

Curriculum Vitae

Personal Information

- Citizen of Russia, born in Kaluga on 15th of May 1991. Married.
- E-mail: nikitapolyansky@gmail.com
- Languages: Russian (mother tongue), English (fluent)

Research Interests

Blockchain, coding theory, combinatorics, information theory, theoretical aspects of engineering

Education

Ph.D. in Mathematics Sept. 2013–Sept. 2016

Moscow State University

Department of Probability Theory

Thesis: “Cover-Free Codes” (in Russian) [[pdf](#)]

Advisor: [Prof. Arkady Dyachkov](#)

Defended on 30.09.2016

Awarded by the Russian Academy of Sciences on 09.02.2017

B.S. and M.S. in Mathematics (cum laude) Sept. 2008–June 2013

Moscow State University

Thesis: “Coding Theory Problems for Some Models of DNA Codes and Group Testing”

Advisor: [Prof. Arkady Dyachkov](#)

Academic Positions

Senior Researcher Nov. 2019–Sept. 2021

Technical University of Munich

Institute for Communications Engineering

Host: [Prof. Antonia Wachter-Zeh](#)

Research Scientist (partially on leave) Dec. 2018–June 2021

Skolkovo Institute of Science and Technology

Center for Computational and Data-Intensive Science and Engineering

Advisor: [Prof. Grigory Kabatiansky](#)

- Post-Doctoral Researcher** Oct. 2017–Dec. 2018
Technion–Israel Institute of Technology
Faculty of Mathematics
 Host: [Prof. Ron Aharoni](#)
- Research Fellow** (part-time) June 2015–May 2018
Institute for Information Transmission Problems
Russian Academy of Sciences
Dobrushin Mathematics Laboratory
 Head: [Prof. Mikhail Blank](#)

Industrial Experience

- Research Scientist** Oct. 2021–Present
IOTA Foundation
Research Department
 Team Leader: Dr. William Sanders
- Senior Engineer** Feb. 2015–Oct. 2017
Huawei Technologies Co. Ltd.
Channel Coding Team
 Team Leader: Dr. Alexey Maevskiy

Teaching Experience

- **Channel Coding**, Lecturer for master students (with Prof. Antonia Wachter-Zeh), 80-150 participants, Technical University of Munich. Winter Terms 2019/2020, 2020/2021, and Summer Terms 2020, 2021.
- **Probability Theory and Statistics**, Teaching Assistant for undergraduate students, ca. 20 participants, Moscow State University. Spring Semester 2015.
- **Point-Line Incidences**, Teaching Assistant for excellent secondary-school students, ca. 10 participants, 26th Summer Conference International Mathematical Tournament of Towns. August 2014.

Preprints

23. [Quadratic-curve-lifted Reed-Solomon codes](#) (with Hedongliang Liu, Lukas Holzbaur, Sven Puchinger, Antonia Wachter-Zeh)
22. [Codes for the Z-channel](#) (with Yihan Zhang)
21. [Coding with feedback over the Z-channel](#) (with Christian Deppe, Vladimir Lebedev, and Georg Maringer), under revision in *IEEE Transactions on Information Theory*, 2021.

20. **Systematic single-deletion multiple-substitution correcting codes** (with Wentu Song, Kui Cai, and Xuan He), under revision in *IEEE Transactions on Information Theory*, 2020.
19. **Two-stage coding over the Z-channel** (with Alexey Lebedev, and Vladimir Lebedev), under revision in *IEEE Transactions on Information Theory*, 2020.

