

# Leonid Petrov. Brief CV

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## Research areas

Probability, Mathematical Physics, Algebraic Combinatorics, Representation Theory.

## Education

2010: Ph.D., Institute for Information Transmission Problems.

2007: Diploma, Lomonosov Moscow State University, Department of Mathematics and Mechanics (Chair of Probability).

## Employment

Since 2019: Associate Professor, Department of Mathematics, University of Virginia.

2014–2019: Assistant Professor, Department of Mathematics, University of Virginia.

2017–2018: Visiting Assistant Professor, Department of Mathematics, MIT.

2011–2014: Research Instructor, Department of Mathematics, Northeastern University.

2009–2011: Research associate, Dobrushin Mathematics Laboratory, Institute for Information Transmission Problems, Moscow, Russia (on leave since 2011).

## Scholarships/prizes/funding

2020–2025: Simons Collaboration Grant for Mathematicians 709055 “Distributional symmetries in stochastic systems”, \$42,000.

2019: The 2020 Bernoulli prize for an outstanding survey article in probability (jointly with Alexei Borodin for the paper *Integrable probability: From representation theory to Macdonald processes*)

2018–2019: PI, NSF DMS conference grant 1839534 “Workshop on Representation Theory, Combinatorics, and Geometry”, amount \$15,000.

- 2017: Simons Foundation Collaboration Grant for Mathematicians. Recommended for funding but not awarded due to the receipt of the NSF DMS grant 1664617 (as per the rules of Collaboration Grants).
- 2017–2021: PI, NSF DMS grant 1664617 “FRG: Collaborative Research: Integrable Probability”. Joint with PIs Jinho Baik (University of Michigan), Alexei Borodin, Vadim Gorin (MIT), and Ivan Corwin (Columbia University). Amount: \$193,453 (UVA part).
- 2016–2017: Co-PI, NSF DMS conference grant 1663552 “2017 Seminar on Stochastic Processes”.
- 2015: Prize of the Moscow Mathematical Society.
- 2014–2015: EDF Fellowship of the University of Virginia.
- 2014: AMS/NSF Travel Grant Award for ICM 2014.
- 2011–2013: RFBR–CNRS grant 11-01-93105 “Representation theory and noncommutative geometry”.
- 2010–2012: RFBR–CNRS grant 10-01-93114 “New models of Markov processes on point configurations. Applications to stochastic queueing networks”.
- 2010: Dynasty foundation fellowship for young scientists.
- 2010: Silver prize of The Fourteenth Möbius Contest.
- 2009: Alexander Kuznetsov/Independent University of Moscow graduate student scholarship.
- 2005, 2006: V. Potatin federal scholarship for academic excellence, leadership and creativity.

## Publications (\* — preprints)

- [37] (\*) *Refined Cauchy identity for spin Hall-Littlewood symmetric rational functions*, arXiv:2007.10886 [math.CO].
- [36] (\*) (with Matteo Mucciconi) *Spin  $q$ -Whittaker polynomials and deformed quantum Toda*, arXiv:2003.14260 [math.PR]. Submitted.
- [35] (\*) (with Mikhail Tikhonov) *Parameter symmetry in perturbed GUE corners process and reflected drifted Brownian motions*, arXiv:1912.08671 [math.PR]. Submitted.
- [34] (\*) *Parameter permutation symmetry in particle systems and random polymers*, arXiv:1912.06067 [math.PR]. Submitted.
- [33] (\*) *PushTASEP in inhomogeneous space*, arXiv:1910.08994 [math.PR]. Submitted.
- [32] (\*) (with Axel Saenz) *Mapping TASEP back in time*, arXiv:1907.09155 [math.PR]. Submitted.

