and Dynamical Systems team, — LRMS, University of Rouen Normandy, Saint-Étienne-du-Rouvray, France, December 2025.
   Topic : *Brick wall excursions.*
3. Seminar of the ADA team, — LMPA, ULCO, Calais, France, November 2025.
   Topic : *Asymptotic of consecutive patterns in permutations and matchings.*
4. Seminar of the Probability and Statistics team, — Institut Élie Cartan de Lorraine, University of Lorraine, Nancy, France, March 2025.
   Topic : *Combinatorial interpretation of coefficients in asymptotic expansions.*
5. Seminar SPACE Tours, — Institut Denis Poisson, Tours, France; December 2024.
   Topic : *Asymptotic of consecutive patterns in permutations and matchings.*

6. Applied Mathematics Webinar Al-Khwarizmi, — Tunis El Manar University, Imam Abdulrahman Bin Faisal University, and King Saud University, Tunis — Saudi Arabia, September 2024 (online).
   Topic : *Asymptotic of consecutive patterns in permutations and matchings.*
7. Seminar Algebra and Topology, — IRMA, University of Strasbourg, Strasbourg, France, April 2024.
   Topic : *Combinatorial interpretation of coefficients in asymptotic expansions.*
8. Seminar CTN, — ICJ, University Lyon 1, Villeurbanne, France, December 2023.
   Topic : *Combinatorial interpretation of coefficients in asymptotic expansions.*
9. Seminar CALIN, — LIPN, University Sorbonne Paris Nord, Villetaneuse, France, September 2023.
   Topic: *Asymptotics for graphically divergent series.*
10. Seminar LIB, — LIB, University of Burgundy, Dijon, France, February 2023.
    Topic: *Irreducibility of combinatorial objects: asymptotic probability and interpretation.*
11. Seminar Combinatorics IRIF, — IRIF, University Paris Cité, France, Paris, September 2022.
    Topic: *Asymptotic probability of irreducible labeled objects in terms of virtual species.*
12. Seminar SoS, — INRIA, LIGM and GMATH, France – Luxembourg, June 2021 (online).
    Topic: *Asymptotic probability of connected surfaces.*
13. Seminar Rauzy, — Aix-Marseille University, Marseille, France, February 2021.
    Topic: *Asymptotics for the probability of labeled objects to be irreducible.*
14. Seminar CALIN, — LIPN, University Sorbonne Paris Nord, Villetaneuse, France, October 2020.
    Topic: *Asymptotics for the probability of labeled objects to be irreducible.*
15. Seminar "Mathematical Physics", — HSE, Moscow, Russia, February 2020.
    Topic: *Watermelon correlation functions near the boundary in the Spanning Trees Model.*

Presentation of didactic research results

1. Conference "Kolmogorov Readings – XI", — Yaroslavl, Russia, May 2013.
   Topic: *Regular Plane Multi-Tilings.*
2. Conference "Teaching fractal geometry and informatics based on ideas of A.N. Kolmogorov at University and High School" — Kostroma, Russia, December 2012.
   Topic: *Regular Tilings and Polygons.*
3. Conference "Kolmogorov Readings – IX", — Yaroslavl, Russia, May 2011.
   Topic: *Semi-regular Polygons on Regular Tilings.*
4. Conference "Kolmogorov Readings – VII", — Yaroslavl, Russia, May 2009.
   Topic: *Discrete Geometry in Mathematical Courses of Kolmogorov School.*

Other talks

1. Seminar of Master's Programme 'Mathematics', — HSE, Moscow, Russia, February 2018.
   Topic: *Correlation functions in the Abelian Sandpile Model.*
2. Seminar "Modern Problems of Mathematical Logic", — HSE, Moscow, Russia, October 2017.
   Topic: *Wang Tiles and Domino Problem.*
3. Workshop "Representation Theory and Integrable Systems", — KdV Institute, Amsterdam, Netherlands, May 2017.
   Topic: *Abelian Sandpile Model.*
4. Seminar "Mathematical Physics", — HSE, Moscow, Russia, April 2017.
   Topic: *Abelian Sandpile Model.*
5. Seminar "Geometry and Dynamics", — HSE, Moscow, Russia, February 2017.
   Topic: *Self-similar Figures and Aperiodic Tilings.*
6. Seminar of Master's Programme 'Mathematics', — HSE, Moscow, Russia, September 2016.
   Topic: *Aperiodic Tilings.*
7. Seminar "Elementary Mathematics", — MSU, Moscow, Russia, February 2008.
   Topic: *The Newton Polygon.*
8. Seminar "Algebraic Groups and Invariant Theory", — MSU, Moscow, Russia, February 2006.
   Topic: *The Hook-Length Formula.*

Organization of events

1. Workshop JGA 2024 — LIB, University of Burgundy, Dijon, France, November 2024.
   Organizer.
2. Conference Permutation Patterns 2023, — LIB, University of Burgundy, Dijon, France, June 2023.
   Organizer.
3. Summer School "Math Department: Preface", — HSE, Moscow, Russia, 2021 (online).
   Chief organizer, handout book chief editor.
4. Summer School "Math Department: Preface", — HSE, Moscow, Russia, 2020 (online).
   Chief organizer, handout book chief editor.
5. Summer School "Contemporary Mathematics", — Dubna, Russia, 2019.
   Organizer.
6. Summer School of Moscow State Fifty seven School, — Sochi, Russia, 2015.
   Organizer.
7. Organization of mathematical and other competitions and works checking (Moscow, Russia).
   a. Moscow Mathematical Olympiad (2003–2018).
   b. Tournament of Towns, local organization in Moscow (2005–2018).
   c. Lomonosov Academic Tournament (2007–2017).
   d. Moscow Linguistic Olympiad (2014).