Journal Papers

18. **On list-decoding certain \mathbb{F}_q -linear codes**, accepted to *Problems of Information Transmission*, 57(4): 1-18, 2021.
17. **Lifted Reed-Solomon codes and lifted multiplicity codes** (with Lukas Holzbaur, Rina Polyanskaya, Ilya Vorobyev, and Eitan Yaakobi), *IEEE Transactions on Information Theory*, 67(12): 8051-8069, 2021.
16. **Feedback insertion-deletion codes** (with Georg Maringer, Ilya Vorobyev, and Lorenz Welter), *Problems of Information Transmission*, 57(3): 212-240, 2021.
15. **Almost affinely disjoint subspaces** (with Hedongliang Liu, Ilya Vorobyev, and Antonia Wachter-Zeh), *Finite Fields and Their Applications*, 75: 1-11, 2021.
14. **Coding in a Z-channel in case of many errors** (with Vladimir Lebedev), *Problems of Information Transmission*, 57(2): 129-135, 2021.
13. **Binary batch codes with improved redundancy** (with Rina Polyanskaya, and Ilya Vorobyev), *IEEE Transactions on Information Theory*, 66(12): 7360-7370, 2020.
12. **Weight distributions for successive cancellation decoding of polar codes** (with Mars Davletshin, and Rina Polyanskaya), *IEEE Transactions on Communications*, 68(12): 7328-7336, 2020.
11. **Hypothesis test for bounds on the size of random defective set** (with Arkady Dyachkov, Vladislav Shchukin, and Ilya Vorobyev), *IEEE Transactions on Signal Processing*, 67(22): 5775 - 5784, 2019.
10. **Separable codes for the symmetric multiple-access channel** (with Arkady Dyachkov, Vladislav Shchukin, and Ilya Vorobyev), *IEEE Transactions on Information Theory*, 65(6): 3738-3750, 2019.
9. **On the metric dimension of the Cartesian powers of a graph** (with Zilin Jiang), *Journal on Combinatorial Theory, Series A*, 165: 1-14, 2019.
8. **On capacities of the two-user union channel** (with Zilin Jiang, and Ilya Vorobyev), *IEEE Transactions on Information Theory*, 65(5): 2774-2781, 2019.
7. **Symmetric disjunctive list-decoding codes** (with Arkady Dyachkov, Vladislav Shchukin, and Ilya Vorobyev), *Designs, Codes and Cryptography*, 82(1-2): 211-229, 2017.
6. **Almost cover-free codes and designs** (with Arkady Dyachkov, Vladislav Shchukin, and Ilya Vorobyev), *Designs, Codes and Cryptography*, 82(1-2): 231-247, 2017.

5. **Cover-free codes and separating system codes** (with Arkady Dyachkov, Vladislav Shchukin, and Ilya Vorobyev), *Designs, Codes and Cryptography*, 82(1-2): 197-209 2017.
4. **Almost cover-free codes**, *Problems of Information Transmission*, 52(2): 142-155, 2016.
3. **Almost disjunctive list-decoding codes** (with Arkady Dyachkov, Vladislav Shchukin, and Ilya Vorobyev), *Problems of Information Transmission*, 51(2): 110-131, 2015.
2. **DNA codes for non-additive stem similarity** (with Arkady Dyachkov, Anna Kuzina, Anthony Macula, and Vladimir Rykov), *Problems of Information Transmission*, 50(3): 247-269 2014.
1. **Bounds on the rate of disjunctive codes** (with Arkady Dyachkov, Vladislav Shchukin, and Ilya Vorobyev), *Problems of Information Transmission*, 50(1): 27-56, 2014.