- [31] (with Alexey Bufetov and Matteo Mucciconi) *Yang-Baxter random fields and stochastic vertex models*, arXiv:1905.06815 [math.PR]. Advances in Mathematics, to appear.
- [30] (with Ivan Corwin and Konstantin Matveev) *The  $q$ -Hahn PushTASEP*, arXiv:1811.06475 [math.PR]. Intern. Math. Research Notices (2019), rnz106.
- [29] (with Alisa Knizel and Axel Saenz) *Generalizations of TASEP in discrete and continuous inhomogeneous space*, Commun. Math. Phys. 372 (2019), no. 3, pp 797–864. <https://link.springer.com/article/10.1007%2Fs00220-019-03495-4>. arXiv:1808.09855 [math.PR].
- [28] (with Christian Gromoll, Mark Meckes) *Quenched Central Limit Theorem in a Corner Growth Setting*, Electron. Comm. Probab. 23 (2018) paper no. 101, 12pp, arXiv:1804.04222 [math.PR].
- [27] (with Alexey Bufetov) *Yang-Baxter field for spin Hall-Littlewood symmetric functions*, arXiv:1712.04584 [math.PR]. Forum of Mathematics Sigma, 7 (2019), e39.
- [26] (with Michael Damron and David Sivakoff) *Coarsening model on  $\mathbb{Z}^d$  with biased zero-energy flips and an exponential large deviation bound for ASEP*, Comm. Math. Phys. 362 (2018) no. 1, 185–217, arXiv:1708.05806 [math.PR].
- [25] (with Sevak Mkrtchyan) *GUE corners limit of  $q$ -distributed lozenge tilings*, Electron. J. Probab. 22 (2017), paper no. 101, 24 pp, arXiv:1703.07503 [math.PR].
- [24] (with Alexei Borodin) *Inhomogeneous exponential jump model*, Probab. Th. Rel. Fields 172 (2018) 323–385, arXiv:1703.03857 [math.PR].
- [23] (with Daniel Orr) *Stochastic higher spin six vertex model and  $q$ -TASEPs*, Advances in Mathematics 317 (2017), 473–525, arXiv:1610.10080 [math.PR].
- [22] (with Vadim Gorin) *Universality of local statistics for noncolliding random walks*, Ann. Probab. (2019), Vol. 47, No. 5, 2686–2753. arXiv:1608.03243 [math.PR].
- [21] (with Alexei Borodin) *Lectures on Integrable probability: Stochastic vertex models and symmetric functions* (2016), arXiv:1605.01349 [math.PR]. Lecture Notes of the Les Houches Summer School, Volume 104, July 2015.
- [20] (with Alexei Borodin) *Higher spin six vertex model and symmetric rational functions* (2016), Selecta Math. 24 (2018), no. 2, 751–874, arXiv:1601.05770 [math.PR].
- [19] (with Konstantin Matveev)  *$q$ -randomized Robinson–Schensted–Knuth correspondences and random polymers* (2015), Annales de l’Institut Henri Poincaré D: Combinatorics, Physics and their Interactions 4 (2017), no. 1, 1–123, arXiv:1504.00666 [math.PR].
- [18] (with Ivan Corwin) *Stochastic higher spin vertex models on the line*, Comm. Math. Phys. 343 (2016), no. 2, 651–700, DOI: 10.1007/s00220-015-2479-5, arXiv:1502.07374 [math.PR].
- [17] (with Alexei Borodin, Ivan Corwin, and Tomohiro Sasamoto) *Spectral theory for interacting particle systems solvable by coordinate Bethe ansatz*, Comm. Math. Phys. 339 (2015), no. 3, 1167–1245, DOI: 10.1007/s00220-015-2424-7, arXiv:1407.8534 [math-ph].

- [16] (with Alexey Bufetov) *Law of Large Numbers for Infinite Random Matrices over a Finite Field*, *Selecta Math.* 21 (2015), no. 4, 1271–1338, arXiv:1402.1772 [math.PR].
- [15] (with Alexei Borodin) *Integrable probability: From representation theory to Macdonald processes*, *Probability Surveys* 11 (2014), 1–58, arXiv:1310.8007 [math.PR].
- [14] (with Alexei Borodin, Ivan Corwin, and Tomohiro Sasamoto) *Spectral theory for the  $q$ -Boson particle system*, *Compositio Mathematica* 151 (2015), no. 1, 1–67, arXiv:1308.3475 [math-ph].
- [13] (with Ivan Corwin) *The  $q$ -PushASEP: A New Integrable Model for Traffic in  $1+1$  Dimension*, *Journal of Statistical Physics*, 160 (2015), no. 4, 1005–1026, arXiv:1308.3124 [math.PR].
- [12] (with Alexei Borodin) *Nearest neighbor Markov dynamics on Macdonald processes*, *Advances in Mathematics*, 300 (2016), 71–155. Special volume honoring Andrei Zelevinsky. arXiv:1305.5501 [math.PR].
- [11] *The Boundary of the Gelfand-Tsetlin Graph: New Proof of Borodin-Olshanski's Formula, and its  $q$ -analogue*, *Moscow Mathematical Journal* 14 (2014) no. 1, 121–160, arXiv:1208.3443 [math.CO].
- [10] *Asymptotics of Uniformly Random Lozenge Tilings of Polygons. Gaussian Free Field*, *Annals of Probability* 43 (2014), no. 1, 1–43, arXiv:1206.5123 [math.PR].
- [9] *Asymptotics of Random Lozenge Tilings via Gelfand-Tsetlin Schemes*, *Probability Theory and Related Fields* 160 (2014), no. 3, 429–487, arXiv:1202.3901 [math.PR].
- [8]  $\mathfrak{sl}(2)$  *Operators and Markov Processes on Branching Graphs*, *Journal of Algebraic Combinatorics* 38 (2013), no. 3, 663–720, arXiv:1111.3399 [math.CO].
- [7] *On Measures on Partitions Arising in Harmonic Analysis for Linear and Projective Characters of the Infinite Symmetric Group* (2011), Proceedings of the international conference “50 years of IITP”, arXiv:1107.0676 [math.CO].
- [6] *Pfaffian Stochastic Dynamics of Strict Partitions*, *Electronic Journal of Probability* 16 (2011), 2246–2295, arXiv:1011.3329 [math.PR].
- [5] *Random Strict Partitions and Determinantal Point Processes*, *Electronic Communications in Probability* 15 (2010), 162–175, arXiv:1002.2714 [math.PR].
- [4] *Random Walks on Strict Partitions*, *Journal of Mathematical Sciences* 168 (2010), no. 3, 437–463, arXiv:0904.1823 [math.PR].
- [3] *Limit Behavior of Certain Random Walks on Strict Partitions*, *Russian Mathematical Surveys* 64 (2009), no. 6, 1139–1141.
- [2] *A Two-parameter Family of Infinite-dimensional Diffusions in the Kingman Simplex*, *Functional Analysis and Its Applications* 43 (2009), no. 4, 279–296, arXiv:0708.1930 [math.PR].

