Curriculum Vitae

Andrei Prokhorov

Current position

2024–2025 Postdoctoral scholar at the University of Chicago

Research interests

Applications of Riemann-Hilbert problems in probability theory and differential equations.

Service

- 12/2024 Organizer of the special session "Discrete and continuous integrable systems: geometry analysis and applications" at the Joint meeting of NZMS, AustMS and AMS, December 9-13, 2024, University of Auckland, New Zealand.
- 06/2022 Organizer of the Summer School on Random Matrices, University of Michigan, Ann Arbor, June 13-24, 2022. Other organizers: Jinho Baik, Raj Nadakuditi.
- 06/2024 Organizer of the Summer School on Random Matrices, University of Michigan, Ann Arbor, June 17-28, 2024. Other organizers: Jinho Baik, Raj Nadakuditi.
- 09/2022 Organizer of the conference, "The charm of integrability - Honoring the scientific contributions of Alexander Its on the occasion of his 70th birthday" University of Bristol, UK, September 12-16, 2022. Other organizers: Tamara Grava, Thomas Bothner, Ken McLaughlin.
- 09/2020–06/2024 Organizer of the seminar on integrable systems and random matrix theory at the University of Michigan. Other organizers: Ahmad Barhoumi, Guilherme Silva, Jinho Baik, Peter Miller.

- 09/2020–12/2020 Mentor of the undergraduate research project "Unraveling the patterns of Painlevé zeros" in the Laboratory of Geometry.
  Other mentors: Jörn Zimmerling, Elizabeth Collins - Woodfin, Benjamin Krakoff.
  Students: Hexin Cui, Wenhao Deng, Xiaoqi Peng

- 05/2021–06/2021 Mentor of the REU project "Computing The Constant In The Left-tail Asymptotic Of Maximum Eigenvalue Distribution Of Finite GUE".
  Other mentor: Fred Adams.
  Student: Xiaoqi Peng.

- 05/2023–06/2023 Mentor of the REU project "Small x asymptotics for special function solutions of Painlevé-III equation".
  Student: Hao Pan.
  Preprint: arXiv:2407.04852

- Guest editor of "Special Issue on Evolution Equations, Exactly Solvable Models and Random Matrices in honor of Alexander Its' 70th birthday"

- Referee:

  Annales Henri Poincaré

  Communications in Mathematical Physics

  Nonlinearity

  Proceedings of the American Mathematical Society

  SIAM Journal on Mathematical Analysis

  Letters in Mathematical Physics

- American Mathematical Society Graduate Student Chapter at Indiana University-Purdue University Indianapolis (`https://sites.google.com/iu.edu/amsiupui`)

  09/2017–06/2018 President

  09/2016–06/2017 Vice-President

  09/2015–06/2016 Secretary

Teaching experience

01/2024–08/2024 Teaching Math 471 (Introduction to Numerical Methods) at University of Michigan, Ann Arbor.

01/2023–05/2023 Teaching Math 354 (Fourier analysis and its applications) at University of Michigan, Ann Arbor.

09/2022–12/2022 Teaching Math 454 (Boundary value problems for partial differential equations)
at University of Michigan, Ann Arbor.

01/2019–05/2021	Teaching Math 216 (Introduction to differential equations) at University of Michigan, Ann Arbor.
09/2019–12/2019	Teaching Math 115 (Calculus I) at University of Michigan, Ann Arbor.
01/2019–05/2019	Teaching Math 15400 (Trigonometry) at Indiana University-Purdue University Indianapolis.
09/2018–12/2018	Teaching Math 15300 (College Algebra) at Indiana University-Purdue University Indianapolis.
09/2018–12/2018	Teaching Math 11000 (Fundamentals of Algebra) at Indiana University-Purdue University Indianapolis.
09/2017–05/2018	Teaching Math M118 (Finite Mathematics) at Indiana University-Purdue University Indianapolis.
05/2017–06/2017	Teaching Math 51000 (Vector Calculus) at Indiana University-Purdue University Indianapolis.
08/2016–12/2016	Teaching Math 17100 (Multidimensional Mathematics) at Indiana University-Purdue University Indianapolis.

