September 2026

# Mykhaylo Shkolnikov

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## Academic positions

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| **01/2024-present** | **Department of Mathematical Sciences, Carnegie Mellon University.**<br>Full Professor. |
| **01/2024-present** | **Center for Nonlinear Analysis, Carnegie Mellon University.**<br>Faculty Member. |
| **07/2020-12/2023** | **ORFE Department, Princeton University.**<br>Associate Professor (with tenure). |
| **10/2018-12/2023** | **Program in Applied & Computational Mathematics, Princeton University.**<br>Associated Faculty Member. |
| **07/2017-12/2023** | **Bendheim Center for Finance, Princeton University.**<br>Affiliated Faculty Member. |
| **07/2015-06/2020** | **ORFE Department, Princeton University.**<br>Assistant Professor. |
| **07/2014-06/2015** | **Department of Mathematics, Princeton University.**<br>Assistant Professor. |
| **07/2012-06/2014** | **Department of Statistics, UC Berkeley.**<br>Postdoctoral Fellow. |
| **01/2012-05/2012** | **Mathematical Sciences Research Institute, Berkeley.**<br>Postdoctoral Fellow. |

## Education

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| **09/2007-01/2012** | **Stanford University.**<br>PhD in Mathematics.<br>Thesis topic: "Competing particle systems and their applications".<br>Thesis advisor: Amir Dembo. |
| **08/2007** | **Ludwig-Maximilians University, Munich, Germany.**<br>Diploma in Mathematics, *passed with distinction.*<br>Specialization: Mathematical Finance, minor: Computer Science.<br>Thesis topic: "Affine matrix-valued diffusions".<br>Thesis advisor: Damir Filipović. |
| **03/2006** | **Ludwig-Maximilians University, Munich, Germany.**<br>Vordiplom in Mathematics (minor: Computer Science), *passed with distinction.* |

## Honors and awards

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| **09/2026-08/2031** | Simons Foundation's Travel Support for Mathematicians. |
| **05/2026** | Institute of Mathematical Statistics (IMS) Fellowship. |
| **09/2025-present** | NSF grant DMS-2342349 "RTG: Frontiers in Applied Analysis". Senior Personnel. |
| **07/2021-06/2024** | NSF grant DMS-2108680 "Probabilistic Approach to Singular Free Boundary Problems and Applications". PI. |
| **07/2021** | Princeton Engineering Commendation List for Outstanding Teaching. |
| **06/2019** | Early Career Prize by the Activity Group on Financial Mathematics & Engineering at the Society for Industrial and Applied Mathematics (SIAM). |
| **05/2019** | E. Lawrence Keyes, Jr./Emerson Electric Co. Faculty Advancement Award by the School of Engineering and Applied Science, Princeton University. |
| **11/2018** | Erlang Prize by the Applied Probability Society of the Institute for Operations Research and the Management Sciences (INFORMS). |

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| **07/2018-06/2021** | NSF grant DMS-1811723 "Large-scale behavior of interacting particle systems". PI. |
| **05/2018-06/2020** | Princeton SEAS innovation award "Particle models of neural synchronization". PI. |
| **05/2017** | NSF grant DMS-1713013 "Mathematical Finance, Probability, and PDE Conference", co-PI. |
| **07/2015-06/2018** | NSF grant DMS-1506290 "Investigation of interacting particle systems by stochastic analysis methods". PI. |
| **01/2015** | INTECH Investment Management LLC sponsorship award for the Princeton Financial Mathematics Seminar. |
| **06/2011-08/2011** | Fellowship award by the Department of Mathematics, Stanford University, partially funded by Two Sigma Invesments, LLC. |
| **02/2008-06/2008** | A. Craig Franklin Fellowship award by Stanford University for strong graduate work. |
| **05/2004-08/2008** | Scholarship of the "Studienstiftung des deutschen Volkes" (German governmental scholarship). |
| **12/2004-01/2012** | e-fellows scholarship. |
| **07/2004** | Honorable Mention at the International Mathematics Olympiad. |