- [1] *Asymptotic Behavior of a Certain Collection of Particles on a Line Under Synchronization*, Proceedings of the XXVIII Conference of Young Scientists of Department of Mechanics and Mathematics of the Lomonosov Moscow State University (2006), 152–156, in Russian.

### Other works

- [1] Sihan Li, Andrew Mecca, Jeewoo Kim, Giusy Caprara, Elizabeth Wagner, Ting-Ting Du, Leonid Petrov, Wenhao Xu, Runjia Cui, Ivan Rebustini, Bechara Kachar, Anthony Peng, and Jung-Bum Shin, *Myosin-VIIa is expressed in multiple isoforms and essential for tensioning the hair cell mechanotransduction complex*. Nature Communications, 11, Article number: 2066 (2020). <https://www.nature.com/articles/s41467-020-15936-z>.

## Organization and service

- 2020: Online conference on Statistical Mechanics, Integrable Systems and Probability, April 27 - May 1, 2020, <http://mtikhonov.com/smisp/>
- 2020: (**postponed due to COVID-19**) Program "Integrability and combinatorics at finite temperature" at MATRIX Institute, University of Melbourne, June 1-19, 2020, <https://www.matrix-inst.org.au/events/integrability-and-combinatorics-at-finite-temperature/>
- 2020: (**postponed due to COVID-19**) Special Session on Integrable Probability at the 2020 AMS Spring Southeastern Sectional Meeting at University of Virginia, March 13-15, 2020, [http://www.ams.org/meetings/sectional/2273\\_program.html](http://www.ams.org/meetings/sectional/2273_program.html)
- 2019: Virginia Integrable Probability Summer School, May 27 - June 8, 2019, <http://vipss.int-prob.org/>
- 2018-19: Reading seminar on Integrable Probability, <https://lpetrov.cc/reading-2019/>
- 2018: Workshop on Representation Theory, Combinatorics, and Geometry at UVA, October 19-21, 2018, <http://math.virginia.edu/ims/workshop-fall-2018/>
- 2018: Conference "Integrable Probability Boston 2018 (IntProb Boston)" at MIT, May 14-18, 2018, <http://frg.int-prob.org/conference2018/>
- 2017+: Developer of the website and forum for the FRG "Integrable Probability", <http://frg.int-prob.org/>
- 2017+: Developer of the University of Virginia Math Department website, <http://math.virginia.edu/>
- 2017: Conference "Seminar on Stochastic Processes 2017" at UVA, March 8-11, 2017, <http://faculty.virginia.edu/ssp17/>
- 2016-17: Reading seminar on Integrable Probability, <https://lpetrov.cc/2016/12/reading-seminar/>

2014-17: University of Virginia Probability Seminar, <http://math.virginia.edu/seminars/probability/>

2014-17: Undergraduate Math Club at the University of Virginia, <http://math.virginia.edu/seminars/mathclub/>

## Teaching

*University of Virginia (since 2014)*

Complex Variables; Introduction to Probability; Introduction to Stochastic Processes; Calculus III; Random matrices (graduate topics course); Real Analysis and Linear Spaces (graduate).

*Northeastern University (2011–2014)*

Calculus II for Sci&Eng; Probability and Statistics; Statistics and Stochastic Processes; Probability 1 (graduate course); Topics in Probability (graduate topics course).

## Editing and reviewing

- Editor at “Mathematical Physics, Analysis and Geometry”.
- I regularly referee scholarly journal papers submitted to numerous journals, including Ann. Prob., Adv. Math., Adv. Appl. Math., Comm. Math. Phys., Intern. J. Math., Arkiv för Mat., SIGMA, J. Alg. Comb., Comm. Pure Appl. Math., Intern. Math. Res. Notices, J. Appl. Probab., J. Comb. Theory A, Symp. Th. Aspects of Comp. Sci., J. of Stat. Physics, Electron. Comm. Probab.
- I am a regular reviewer for the Mathematical Reviews database.
- I reviewed grant proposals for several funding agencies.

## Informatic skills

L<sup>A</sup>T<sub>E</sub>X, Mathematica, git, Python, html/jekyll and web design, UNIX, Computer experimentation, Probabilistic visualization, Cloud computing.

Last updated: July 24, 2020

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