

# YULIA PETROVA. CURRICULUM VITAE

## PERSONAL DATA

---

NAME: Petrova Yulia (Iuliia) Petrovna  
DATE OF BIRTH: 29 June 1991, Ukhta, Russia (ex. USSR)  
  
CURRENT POSITION: Assistant Professor (Professora Adjunta), PUC-Rio  
Pontifícia Universidade Católica do Rio de Janeiro  
CURRENT ADDRESS: R. Marquês de São Vicente, 124 (room 854)  
Gávea, Rio de Janeiro, Brazil, 22451-040  
  
PHONE, EMAIL: +55 (21) 96 739 7394, yu.pe.petrova@yandex.ru  
HOMEPAGE: <https://yulia-petrova.github.io/>  
MARITAL STATUS: married, no children  
  
LAST CV UPDATE: 21/03/2023



## RESEARCH INTERESTS

---

- *Fluid dynamics*: multiphase flow in porous media, viscous/gravitational fingering phenomenon
- *Hyperbolic conservation laws*: Riemann problem, travelling and shock waves
- *Spectral theory*: asymptotics of eigenvalues for compact operators
- *Probability theory*: Gaussian processes, small ball probabilities
- *Industrial applications*: enhanced oil recovery (EOR) methods

## EDUCATION

---

Nov 2018 | PhD in Mathematics and Physics, St. Petersburg State University, Russia  
Supervisor: [Alexander I. Nazarov](#). PhD thesis: «Exact  $L_2$ -small ball asymptotics for finite-dimensional perturbations of Gaussian processes» (in Russian). [Short version](#) (in Russian)  
JUN 2013 | MSc in Mathematics, [chair of Mathematical Physics](#), St. Petersburg State University, Russia

## PROFESSIONAL EXPERIENCE

---

2023– PRESENT | Assistant Professor at [PUC-Rio](#) as a part of “Projeto Paz”, Rio de Janeiro, Brazil  
2021– 2023 | Postdoc of excellence at [Instituto de Matematica Pura e Aplicada \(IMPA\)](#)  
Rio de Janeiro, Brazil. Researcher at [Center PI](#), IMPA  
2017–2021 | Researcher at [Chebyshev laboratory](#), St. Petersburg State University, Russia  
Participant of industrial projects with PJSC «Gazprom Neft»  
2018–2021 | Teaching at [Department of Mathematics and Computer Science](#)  
St. Petersburg State University, Russia  
2014–2018 | Teaching at [Department of Mathematics and Information Technology](#)  
St. Petersburg Academic University, Russia  
2012–2015 | Teaching at [Institute of Physics, Nanotechnology and Telecommunications](#)  
St. Petersburg Polytechnic University, Russia

## RESEARCH AWARDS

---

2019 | [Laureat of the «Young Mathematician» prize of the St. Petersburg Mathematical Society](#)  
2018–2019 | [«Gazprom Neft» Scholarship](#)  
2018 | [Winner of 22nd Möbius Contest](#) in nomination «Undergraduates and graduates»  
2009 | [Euler Fellowship for undergraduate students](#)

## RECOMMENDATION LETTERS

---

- [Dan Marchesin](#), IMPA, Rio de Janeiro, Brazil ([marchesi@impa.br](mailto:marchesi@impa.br))
- [Alexander Nazarov](#), St. Petersburg department of PDMI, Russia ([al.il.nazarov@gmail.com](mailto:al.il.nazarov@gmail.com))
- [Mikhail Lifshits](#), St. Petersburg State University, Russia ([mikhail@lifshits.org](mailto:mikhail@lifshits.org))
- [Yalchin Efendiev](#), Texas A&M, USA ([yalchinrefendiev@gmail.com](mailto:yalchinrefendiev@gmail.com))