Selected Conference Papers and Preprints

27. **On learning sparse vectors from mixture of responses**, Proc. 2021 *NeurIPS*
26. **On codes for the noisy substring channel** (with Yonatan Yehezkeally), Proc. 2021 *IEEE Int'l Symp. Inf. Theory (ISIT)*
25. **On multiple-deletion multiple-substitution correcting codes** (with Kui Cai, Xuan He, and Wentu Song), Proc. 2021 *IEEE Int'l Symp. Inf. Theory (ISIT)*
24. **Two-stage coding for the Z-channel**, Proc. 2021 *IEEE Int'l Symp. Inf. Theory (ISIT)*
23. **Optimal codes correcting localized deletions** (with Rawad Bitar, Serge Kas Hanna, and Ilya Vorobyev), to appear in Proc. 2021 *IEEE Int'l Symp. Inf. Theory (ISIT)*
22. **On lifted multiplicity codes** (with Lukas Holzbaur, Rina Polyanskaya, Ilya Vorobyev, and Eitan Yaakobi), Proc. 2020 *IEEE Inf. Theory Workshop (ITW)*.
21. **Decoding of lifted affine-invariant codes** (with Lukas Holzbaur), Proc. 2020 *IEEE Inf. Theory Workshop (ITW)*.
20. **Feedback insertion-deletion codes** (with Georg Maringer, Ilya Vorobyev, and Lorenz Welter), Proc. 2020 *IEEE Inf. Theory Workshop (ITW)*.
19. **Coding with feedback over the Z-channel** (with Christian Deppe, Vladimir Lebedev, and Georg Maringer), Proc. *26th Int'l Comput. Combin. Conf. (COCOON)*.
18. **Lifted Reed-Solomon codes with application to batch codes** (with Lukas Holzbaur, Rina Polyanskaya, and Ilya Vorobyev), Proc. 2020 *IEEE Int'l Symp. Inf. Theory (ISIT)*.
17. **Optimal Codes Correcting a Burst of Deletions of Variable Length** (with Andreas Lenz), Proc. 2020 *IEEE Int'l Symp. Inf. Theory (ISIT)*.
16. **Duplication with transposition distance to the root for q -ary sequences** (with Ilya Vorobyev), Proc. 2020 *IEEE Int'l Symp. Inf. Theory (ISIT)*.

15. **Binary batch codes via finite geometry** (with Ilya Vorobyev), Proc. 2019 *IEEE Int'l Symp. Inf. Theory (ISIT)*.
14. **Trivariate lifted codes with disjoint repair groups** (with Ilya Vorobyev), Proc. 2019 *IEEE REDUNDANCY*.
13. **Binary batch codes based on lifted multiplicity codes** (with Rina Polyanskaya), Proc. 2019 *IEEE REDUNDANCY*.
12. **How to guess an n -digit number** (with Zilin Jiang), Proc. 2019 *ACM-SIAM Symp. Discrete Alg. (SODA)*.
11. **A near-optimal algorithm for adaptive searching of two counterfeit coins** (with Zilin Jiang, and Ilya Vorobyev), Proc. 2019 *Workshop Coding Crypt. (WCC)*.
10. **Separable codes for the symmetric multiple-access channel** (with Arkady Dyachkov, Vladislav Shchukin, and Ilya Vorobyev), Proc. 2018 *IEEE Int'l Symp. Inf. Theory (ISIT)*.
9. **Generalization of Floor Lifting for QC-LDPC Codes: Theoretical Properties and Applications** (with Sergei Egorov, German Svistunov, Vasiliy Usatyuk, and Ilya Vorobyev), Proc. 2018 *IEEE East-West Design and Test Symp. (EWDTS)*.
8. **Hypothesis test for upper bound on the size of random defective set** (with Arkady Dyachkov, Vladislav Shchukin, and Ilya Vorobyev), Proc. 2017 *IEEE Int'l Symp. Inf. Theory (ISIT)*.
7. **On multistage learning a hidden hypergraph** (with Arkady Dyachkov, Vladislav Shchukin, and Ilya Vorobyev), Proc. 2016 *IEEE Int'l Symp. Inf. Theory (ISIT)*.
6. **On a hypergraph approach to group testing problems** (with Arkady Dyachkov, Vladislav Shchukin, and Ilya Vorobyev), Proc. 2016 *IEEE Int'l Symp. Inf. Theory (ISIT)*.
5. **Almost cover-free codes and designs** (with Arkady Dyachkov, Vladislav Shchukin, and Ilya Vorobyev), Proc. 2015 *IEEE Int'l Symp. Inf. Theory (ISIT)*.
4. **Cover-free codes and separating system codes**, (with Arkady Dyachkov, Vladislav Shchukin, and Ilya Vorobyev), Proc. 2015 *IEEE Int'l Symp. Inf. Theory (ISIT)*.
3. **Symmetric disjunctive list-decoding codes**, *Proc. IEEE Int'l Symp. Inf. Theory (ISIT)*, (with Arkady Dyachkov, Vladislav Shchukin, and Ilya Vorobyev), Proc. 2015 *IEEE Int'l Symp. Inf. Theory (ISIT)*.
2. **Bounds on the rate of superimposed codes** (with Arkady Dyachkov, Vladislav Shchukin, and Ilya Vorobyev), Proc. 2014 *IEEE Int'l Symp. Inf. Theory (ISIT)*.
1. **DNA codes for non-additive stem similarity** (with Arkady Dyachkov, and Julia Volkova), Proc. 2011 *IEEE Int'l Symp. Inf. Theory (ISIT)*.