## Publications and submitted papers

1. "Affine matrix-valued diffusions" (2007). *Diploma thesis. Ludwig-Maximilians University, Munich.*
2. "Competing particle systems evolving by i.i.d. increments" (2009). *Electron. J. Probab.* **14**, pp. 728–751.
3. "Competing particle systems evolving by interacting Lévy processes" (2011). *Ann. Appl. Probab.* **21**, pp. 1911–1932.
4. "Large systems of diffusions interacting through their ranks" (2012). *Stoch. Proc. Appl.* **122**, pp. 1730–1747.
5. "Concentration of measure for systems of Brownian particles interacting through their ranks" (2014). Joint work with S. Pal. *Ann. Appl. Probab.* **24**, pp. 1482–1508.
6. "Two models for stochastic losses given default" (2012). Joint work with S. Farinelli. *J. Credit Risk* **8**, paper 4.
7. "Large volatility-stabilized markets" (2013). *Stoch. Proc. Appl.* **123**, pp. 212–228.
8. "Convergence rates for rank-based models with applications to portfolio theory" (2013). Joint work with T. Ichiba and S. Pal. *Probab. Theory Related Fields* **156**, pp. 415–448.
9. "On the one-sided Tanaka equation with drift" (2011). Joint work with I. Karatzas and A. N. Shiryaev. *Electron. Commun. Probab.* **16**, pp. 664–677.
10. "Strong solutions of stochastic equations with rank-based coefficients" (2013). Joint work with T. Ichiba and I. Karatzas. *Probab. Theory Related Fields* **156**, pp. 229–248.
11. "Competing particle systems and their applications" (2011). *PhD thesis. Stanford University.*
12. "Some universal estimates for reversible Markov chains" (2013). *Electron. J. Probab.* **18**, article 11.
13. "Limits of multilevel TASEP and related processes" (2015). Joint work with V. Gorin. *Ann. Inst. Henri Poincaré Probab. Stat.* **51**, pp. 18–27.
14. "Small time central limit theorems for semimartingales with applications" (2015). Joint work with S. Gerhold, M. Kleinert and P. Porkert. *Stochastics* **87**, pp. 723–746.
15. "Systems of Brownian particles with asymmetric collisions" (2016). Joint work with I. Karatzas and S. Pal. *Ann. Inst. Henri Poincaré Probab. Stat.* **52**, pp. 323–354.
16. "Fluctuations of martingales and winning probabilities of game contestants" (2013). Joint work with D. Aldous. *Electron. J. Probab.* **18**, article 47.

17. "Large deviations for diffusions interacting through their ranks" (2016). Joint work with A. Dembo, S. R. S. Varadhan and O. Zeitouni. *Comm. Pure Appl. Math.* **69**, pp. 1259–1313.

18. "Multidimensional sticky Brownian motions as limits of exclusion processes" (2015). Joint work with M. Z. Racz. *Ann. Appl. Probab.* **25**, pp. 1155–1188.

19. "Multilevel Dyson Brownian motions via Jack polynomials" (2015). Joint work with V. Gorin. *Probab. Theory Related Fields* **163**, pp. 413–463.

20. "Interacting particle systems at the edge of multilevel Dyson Brownian motions" (2017). Joint work with V. Gorin. *Adv. Math.* **304**, pp. 90–130.

21. "Forward performance processes in incomplete markets and ill-posed HJB equations" (2016). Joint work with R. Sircar and T. Zariphopoulou. *SIAM J. Financial Math.* **7**, pp. 588–618.

22. "Stochastic Airy semigroup through tridiagonal matrices" (2018). Joint work with V. Gorin. *Ann. Probab.* **46**, pp. 2287–2344.

23. "SPDE limit of the global fluctuations in rank-based models" (2018). Joint work with P. Kolli. *Ann. Probab.* **46**, pp. 1042–1069.

24. "Intertwinings of beta-Dyson Brownian motions of different dimensions" (2018). Joint work with K. Ramanan. *Ann. Inst. Henri Poincaré Probab. Stat.* **54**, pp. 1152–1163.

25. "Particle systems with singular interaction through hitting times: application in systemic risk modeling" (2019). Joint work with S. Nadtochiy. *Ann. Appl. Probab.* **29**, pp. 89–129.

26. "Edge of spiked beta ensembles, stochastic Airy semigroups and reflected Brownian motions" (2019). Joint work with P. Y. Gaudreau Lamarre. *Ann. Inst. Henri Poincaré Probab. Stat.* **55**, pp. 1402–1438.

27. "Dynamics of observables in rank-based models and performance of functionally generated portfolios" (2018). Joint work with S. A. Almada Monter and J. Zhang. *Ann. Appl. Probab.* **29**, pp. 2849–2883.

28. "Construction of forward performance processes in stochastic factor models and an extension of Widder's theorem" (2020). Joint work with L. Avanesyan and R. Sircar. *Finance Stoch.* **24**, pp. 981–1011.

29. "Mean field systems on networks, with singular interaction through hitting times" (2020). Joint work with S. Nadtochiy. *Ann. Probab.* **48**, pp. 1520–1556.