## RESEARCH GRANTS

---

- |           |  |
|-----------|--|
| 2021      | Co-principal investigator of the Russian Science Foundation grant 21-11-00047:<br>Stochastic processes and fields with application to data analysis                              |
| 2019–2021 | Participant of the Russian Science Foundation grant 19-71-30002:<br>Analysis, geometry, mathematical physics and applications  |
| 2019–2020 | Participant of the <a href="#">President grant MD-1791.2019.1</a> :<br>Parabolic equations describing displacement of viscous fluids in porous media and systems with hysteresis |
| 2017–2018 | Participant of Russian Science Foundation Grant 17-11-01003:<br>Asymptotic spectral analysis: gaps, near-threshold anomalies, “invisibility” and eigenvalues                     |
| 2016–2018 | Participant of RFBR Grant 16-01-00258a:<br>Approximation of stochastic processes and functionals of them   |
| 2013–2016 | Participant of St. Petersburg State University Grant 6.38.670.2013:<br>Partial Differential Equations and applications   |

## PATENT

---

- |      |   |
|------|---|
| 2022 | A. Groman, F. Bakharev, S. Tikhomirov, Y. Petrova, N. Rastegaev, A. Enin, K. Kalinin.<br><a href="#">Patent No. 2772808 C1 Russian Federation</a> , IPC E21B 43/16, C09K 8/58. Method for enhanced oil recovery: No. 2021133106: Appl. 11/15/2021 : publ. May 25, 2022 / applicant Limited Liability Company "Gazpromneft-Technological Partnerships". – EDN WLGWAU |
|------|---|

## RESEARCH PAPERS AND PREPRINTS

---

12. (with A. Nazarov)  *$L_2$ -small ball asymptotics for Gaussian random functions*. [Article in progress](#).
11. (with B. Plohr, D. Marchesin) *Vanishing adsorption admissibility criterion for contact discontinuities in the polymer model*. [arXiv:2211.10326](#).
10. (with F. Bakharev, A. Enin, N. Rastegaev) *Impact of dissipation ratio on vanishing viscosity solutions of the Riemann problem for chemical flooding model*. [arXiv:2111.15001](#). Accepted to Journal of Hyperbolic Differential Equations.
9. (with F. Bakharev, A. Enin, K. Kalinin, N. Rastegaev, S. Tikhomirov) *Optimal polymer slugs injection profiles*. Journal of Computational and Applied Mathematics, January 2023, p.115042; [doi:10.1016/j.cam.2022.115042](#). Version on [arXiv:2012.03114](#).
8. (with F. Bakharev, A. Enin, A. Groman, A. Kalyuzhnyuk, S. Matveenko, I. Starkov, S. Tikhomirov) *Velocity of viscous fingers in miscible displacement: Comparison with analytical models*. Journal of Computational and Applied Mathematics, March 2022; [doi:10.1016/j.cam.2021.113808](#).
7. (with S. Tikhomirov, F. Bakharev, A. Groman, A. Kalyuzhnyuk, A. Enin, K. Kalinin, N. Rastegaev) *Calculation of graded viscosity banks profile on the rear end of the polymer slug*. Paper SPE-206426-MS, SPE Russian Petroleum Technology Conference, October 2021; [doi:10.2118/206426-MS](#).
6.  *$L_2$ -small ball asymptotics for a family of finite-dimensional perturbations of Gaussian functions*. Zapiski Nauchnykh Seminarov POMI, vol. 501. Nikitin’s memorial volume, pp. 236–258, 2021. (In Russian). English version: [arXiv:1905.07804](#).
5. (with F. Bakharev, L. Campoli, A. Enin, S. Matveenko, S. Tikhomirov, A. Yakovlev) *Numerical investigation of viscous fingering phenomenon for raw field data*. Transport in Porous Media, 2020, pp. 1–22; [doi:10.1007/s11242-020-01400-5](#).
4. *On spectral asymptotics for a family of finite-dimensional perturbations of operators of trace class*. Doklady Math., 2018, vol. 98, №1, pp. 367–369; [doi:10.1134/S1064562418050204](#).
3. *Exact  $L_2$ -small ball asymptotics for some Durbin processes*. Zap. nauchn. sem. POMI, 2017, vol. 466, pp. 211–233. (In Russian) Translated: Journal of Mathematical Sciences (USA), 2020, 244(5), pp. 842–857; [doi:10.1007/s10958-020-04657-9](#).
2. *Spectral asymptotics for problems with integral constraints*. Mat. Zametki, 2017, vol. 102(3), pp. 405–414 (In Russian). Translated: Mathematical Notes, 2017, 102(3-4), pp. 369–377; [doi:10.1134/S0001434617090073](#).
1. (with A. I. Nazarov) *The small ball asymptotics in Hilbertian norm for the Kac–Kiefer–Wolfowitz processes*. Teor. Veroyatnost. i Primenen., 2015, Volume 60, Issue 3, Pages 482–505. Translated: Theory of Probability and its Applications, 2016, 60(3), pp. 460–480; [doi:10.1137/S0040585X97T987752](#).