Patents

6. Usatyuk, V., Polianskii, N., and Vorobyev, I., **Devices and Methods for Generating a Low-Density Parity-Check Code for an Incremental Redundancy HARQ Communication Apparatus**, U.S. Patent No. 10,944,425, 2021
5. Usatyuk, V., Vorobyev, I., Polianskii, N., and Svistunov, G., **Method and Apparatus for Encoding and Decoding of Variable Length Quasi-Cyclic Low-Density Parity-Check (QC-LDPC) Codes**, U.S. Patent No. 10,931,310, 2021
4. Wang, J., Zhang, G., Zhang, H., Xu, C., Huang, L., Dai, S., Luo, H., Qiao, Y., Li, R., Wang, J., Chen, Y., Polianskii, N., Kamenev, M., Shen, Z., Haungfu, Y., Du, Y., **Polar Code Encoding Method and Apparatus in Wireless Communication**, U.S. Patent No. 10,659,194, 2020
3. Usatyuk, V., Polianskii, N., Vorobyev, I., Gaev, V., Svistunov, G., Kamenev M., Kameneva, Y., **Generalized Low-Density Parity Check Codes (GLDPC)**, U.S. Patent Application No. 16/741,199, 2020
2. Usatyuk, V., and Polianskii, N., **Construction of QC-LDPC Codes for a Hybrid Automatic Repeat Request (HARQ) Scheme**, Int. Publ. No. WO 2018/030909, 2018
1. Muratchaev, S., Polianskii, N., and Trefilov, M., **Device and Method for Adjusting Transmission Size in Case of Decoding Failures**, Int. Publ. No. WO 2017/176147, 2017

Mentoring and Advising Experience

Doctoral students co-advised at Technical University of Munich

- Lucas Holzbaur (November 2019 - September 2021)
- Lorenz Welter (May 2020 - November 2020)
- Georg Maringer (January 2020 - September 2021)
- Andreas Lenz (November 2019 - April 2020)
- Hedongliang Liu (January 2019 - September 2021)

Master student advised at Technical University of Munich

- Gökberk Erdogan (April 2021 - Present)

Bachelor student mentored (remotely) at Bogazici University

- Arda Aydın (August 2020 - April 2021)

Awards, Honors and Grants

- Single-PI in two grants:
 1. **Coding for multi-user data storage systems**, Russian Science Foundation, project no. 19-71-00137. (2019–2021)
 2. **Codes and mathematical models with applications to group testing and compressed sensing problems**, Russian Foundation for Basic Research, project no. 18-31-00310. (2018–2019)
- Diploma with Honors from Moscow State University, 2013
- Increased Academic Scholarship (for research and study achievements), 2012-2013

Industry Collaboration

In 2017, my colleagues and I proposed the so-called **Polar sequence** for encoding polar codes, which was adopted by 3GPP for the Enhanced Mobile Broadband control channels for the 5G New Radio interface. Patent “**Polar code encoding method and apparatus in wireless communications**” (with Jun Wang, Gongzheng Zhang, Huazi Zhang, Chen Xu, Lingchen Huang, Shengchen Dai, Hejia Luo, Yunfei Qiao, Rong Li, Jian Wang, Ying Chen, Mikhail Kamenev, Zukang Shen, Yourui Huang Fu, and Yinggang Du).