30. "Global solutions to the supercooled Stefan problem with blow-ups: regularity and uniqueness" (2019). Joint work with F. Delarue and S. Nadtochiy. *Probab. Math. Phys.* **3**, pp. 171–213.

31. "Inverting the Markovian projection, with an application to local stochastic volatility models" (2020). Joint work with D. Lacker and J. Zhang. *Ann. Probab.* **48**, pp. 2189–2211.

32. "Zero kinetic undercooling limit in the supercooled Stefan problem" (2020). Joint work with G. Baker. *Ann. Inst. Henri Poincaré Probab. Stat.* **58**, pp. 861–871.

33. "Superposition and mimicking theorems for conditional McKean-Vlasov equations" (2023). Joint work with D. Lacker and J. Zhang. *J. Eur. Math. Soc.* **25**, pp. 3229–3288.

34. "Convergence of a time-stepping scheme to the free boundary in the supercooled Stefan problem" (2023). Joint work with V. Kaushansky, C. Reisinger, Z. Q. Song. *Ann. Appl. Probab.* **33**, pp. 274–298.

35. "Scaling limits of external multi-particle DLA on the plane and the supercooled Stefan problem" (2024). Joint work with S. Nadtochiy, X. Zhang. *Ann. Inst. Henri Poincaré Probab. Stat.* **60**, pp. 658–691.

36. "A singular two-phase Stefan problem and particles interacting through their hitting times" (2024). Joint work with G. Baker. *Ann. Appl. Probab.* **34**, pp. 4493–4512.

37. "Stefan problem with surface tension: global existence of physical solutions under radial symmetry" (2023). Joint work with S. Nadtochiy. *Probab. Theory Related Fields* **187**, pp. 385–422.

38. "Well-posedness of the supercooled Stefan problem with oscillatory initial conditions" (2024). Joint work with S. Mustapha. *Electron. J. Probab.* **29**, pp. 1–21.

39. "Stefan problem with surface tension: uniqueness of physical solutions under radial symmetry" (2024). Joint work with Y. Guo, S. Nadtochiy. *Arch. Ration. Mech. Anal.* **248**, article 90.

40. "Deep level-set method for Stefan problems" (2024). Joint work with H. M. Soner, V. Tissot-Daguette. *J. Comput. Phys.* **503**.

41. "Multilevel Dyson Brownian motions via the superposition principle" (2024). Joint work with B. Budway. To appear in *Ann. Inst. Henri Poincaré Probab. Stat.* Preprint available at *arxiv.org/abs/2403.10724*.

42. "From rank-based models with common noise to pathwise entropy solutions of SPDEs" (2026). Joint work with L. C. Yeung. *Ann. Appl. Probab.* **36**, pp. 319–354.

43. "Cascade equation for the discontinuities in the Stefan problem with surface tension" (2024). Joint work with Y. Guo, S. Nadtochiy. *Submitted.* Preprint available at *arxiv.org/abs/2410.15249*.

44. "Intertwining diffusions and wave equations" (2025). Joint work with B. Budway, S. Pal. *Submitted.* Preprint available at *arxiv.org/abs/1306.0857v4*.

45. "Relative arbitrage problem under eigenvalue lower bounds" (2025). Joint work with J.-H. Lai, H. M. Soner. To appear in *Finance Stoch.* Preprint available at *arxiv.org/abs/2512.17702*.

46. "Universal Central Limit Theorem for non-exchangeable interacting diffusions" (2026). Joint work with L. C. Yeung. *Submitted.* Preprint available at *arxiv.org/abs/2607.07598*.

## Plenary talks

**06/2024** Byrne Conference on Stochastic Analysis in Finance and Insurance, University of Michigan.
**06/2022** Advances in Mathematical Finance and Optimal Transport (in honor of W. Schachermayer's birthday), Centro di Ricerca Matematica Ennio de Giorgi, Pisa.
**05/2019** Southeastern Probability Conference, Duke University.
**12/2018** Advances in Asymptotic Probability (in honor of A. Dembo's birthday), Stanford University.
**10/2018** Eastern Conference on Mathematical Finance, Illinois Institute of Technology.
**05/2018** Seminar on Stochastic Processes, Brown University.
**09/2017** SIAM-LMS Conference on Mathematical Modelling in Finance, London.
**03/2017** Western Conference in Mathematical Finance, University of Washington.
**11/2015** Northeast Probability Seminar, NYU.
**05/2015** Stochastic Portfolio Theory Conference, Columbia University.
**03/2015** Mathematical Finance and Partial Differential Equations Conference, Rutgers.
**06/2012** Probability, Control and Finance: A Conference in Honor of I. Karatzas, Columbia University.