## PARTICIPATION AT CONFERENCES & SCHOOLS

FEB 2023	<a href="#">Multiscale Analysis and Methods for Quantum and Kinetic Problems</a> . Singapore. Talk in junior researcher section: “Two tube model of miscible displacement: travelling waves and normal hyperbolicity”	Slides: <a href="#">.pdf</a> <a href="#">.pptx</a>
JAN 2023	<a href="#">13th Americas Conference on Diff. Equations and Nonlinear Analysis and ICMC Summer Meeting on Differential Equations</a> . São Carlos, Brazil. Invited speaker in section “Conservation Laws and Transport Equations”. “Two tube model of miscible displacement: travelling waves and normal hyperbolicity”	Slides: <a href="#">.pdf</a> <a href="#">.pptx</a>
OCT 2022	<a href="#">Conference IMPA 70 years &amp; International Conference on Dynamical Systems. Celebrating the 60th Birthday of Marcelo Viana</a> , Rio de Janeiro, Brazil	
JULY 2022	<a href="#">O.A. Ladyzhenskaya centennial conference on PDE's</a> . St. Petersburg, Russia. Online participation. “On the impact of dissipation ratio on vanishing viscosity solutions of Riemann problems for chemical flooding models”	Poster
JULY 2022	<a href="#">Hyperbolic Balance Laws &amp; Beyond</a> . Magdeburg, Germany	Poster
JUNE 2022	<a href="#">International Conference on Hyperbolic Problems (HYP)</a> . Malaga, Spain “On admissibility criteria for contact discontinuities in Glimm-Isaacson model arising in chemical flooding”	Slides
MAY 2022	<a href="#">Workshop: Branching systems, reaction-diffusion equations and population models</a> , Centre de recherches mathématiques (CRM), Montreal. Online.	
DEC 2021	International conference “Probabilistic methods in analysis”, in Sirius, Sochi, Russia. Plenary talk: “Small ball probabilities for Gaussian processes”	Slides
DEC 2021	<a href="#">Workshop: “Nonlinear PDEs and Modelling”</a> , St. Petersburg, Russia. Talk: “Looking for exact mixing velocities in miscible displacement: two-tube model”	Slides
AUG 2021	<a href="#">InterPore2021. Brazilian Chapter</a> .	Slides
JUNE 2021	<a href="#">InterPore2021. Online conference</a> . Talk: “Graded viscosity banks on the rear end of the polymer slug”	Slides
AUG 2019	<a href="#">Third ZiF Summer School</a> “Randomness in Physics and Mathematics” From Stochastic Processes to Networks. Bielefeld, Germany “Exact $L_2$ -small ball asymptotics for detrended Green Gaussian processes”	Poster
MAY 2019	<a href="#">Stochastic models II</a> . Euler Institute, St. Petersburg, Russia Talk: “Exact $L_2$ -small ball probabilities for Durbin processes”	Slides
JAN 2018	<a href="#">The third Indo-Russian meeting in probability and statistics</a> . Bangalore, India Talk: “Exact small ball asymptotics in $L_2$ -norm for finite-dimensional perturbations of Gaussian processes: spectral method”	Slides
DEC 2017	<a href="#">St. Petersburg winter conference on Probability Theory and Mathematical physics</a> . PDMI-MIAN. Talk: “On exact spectral asymptotics of finite-dimensional perturbations of integral operators of trace class”	Slides
JUNE 2017	<a href="#">Symposium on Probability Theory and Random Processes</a> , St. Petersburg “Exact $L_2$ -small ball asymptotics for perturbations of Brownian bridge”	Slides
APRIL 2017	<a href="#">International conference on partial differential equations</a> Silkroad Mathematics Center series international conferences. Beijing, China “Spectral asymptotics in some problems with integral constraints”	Poster
JUNE 2016	<a href="#">Days of Diffraction-2016</a> , St. Petersburg, Russia Talk: “Spectral asymptotics in some problems with integral constraints”	Slides
MAY 2016	<a href="#">The 2nd Russian-Indian Joint Conference in Statistics and Probability</a> . Talk: “Small ball asymptotics for detrended Green Gaussian processes”	Slides
SEPT 2015	<a href="#">Yu.V.Linnik Centennial Conference</a> , St. Petersburg, Russia Talk: “The $L_2$ -small ball asymptotics for the Kac-Kiefer-Wolfowitz processes”	
JULY 2015	<a href="#">7th St.Petersburg Conference in Spectral Theory</a> Talk: “Asymptotics of eigenvalues for some integro-differential operators”	Slides
JULY 2014	<a href="#">Students school on PDEs and Geometric Measure Theory</a> , CIME, Italy	
JULY 2010	<a href="#">XIII Diffiety School on Mathematics</a> , Santo Stefano del Sole, Italy	
JULY 2009	<a href="#">XII Diffiety School on Mathematics</a> , Santo Stefano del Sole, Italy	