Talks

(F - faculty candidate talk, P - poster, C - conference talk, S - seminar talk, I - invited talk)

43. (F) **Codes for load-balancing in data storage**, CS Department, University of Warwick, (virtual), Dec. 2021
42. (P) **On learning sparse vectors from mixture of responses**, *Conference on Neural Information Processing Systems*, Sydney, (virtual), Dec. 2021
41. (C) **On multiple-deletion multiple-substitution correcting codes**, *IEEE International Symposium on Information Theory*, Melbourne, (virtual), Jul. 2021
40. (C) **Two-stage coding over the Z-channel**, *IEEE International Symposium on Information Theory*, Melbourne, (virtual), Jul. 2021
39. (I) **How to guess an n -digit number**, *Moscow Conference on Combinatorics and Applications*, Moscow, Moscow Institute of Physics and Technology, (virtual), Jul. 2021
38. (C) **Decoding of lifted affine-invariant codes**, *IEEE Information Theory Workshop*, Italy (virtual), Apr. 2021
37. (S) **How to guess an n -digit number**, *Seminar on combinatorial search*, Alfred Renyi Institute of Mathematics, Budapest (virtual), Mar. 2021
36. (S) **Compression technique for constructing error-correcting codes**, *Coding theory seminar*, Skoltech, Moscow (virtual), Nov. 2020

35. (C) **Coding with feedback over the Z-channel**, *International Computing and Combinatorics Conference*, Atlanta (virtual), Sept. 2020
34. (C) **Adversarial Z-channel**, *Workshop on Coding, Cooperation, and Security in Modern Communication Networks*, Munich (virtual), July 2020
33. (C) **Duplication with transposition distance to the root for q -ary strings**, *IEEE International Symposium on Information Theory*, Los-Angeles (virtual), June 2020
32. (S) **On a generalization of Reed-Muller codes with strong locality properties**, *Coding theory seminar*, IITP RAS, Moscow, Oct. 2019
31. (C) **Batch codes based on lifted multiplicity codes**, *International Symposium "Problems of Redundancy in Information and Control Systems"*, Moscow, Oct. 2019
30. (P) **Duplication distance to the root for q -ary strings**, *Munich Workshop on Coding and Cryptography*, Technical University of Munich, Munich, July 2019
29. (C) **Constructions of batch codes via finite geometry**, *IEEE International Symposium on Information Theory*, Paris, July 2019
28. (I) **Constructions of batch codes via finite geometry**, *Coding theory seminar*, TUM, Munich, May 2019
27. (S) **Duplication distance to the root for a binary word**, *Coding theory seminar*, IITP RAS, Moscow, Oct. 2018
26. (C) **How to guess an n -digit number**, *ACM-SIAM Symposium on Discrete Algorithms*, San-Diego, Jan. 2019
25. (S) **How to guess an n -digit number**, *Combinatorics seminar*, Technion, Haifa, Oct. 2018
24. (S) **Coding for private information retrieval**, *Coding theory seminar*, IITP RAS, Moscow, Oct. 2018
23. (C) **Weight Distributions for Successive Cancellation Decoding of Polar Codes**, *International Workshop on Algebraic and Combinatorial Coding Theory*, Russia, Svetlogorsk, Sept. 2018
22. (C) **Separable codes on the symmetric multiple access channels**, *IEEE International Symposium on Information Theory*, Vail, June 2018
21. (C) **On the metric dimension of Cartesian powers of a graph**, *Workshop on Graphs, Networks and their Applications*, Moscow, May 2018
20. (S) **Capacity of the two-user union channel with feedback**, *Coding theory seminar*, IITP RAS, Moscow, Apr. 2018
19. (S) **On the metric dimension of Cartesian powers of a graph**, *Coding theory seminar*, Technion, Haifa, Jan. 2018
18. (S) **On the metric dimension of non-binary Hamming spaces**, *Coding theory seminar*, IITP RAS, Moscow, Dec. 2018