Teaching Experience

University Sorbonne Paris Nord (Paris-13) **2019-2023**

Teaching assistant at LIPN and LAGA. Key responsibilities: giving seminars (TD) and practice classes (TP).

1. System administration, Engineering school, Year 2, Spring 2023, 30 hours (TP).
2. System administration, Bachelor II (Informatics), Spring 2022, 30 hours (TP).
3. Functional programming, Bachelor II (Informatics), Spring 2022, 12 hours (TD) + 15 hours (TP).
4. Algorithmics for Linear Algebra, Bachelor I (Informatics), Spring 2023, 12 hours (TD) + 18 hours (TP).
5. Programming–2, Bachelor I (Informatics), Spring 2022, 18 hours (TD) + 18 hours (TP).
6. Programming–1, Bachelor I (Mathematics), Fall 2022, 18 hours (TD) + 18 hours (TP).
7. Linear algebra, Bachelor I (Mathematics), Spring 2021, 32 hours (TD).
8. Probability theory, Bachelor II (Economics), Fall 2020, 32 hours (TD).
9. Calculus–4, Bachelor II (Mathematics), Spring 2020, 24 hours (TD).
10. Calculus–1, Bachelor I (Mathematics), Fall 2019, 40 hours (TD).

Higher School of Economics (HSE) **2016-2017**

Teaching assistant at the Department of Mathematics. Key responsibilities:

1. Discussing Algebra with the First year Bachelor students.
2. Giving Algebra examinations for the First year Bachelor students.

Math Schools for Students **2007-2021**

Lecturer. Key responsibilities: giving lectures, discussing mathematical problems with students.

1. Summer School "Math Department: Preface" (Moscow, Russia) **2019**
   Lecture: *Little Fermat's Theorem.* 2019
2. Summer School "Contemporary Mathematics" (Dubna, Russia) **2007-2018**
   Course: *Periodic and Aperiodic Tilings.* 2018
   Course: *Polygons and Circles on Lattices and Aperiodic Tilings.* 2010
   Course: *Lobachevski Geometry, Fuchsian Groups, Teichmüller Space* (with Alexander Bufetov). 2007
3. Summer School of Russian Reporter, Random Workshop (Dubna, Russia) **2018**
   Course: *Introduction to Probability Theory.* 2018

4. School "Combinatorics and Algorithms" (Sudislavl, Russia) **2012-2016**
   Course: *Tilings and Tesselations.* 2014, 2016
   Course: *Introduction to Combinatorics* (with Boris Bychkov). 2013
   Course: *Learning the Basics.* 2012

Moscow State Fifty Seventh School **2004-2018**

Teacher of Mathematics at High School and Secondary School. Key responsibilities:

1. Managing of an educational process, making a curriculum.
2. Giving courses of Special Mathematics for gifted students of 15-18 years old (2007-2010, 2009-2012, 2011-2014, 2014-2017). Studied themes included Combinatorics, Number Theory, Set Theory, Calculus, Probability Theory, Linear Algebra etc.
3. Giving elective mathematical courses for students of 10-12, 13-15, 15-18 years old (including courses for gifted students). Studied themes included competition topics in Combinatorics, Number Theory, Graph Theory, Invariants etc.
4. Organizing mathematical competitions.
5. Managing of new students admission to the mathematical classes.
6. Organizing outdoor activities for students (such as journeys and trips).

Advanced Education and Science Center of Moscow State University **2009-2010**

Assistant at the Department of Mathematics. Key responsibilities:

1. Geometry lessons for gifted students of 15-18 years old.
2. Organizing mathematical competitions.
3. An intake of new students at the mathematical classes.

Prizes and Awards

1. Russian Countrywide Student Competition "I am a professional", *Silver medal.* **2018**
2. MSc academic scholarship at HSE, *Winner's Award.* **2017**
3. Full tuition coverage scholarship (by merit) at HSE. **2016-2018**
4. Full tuition coverage scholarship (by merit) at MSU. **2008-2011**
5. Partial Differential Equation Student Competition at MSU, *Winner's Award.* **2006**
6. Geometry and Topology Student Competition at MSU, *Honorable Mentions.* **2005**
7. Full tuition coverage scholarship (by merit) at MSU. **2003-2008**
8. MSU Math Competition, *Winner's Award equivalent to Admission to MSU without Exams.* **2003**
9. Moscow Mathematical Olympiad, *Third Degree Award.* **1998, 2000-2003**
10. Tournament of Towns, *Summer Conference Award.* **2002**
11. Tournament of Towns, *Winner's Award.* **1999, 2001**
12. Moscow Linguistic Olympiad, *Special Prize.* **2000**

Computer Skills

1. Packages: TeX, Maple, MATLAB, Wolfram Mathematica, CorelDraw, etc.
2. Coding experience: Sage, Python, C/C++, OCaml, Pascal, HTML.

Languages

1. Russian: native.
2. English, French: fluent.
3. German, Italian: basic.

Other Achievements and Social Activity

1. Organization of outdoor activities: experienced as a leader of Water, Bycicle and Mountain outdoor tours (2005–2019).
2. Organization of competitions in the word guessing game of "The Hat" (2011–2019).
3. Participation in the International Shakespeare Schools Festival (2009).
   Play: Mach Ado about Nothing by William Shakespeare.
   Stage Directors: Olga Vinogradova and Susan McLeash.
4. Music School, First Class Honours.
   a. Studying at the Brass department, class of the Trumpet (1995-2002).
   b. Playing the Piano, studying the Theory of Music (1995-2002).
   c. Participation in the Brass band (1999-2003).
5. Participation in the choir of the Palais Royal Academy (2022).
   a. Composition: Requiem by Wolfgang Amadeus Mozart.
   b. Conductor: Jean-Philippe Sarcos.