## INVITED TALKS AT SEMINARS (2020-2023)

MARCH 2023	<a href="#">Q.T.P. seminar at PUC-Rio (Que Termina em Pizza)</a> , Rio, Brazil. Seminar organizer: Lorenzo J. Diaz. Talk: “Viscous fingering: theory and applications”	<a href="#">.pdf</a> <a href="#">.pptx</a>
NOV 2022	<a href="#">Oberseminar ”Nonlinear Dynamics” at Freie Universität Berlin</a> , Germany (joint talk with S.Tikhomirov). Seminar organizers: Bernold Fiedler, Isabelle Schneider, Eckehard Schöll, Matthias Wolfrum. Talk: “Two tube model of miscible displacement: travelling waves and normal hyperbolicity”	<a href="#">Slides</a>
JULY 2022	<a href="#">Seminário de Probabilidade at Instituto de Matemática</a> , UFRJ, Rio, Brazil. Seminar organizers: Giulio Iacobelli and Maria Eulalia Vares. Talk: “Small ball probabilities for Gaussian processes”	<a href="#">Slides</a>
JULY 2022	<a href="#">Seminário Luiz Adauto de Análise/EDP at Instituto de Matemática</a> , UFRJ, Rio, Brazil. Seminar organizer: Daniel Marroquin. Talk: “On chemical flooding models: Riemann problem solutions and viscous fingering phenomenon”	<a href="#">Slides</a>
MAY 2022	<a href="#">Oberseminar “Nonlinear Dynamics” WIAS Berlin</a> , Germany. Online. Seminar organizers: Bernold Fiedler, Isabelle Schneider, Eckehard Schöll, Matthias Wolfrum. Talk: “On the impact of dissipation ratio on vanishing viscosity solutions of Riemann problems for chemical flooding models”	<a href="#">Slides</a>
12 MAY 2022	<a href="#">2-do Encontro Mulheres Matematicas do IMPA</a> , Rio, Brazil. Online. Organizers: Claudia Lorena Duarte, Daniela Paiva Penuela, Zoraida Fernandez Rico. Sessão Temática - Dinâmica dos Fluidos.	<a href="#">Slides</a>
APRIL 2022	CeMEAI seminar at ICMC/USP in São Carlos, Brazil. Seminar organizer: Tiago Pereira. Talk: “On solutions of a Riemann problem for a chemical flooding model”	<a href="#">Slides</a>
APRIL 2022	Seminar of Applied and Computational Mathematics at IMPA, Rio, Brazil. Seminar organizers: Alexei Mailybaev, Dan Marchesin. Talk: “Toy model of viscous fingering”	<a href="#">Slides</a>
APRIL 2022	Seminar on Analisis and PDE at IMPA, Rio, Brazil. Seminar organizer: Felipe Linares. Talk: “On the impact of dissipation ratio on vanishing viscosity solutions of Riemann problems for chemical flooding models”	<a href="#">Slides</a>