17. (C) **Signature codes on the symmetric multiple access channels**, *International Workshop on Coding and Cryptography*, Saint-Petersburg, Sept. 2017
16. (C) **Hypothesis test for upper bound on the size of random defective set**, *IEEE International Symposium on Information Theory*, Aachen, June 2017
15. (S) **Non-adaptive group testing based on LDPC codes**, *Coding theory seminar*, IITP RAS, Moscow, Mar. 2017
14. (S) **Coding theory at the Department of Probability Theory**, *Principle Seminar of the Department of Probability Theory*, MSU, Mar. 2017
13. (C) **On multistage learning a hidden hypergraph**, *IEEE International Symposium on Information Theory*, Barcelona, July 2016
12. (C) **Adaptive learning a hidden hypergraph**, *International Workshop on Algebraic and Combinatorial Coding Theory*, Bulgaria, Albena, June 2016
11. (S) **Adaptive learning a hidden hypergraph**, *Coding theory seminar*, IITP RAS, Moscow, Apr. 2016
10. (C) **Almost cover-free codes**, *IEEE International Symposium on Information Theory*, Hong Kong, June 2015
9. (C) **Almost cover-free codes and designs**, *International Workshop on Coding and Cryptography*, Paris, Apr. 2015
8. (S) **Almost cover-free codes**, *Coding theory seminar*, IITP RAS, Moscow, Mar. 2015
7. (S) **Separable codes**, *Coding theory seminar*, IITP RAS, Moscow, Feb. 2015
6. (C) **Almost disjunctive list-decoding codes**, *International Workshop on Algebraic and Combinatorial Coding Theory*, Russia, Svetlogorsk, Sept. 2014
5. (C) **Bounds on the rate of superimposed codes**, *IEEE International Symposium on Information Theory*, Honolulu, July 2014
4. (S) **Upper bounds on the rate of disjunctive codes**, *Coding theory seminar*, IITP RAS, Moscow, May 2013
3. (C) **Random coding bounds on the rate for non-adaptive threshold group testing**, *Workshop Search Methodologies III*, Bielefeld, Sept. 2012
2. (S) **Random coding bounds on the rate for non-adaptive threshold group testing**, *Coding theory seminar*, IITP RAS, Moscow, May 2012
1. (S) **On optimal DNA codes for non-additive stem distance**, *Coding theory seminar*, IITP RAS, Moscow, Mar 2011

Relevant Courses and Skills

Courses: coding theory, probability theory, linear algebra, information theory, discrete mathematics, analysis, graph theory, financial mathematics, statistics

Programming languages: C++, Matlab, Python

Other activities

- Referee for the following journals
 - IEEE Transactions on Information Theory ($\times 6$)
 - IEEE Transactions on Communications ($\times 2$)
 - Nature Communications ($\times 1$)
 - Journal of Statistical Planning and Inference ($\times 1$)
 - Discrete Mathematics ($\times 2$)
 - Entropy ($\times 2$)
 - Discrete Applied Mathematics ($\times 2$)
 - Designs, Codes and Cryptography ($\times 1$)
 - Problems of Information Transmission ($\times 9$)
- Referee for the following conferences
 - IEEE International Symposium on Information Theory 2015-2021 ($\times 15$)
 - IEEE Information Theory Workshop 2017-2021 ($\times 4$)
 - ACM-SIAM Symposium on Discrete Algorithms 2021 ($\times 1$)
 - International Symposium on Topics in Coding 2021 ($\times 1$)
 - International Workshop on Coding and Cryptography 2018 ($\times 1$)
 - International Symposium on Problems of Redundancy in Information and Control Systems 2019, 2021 ($\times 6$)
 - IMA International Conference on Cryptography and Coding 2021 ($\times 1$)

References

- [Antonia Wachter-Zeh](#), Associate Professor, Institute for Communications Engineering, Technical University of Munich. **Email:** antonia.wachter-zeh@tum.de
- [Eitan Yaakobi](#), Associate Professor, Department of Computer Science, Technion – Israel Institute of Technology. **Email:** yaakobi@cs.technion.ac.il
- [Grigory Kabatianskiy](#), Professor, Adviser to the President for Science, Skolkovo Institute of Science and Technology. **Email:** g.kabatyansky@skoltech.ru
- [Cai Kui](#), Associate Professor, Faculty of Science, Mathematics and Technology, Singapore University of Technology and Design. **Email:** cai_kui@sutd.edu.sg

- **Zilin Jiang**, Assistant Professor, School of Mathematical and Statistical Sciences, Arizona State University. **Email:** zilinj@asu.edu

External References

- **Sidharth Jaggi**, Associate Professor, School of Mathematics, University of Bristol. **Email:** sid.jaggi@bristol.ac.uk
- **Mary Wootters**, Assistant Professor, Department of Computer Science, Stanford University. **Email:** marykw@stanford.edu