Refereed publications

- H. Desiraju, A. R. Its, and A. Prokhorov. "Nonlinear steepest descent on a torus: A case study of the Landau-Lifshitz equation". In: *Nonlinearity* 38.4 (Mar. 2025), p. 045023. arXiv: 2405.17662 [math.AP]. URL: https://dx.doi.org/10.1088/1361-6544/adbe22

- A. Barhoumi, O. Lisovyy, P. D. Miller, and A. Prokhorov. "Painlevé-III Monodromy Maps Under the $D_6 \to D_8$ Confluence and Applications to the Large-Parameter Asymptotics of Rational Solutions". In: *Symmetry, Integrability and Geometry: Methods and Applications* (Mar. 2024). ISSN: 1815-0659. arXiv: 2307.11217 [math.CA]. URL: http://dx.doi.org/10.3842/SIGMA.2024.019

- J. Baik, A. Prokhorov, and G. L. F. Silva. "Differential equations for the KPZ and periodic KPZ fixed points". In: *Comm. Math. Phys.* 401.2 (2023), pp. 1753–1806. ISSN: 0010-3616,1432-0916. MR: 4610285. arXiv: 2208.11638 [math.PR]. URL: https://doi.org/10.1007/s00220-023-04683-z

- E. C. Bailey, S. Bettin, G. Blower, J. B. Conrey, A. Prokhorov, M. O. Rubinstein, and N. C. Snaith. "Mixed moments of characteristic polynomials of random unitary matrices". In: *J. Math. Phys.* 60.8 (2019), pp. 083509, 26. ISSN: 0022-2488,1089-7658. MR: 3995715. arXiv: 1901.07479 [math-ph]. URL: https://doi.org/10.1063/1.5092780

- T. Bothner, A. Its, and A. Prokhorov. "On the analysis of incomplete spectra in random matrix theory through an extension of the Jimbo-Miwa-Ueno differential". In: *Adv. Math.* 345 (2019), pp. 483–551. ISSN: 0001-8708,1090-2082. MR: 3899969. arXiv: 1708.06480 [math-ph]. URL: https://doi.org/10.1016/j.aim.2019.01.025

- A. R. Its, O. Lisovyy, and A. Prokhorov. "Monodromy dependence and connection formulae for isomonodromic tau functions". In: *Duke Math. J.* 167.7 (2018), pp. 1347–1432. ISSN: 0012-7094,1547-7398. MR: 3799701. arXiv: 1604.03082 [math-ph]. URL: https://doi.org/10.1215/00127094-2017-0055

- A. Its and A. Prokhorov. "Connection problem for the tau-function of the sine-Gordon reduction of Painlevé-III equation via the Riemann-Hilbert approach". In: *Int. Math. Res. Not. IMRN* 22 (2016), pp. 6856–6883. ISSN: 1073-7928,1687-0247. MR: 3632069. arXiv: 1506.07485 [math-ph]. URL: https://doi.org/10.1093/imrn/rnv375

- A. O. Prokhorov and N. D. Filonov. "The Maxwell operator with periodic coefficients in a cylinder". In: *Algebra i Analiz* 29.6 (2017), pp. 182–196. ISSN: 0234-0852. MR: 3723815. arXiv: 1801.10440 [math-ph]. URL: https://doi.org/10.1090/spmj/1524

- A. Prokhorov and N. Filonov. "Regularity of electromagnetic fields in convex domains". In: *J. Math. Sci. (N.Y.)* 210.6 (2015), pp. 793–813. ISSN: 1072-3374,1573-8795. MR: 3407793. arXiv: 1501.07081 [math-ph]. URL: https://doi.org/10.1007/s10958-015-2591-2

Submitted to journal

- H. Desiraju, P. Ghosal, and A. Prokhorov. *Proof of Zamolodchikov conjecture for semi-classical conformal blocks on torus*. 2024. arXiv: 2407.05839 [math-ph], submitted to 'Communications on Pure and Applied Mathematics'

- H. Pan and A. Prokhorov. *Asymptotic properties of special function solutions of the Painlevé III equation*. 2024. arXiv: 2407.04852 [math.CA], submitted to 'Studies in Applied Mathematics'

Non-refereed publications and preprints

- A. Its and A. Prokhorov. *On $\beta = 6$ Tracy-Widom distribution and the second Calogero-Painlevé system*. 2020. arXiv: 2010.06733 [nlin.SI]

- A. R. Its and A. Prokhorov. "On some Hamiltonian properties of the isomonodromic tau functions". In: *Rev. Math. Phys.* 30.7 (2018), pp. 1840008, 38. ISSN: 0129-055X,1793-6659. MR: 3833049. arXiv: 1803.04212 [math-ph]. URL: https://doi.org/10.1142/S0129055X18400081

Thesis

- A. Prokhorov. *Connection Problem for Painleve Tau Functions*. Thesis (Ph.D.)–Purdue University. ProQuest LLC, Ann Arbor, MI, 2019, p. 112. ISBN: 979-8379-67239-3. MR: 4625528. URL: http://dx.doi.org/10.7912/rygf-2h27

Education

2019	PhD, Department of Mathematical Sciences at Indiana University-Purdue University Indianapolis. Dissertation: "Connection problem for Painlevé tau functions". Advisor: Alexander Its.
2014	Master of Physics, St. Petersburg State University. Thesis: "Regularity of electromagnetic fields in convex domains". Advisor: Nikolai Filonov.