## Other talks and visits

**2025:** University of Munich, University of Tokyo, Columbia University.

**2024:** SIAM Financial Mathematics and Engineering seminar (online), Princeton: Oxford-Princeton Workshop on Financial Mathematics and Stochastic Analysis.

**2023:** TU Berlin, University of North Carolina.

**2022:** USC (online), Carnegie Mellon University (online), Joint Israeli Probability Seminar (online), Columbia University (online), University of Tokyo, TU Munich.

**2021:** Harvard University (online), University of Leeds (online), Berlin Probability Colloquium (online), Stanford University (online), SIAM conference on Financial Mathematics & Engineering (online), CIRM Workshop "Advances in Stochastic Analysis for Handling Risks in Finance & Insurance" (online), USC (online).

**2020:** Oxford University (online), Indiana University (online), Princeton University (online), Columbia University (online), Rutgers University (online).

**2019:** TU Vienna, London School of Economics, Imperial College London, Rutgers University, NUS: 4th Berlin-Princeton-Singapore Workshop on Quantitative Finance, MIT, Centre International de Recontres Mathématiques (Luminy): Integrability and Randomness in Mathematical Physics and Geometry, Toronto: SIAM Conference on Financial Mathematics & Engineering, Berlin Mathematical Finance Seminar, Nice: Annals of Applied Probability Meeting, NYU, University of Münster.

**2018:** The Hong Kong Polytechnic University, University of Toronto, Columbia University, Duke University, Casa Mathemática Oaxaca: Workshop on Stochastic Analysis and its Applications, Mittag-Leffler Institute: Conference on Gaussian Fields in Random Matrix Theory, Illinois Institute of Technology, University of Delaware: AMS sectional meeting, Princeton University: Program in Applied & Computational Mathematics colloquium, TU Munich.

**2017:** London Mathematical Finance Seminar, Columbia University, Oberwolfach: Mathematics of Quantitative Finance, University of Michigan, Oxford: Oxford-Princeton Workshop on Financial Mathematics and Stochastic Analysis, Edinburgh: Workshop on BSDEs, SPDEs and their Applications, Montréal: Mathematical Congress of the Americas (Probability Theory session), Stony Brook, University of Vienna, UT Austin.

**2016:** Kavli Institute for Theoretical Physics: Non-equilibrium dynamics of stochastic and quantum integrable systems, UC Santa Barbara, Rutgers University, MIT, University of Michigan: Byrne Workshop on Stochastic Analysis in Finance and Insurance, ICMS Edinburgh: At the Frontiers of Quantitative Finance.

## Professional activities

**Associate editor**: *Annals of Applied Probability*, *Applied Mathematical Finance*, *Mathematical Finance*.

**Conference organization**: CNA RTG Summer School: Topics at the Interface of PDE and Probability (Pittsburgh, 2026), Eastern Conference on Mathematical Finance (Pittsburgh, 2025), AMS-UMI International Joint Meeting: Special Session on Stochastic Analysis (Palermo, 2024), IMSI Workshop: Laplacian Growth Models (Chicago, 2023), 2 Sessions at the SIAM Conference on Financial Mathematics & Engineering (Philadelphia, 2023), 2 Sessions at the SIAM Conference on Financial Mathematics & Engineering (online, 2021), 2 Sessions at the SIAM Conference on Financial Mathematics & Engineering (Toronto, 2019), Columbia-Princeton Probability Day (Princeton, 2015, 2017, 2019, 2023), Princeton-Rutgers Math Finance Day (New Brunswick, 2018), Mathematical Finance, Probability, and PDE (New Brunswick, 2017), 9th World Congress of the Bachelier Finance Society (New York, 2016), 9th, 10th Oxford-Princeton Workshop on Financial Mathematics and Stochastic Analysis (Princeton, 2015, Oxford, 2017), Invited Session at the INFORMS Annual Meeting (Philadelphia, 2015).

**Seminar organization**: Carnegie Mellon Math Colloquium, Carnegie Mellon Probability/Math Finance Seminar, Princeton Financial Mathematics Seminar, Princeton Probability Seminar, Princeton Stochastic Analysis Seminar, Princeton ORFE Colloquium, UC Berkeley Probability Seminar.