Work experience

2021–2024	NSF Postdoctoral Fellow based at the University of Michigan, Ann Arbor
09/2021–12/2021	Postdoctoral fellow, Mathematical Sciences Research Institute, Berkeley.
09/2019–06/2021	Postdoctoral Assistant Professor, Department of Mathematics, University of Michigan, Ann Arbor.
01/2017–	Researcher, Saint-Petersburg State University.
02/2014–06/2014	Researcher, Saint-Petersburg State University.
09/2013–10/2013	Researcher, Saint-Petersburg State University.
09/2011–12/2012	Research Assistant at the Chebyshev Laboratory at the Saint-Petersburg State University.

Honors/Awards

- First Year Fellowship from School of Science, IUPUI, 2014.
- Outstanding Advanced Mathematics Graduate Student, IUPUI, 2016.
- Charalambos D. Aliprantis Prize, IUPUI, 2017. (This scholarship is awarded to mathematics graduate students who exemplify outstanding scholastic achievements as well as leadership qualities.)
- Yuri Abramovich Memorial Scholarship, IUPUI, 2018. (This scholarship supports continuing undergraduate and graduate students who have a keen interest in the study of mathematics, who demonstrate academic excellence, especially in mathematics courses beyond the sophomore level and who show promise for a career in mathematics.)
- Outstanding Advanced Mathematics Graduate Student, IUPUI, 2019.
- NSF Postdoctoral Fellowship, 2021-2024

Research Presentations

- University of South Florida, Departmental Colloquium, March 7, 2025.
  Talk: "Nonlinear steepest descent on a torus: A case study of the Landau-Lifshitz equation"
- University of Utah, Stochastics seminar, February 28 ,2025.
  Talk: "Proof of Zamolodchikov conjecture for semi-classical conformal blocks on the torus"
- University of Chicago, Probability and Statistical Physics Seminar, February 21, 2025.
  Talk: "Proof of Zamolodchikov conjecture for semi-classical conformal blocks on the torus."
- Talk at the IUPUI AMS student chapter "Semiclassical analysis of conformal blocks on the torus.", May 17, 2024.
- AMS Spring Central Sectional Meeting, University of Cincinnati, Cincinnati, OH, April 15-16, 2023. Talk: "Large time asymptotic for solutions of Landau-Lifshitz equation using Riemann-Hilbert approach"
- AMS Joint Mathematics Meeting, Boston, January 4-7, 2023. Talk: "Asymptotical properties of rational solutions of Painlevé-III (D_6) equation and application to modulated bi-orthogonal polynomials."
- Midwestern Workshop on Asymptotic Analysis, Purdue University Fort Wayne, October 7-9, 2022.
  Talk: "Monodromy Map under the Confluence PIII(D_6) $\to$ PIII(D_8)".
- The Twelfth IMACS International Conference on Nonlinear Evolution Equations and Wave Phenomena: Computation and Theory, University of Georgia, Athens, GA, USA, March 30 - April 1st, 2022.
  Talk: "Large parameter asymptotic of rational solutions of Painlevé III (D_6) equation near zero".
- AMS Spring Central Virtual Sectional Meeting, March 26-27, 2022.
  Talk: "Integrable systems governing KPZ fixed points".
- Michigan State University, Mathematical Physics seminar, November 9th, 2021
  Talk: "On $\beta = 6$ Tracy-Widom distribution and the second Calogero-Painlevé system"
- Mathematical Sciences Research Institute Seminar, December 3rd, 2021
  Talk: "Integrable structure for the Multitime distribution of TASEP"
- Mathematical Sciences Research Institute Mini Course, September 2nd, 2021
  Talk: "Riemann-Hilbert problems application in the random matrix theory"

- Asymptotic methods in Mathematical Physics, Conference dedicated to the memory of V. S. Buslaev, EIMI, Saint-Petersburg, June 20th - 22nd, 2021
  Talk: " Integrable structure for the multipoint distribution of TASEP".

- Integrable systems in Geometry and Mathematical Physics, Conference in memory of Boris Dubrovin, SISSA, Trieste, June 28th - July 2nd, 2021
  Virtual 3 minute talk: " Large parameter asymptotics of rational solutions of Painlevé III equation near zero".