**Referee** for *Annales de l'Institut Henri Poincaré*, *Annals of Applied Probability*, *Bernoulli*, *Communications on Pure and Applied Mathematics*, *Electronic Communications in Probability*, *Electronic Journal of Probability*, *Finance and Stochastics*, *International Mathematics Research Notices*, *Journal of the American Mathematical Society*, *Journal of Applied Econometrics*, *Journal of Mathematical Physics*, *Journal of Theoretical Probability*, *Letters in Mathematical Physics*, *Mathematical Finance*, *Mathematics of Operations Research*, *Probability Theory and Related Fields*, *Proceedings of the National Academy of Sciences*, *SIAM Journal of Financial Mathematics*, *Stochastic Partial Differential Equations: Analysis and Computations*, *Stochastic Processes and their Applications*, *Stochastics*.

**Administrative**:

CMU Mellon College of Science College Council (2025),
CMU Math Faculty Search Committee (2024-2025),
CMU Math Graduate Admissions (2024-2025),
NSF panelist (2022),
Princeton ORFE Director of Graduate Studies (2020-2022),
Princeton Graduate School Curriculum Committee (2020-2022),
Princeton ORFE Search Committee for an Assistant Professor appointment in Data Science (2018-2019),
Princeton ORFE Graduate Admissions (2016, 2017, 2018, 2019, 2020).

**Academic Committee Member**:

**PhD Defense Committee** of Maria Avdeeva, Graeme Baker, Cameron Bruggeman, Gokce Dayanikli, Joe Durante, Jacob Funk, Pierre Yves Gaudreau Lamarre, Christy V. Graves, Han Hao, Praveen Kolli, Daniel Lacker, Nongchao Li, Zhi Li, Zongxi Li, Suqi Liu, Shukun Long, Kun Lu, Scander Mustapha, Sinem Uysal, Peiqi Wang, Minghan Yan, Jiacheng Zhang, Licheng Zhang, Lingfu Zhang, Zeyu Zhang, Tianqi Zhao.

**General/Preliminary Examination Committee** of Arseniy Andreev, Levon Avanesyan, Graeme Baker, Pierre Bayle, Benjamin Budway, Mark Cerenzia, Alexandru Damian, Jou-Hua Lai, Pierre Yves Gaudreau Lamarre, Daniel Gitelman, Miriam Gordin, Christy V. Graves, Yucheng Guo, Gulnaz Jenish, Lexie Li, Zongxi Li, Maycee Lin, Yair Shenfeld, Yimeng Sun, Zongjun Tan, Jiacheng Zhang, Yunxiu Zhou.

## Advising

**Postdoctoral supervision**: Lane Chun Yeung (2023-2025), Anton Ullrich (2025-present).

**PhD thesis supervision**: Praveen Kolli (defended: 04/2018), Pierre Yves Gaudreau Lamarre (defended: 05/2020), Levon Avanesyan (defended: 12/2020), Jiacheng Zhang (defended: 05/2021), Graeme Baker (expected: 06/2023), Scander Mustapha (defended: 05/2024), Yucheng Guo (defended: 05/2026), Jou-Hua Lai (expected: 05/2027), Benjamin Budway (expected: 05/2027).

**Senior thesis supervision**: Alan Chung, Dhruv Bansal, Bulut Cakmak, June Chang, Luyu Cheng, Nicholas Chow, Bill Dong, Laura Fang, Allison Harris, Kavirath Jain, Arnav Joshi, Lingdian Kong, Fatomata Konteh, Alex Luo, Stella Ma, Taishi Nakase, Paul Noh, Ebo Quansah, Fangying Shi, Nathan Sima, Zhuo Qun Song, Michael Stambler, Austin Stiefelmaier, Christina Walter, Andrew Wang, William Xocoy, Sung Hyun Yoo, Sean Yun.

**Academic advising**: $\approx 15$ undergraduate students per year at Princeton.

## Teaching

**Carnegie Mellon University**: Stochastic Calculus for Finance I (Masters), Stochastic Calculus for Finance II (Masters), Financial Products and Markets (Masters), Particles Interacting through their Mean Field and Applications to Finance (PhD).

**Princeton University**: Probability Theory (PhD), Probabilistic Theory of Network Games and Mean Field Interactions (PhD, co-taught with René Carmona), Stochastic Calculus (PhD), Probability and Stochastic Systems (undergraduate), Stochastic Portfolio Theory (PhD), Financial Risk Management (undergraduate), Calculus II (undergraduate), Advanced Multivariable Calculus (undergraduate).

**UC Berkeley**: Introduction to Probability and Statistics (undergraduate), Concepts of Probability (undergraduate).

## Non-academic employment

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| **08/2017** | Consultant at the research division of INTECH Investment Management LLC, Princeton. |
| **06/2011-08/2011, 06/2012** | Internships at the research division of INTECH Investment Management LLC, Princeton. |
| **06/29/2009-09/05/2009** | Internship in Group Risk Methodology, UBS AG, Zurich. |