- IU Analysis seminar, Bloomington, March 17th, 2021
  Virtual talk: " Behavior of rational solutions of Painlevé III equation near zero".

- Bernoulli-IMS One World Symposium, Virtually, August 24th - 28th, 2020.
  Talk: " On $\beta = 6$ Tracy-Widom distribution and the second Calogero-Painlevé system. ".

- Junior Integrable Probability Seminar, Virtually, July 9th, 2020.
  Talk: " Integrable structure behind the multitime KPZ fixed point distribution. ".

- Workshop "Complex analysis in mathematical physics and applications", Isaac Newton Institute for Mathematical Studies, Cambridge, UK, October 28th - November 1st, 2019.
  Poster: "Asymptotic of solution of three-component Painlevé II equation".

- Forty-Seventh Annual Mathematics Conference "Differential Equations and Dynamical Systems and their Applications", Miami University, Oxford, OH, USA, September 20 - 21, 2019.
  Talk: "Connection problem for Painlevé tau functions.".

- Workshop "Painlevé equations in the Midwest", University of Michigan, Ann Arbor, MI, USA, August 23 - 24, 2019.
  Talk: "Asymptotic of solution of three-component Painlevé II equation".

- The Eleventh IMACS International Conference on Nonlinear Evolution Equations and Wave Phenomena: Computation and Theory, University of Georgia, Athens, GA, USA, April 17 - 19, 2019.
  Talk: "Asymptotic of 3-component Painlevé-II equation".

- AMS Fall Central Sectional Meeting , University of Michigan, Ann Arbor, October 20-21, 2018.
  Talk: "On some Hamiltonian properties of isomonodromic tau functions".

- Midwestern Workshop on Asymptotic Analysis, IU, Bloomington, October 5-7, 2018.
  Poster: "On some Hamiltonian properties of isomonodromic tau functions".

- Workshop "Tau Functions of Integrable Systems and Their Applications" , BIRS, Banff, Canada, September 2-7, 2018.
  Talk: "On some Hamiltonian properties of isomonodromic tau functions".

- Invited speaker at the probability seminar at University of Virginia, Charlottesville, October 25, 2017.
  Talk: "Limiting distribution of smallest eigenvalue of thinned complex Wishart matrices"

- Midwestern Workshop on Asymptotic Analysis, IUPUI, Indianapolis, October 6-8, 2017.
  Poster: "The smallest eigenvalue distribution of incomplete Laguerre Unitary Ensemble" .

- School on Dyson-Schwinger equations, topological expansions, and random matrices, Columbia University, New York,
  August 28 - September 1, 2017.
  Poster: "The smallest eigenvalue distribution of incomplete Laguerre Unitary Ensemble" .

- Graduate Summer School on Random Matrices at PCMI, Utah, Park city, June 25 - July 15, 2017.
  Poster: "The smallest eigenvalue distribution of incomplete Laguerre Unitary Ensemble" .

- School on "Quantum integrable systems, conformal field theories and stochastic processes" , Institut d'Études Scientifiques de Cargèse, Cargèse, France, September 12-23, 2016.
  Talk "Asymptotics of tau-function for Painlevé equations".

- Workshop "Moduli spaces, integrable systems, and topological recursions" , CRM, Montréal, Canada, January 9-13, 2016.
  Talk "Connection problem for the isomonodromic tau-function of the Sine-Gordon reduction of Painlevé-III equation".

- Workshop "Asymptotics in integrable systems, random matrices and random processes and universality" .
  In honour of Percy Deift's 70th birthday.
  CRM, Montréal, Canada, June 7-11, 2015.
  Poster "Connection problem for the tau-function of the Sine-Gordon reduction of Painlevé-III equation via the Riemann-Hilbert approach".

- 6th St. Petersburg Conference in Spectral Theory,
  dedicated to the memory of M. Sh. Birman.
  Russia, St. Petersburg, July, 3-8, 2014.
  Talk "Regularity of electromagnetic fields in nonsmooth domains".

- Crimean International Mathematical Conference.
  Ukraine, Crimea, Sudak, September 22 - October 4, 2013.
  Talk "Regularity of electromagnetic fields in nonsmooth domains".

- Annual International Conference "Days on Diffraction".
  Russia, St. Petersburg, May, 27-31, 2013.
  Talk "On absolute continuity of spectrum of the periodic Maxwell operator in a cylinder."

- The Twenty Third Crimean Autumn Mathematical School-Symposium.
  Ukraine, Crimea, Laspi-Batiliman, September, 17-29, 2012.
  Talk "The Maxwell operator in the waveguide with periodic coefficients".