MARCH 2022	Seminario das Mulheres IMPA, Rio, Brazil. Seminar organizer: Zoraida Fernandez-Rico. Talk: “Small ball probabilities for Gaussian Processes”	<a href="#">Slides</a>
MARCH 2022	Centro PI seminar at IMPA, Rio, Brazil. Seminar organizers: Roberto Imbuzeiro, Paulo Orenstein. Talk: “Oil Recovery: Fundamental research and Industrial applications”	<a href="#">Slides</a>
FEB 2022	<a href="#">Applied Math/PDE Seminar UC Davis</a> , California, USA. Online. Seminar organizers: Blake Temple, Steve Shkoller, Sameer Iyer. Talk: “On solutions of a Riemann problem for a chemical flooding model”	<a href="#">Slides</a>
NOV 2021	<a href="#">Gabriel Lame Chair Seminar at Chebyshev Laboratory</a> , St. Petersburg, Russia. Online. Seminar organizer: Jean-Michel Roquejoffre. Talk: “On the impact of diffusion ratio on vanishing viscosity solutions of Riemann problems for chemical flooding models”	<a href="#">Slides</a>
OCT 2021	<a href="#">Seminario de EDP e Matematica Aplicada</a> . Online. Seminar organizers: Juan Limaco, Mauro Rincon, Max Souza, Marcelo Calvacanti. Talk: “Admissibilidade das descontinuidades de contato: aplicação para recuperação melhorada de petróleo” (in Portuguese)	
MAY 2021	Colloquium of Industrial Projects at Chebyshev Laboratory, St. Petersburg, Russia. Organizer: Sergey Tikhomirov. Talk: “On mathematical results in Enhanced Oil Recovery project” (in Russian)	<a href="#">Slides</a>
FEB 2020	Student colloquium at Chebyshev Laboratory, St. Petersburg, Russia. Talk: “Mathematical models describing the process of oil recovery”	
JAN 2020	<a href="#">Seminar “Industrial mathematics”</a> at Chebyshev Laboratory, St. Petersburg, Russia. organizers: Fedor Bakharev, Sergey Tikhomirov, Yulia Petrova, Slava Borovitskiy. Talk: “On the solution of the Riemann problem for a hyperbolic system of conservation laws simulating the injection of a polymer into an oil reservoir” (in Russian)	

## TEACHING EXPERIENCE

---

SPRING 2023	Lecture course “Shock waves in conservation laws and reaction-diffusion equations” Department of Mathematics, PUC-Rio, Rio de Janeiro, Brazil		
SPRING 2021	Problem solving classes, calculus of variations for mathematicians Faculty of Mathematics and Computer Science St. Petersburg State University	<a href="#">Materials (rus)</a>	<a href="#">Students reviews</a>
FALL 2020	Problem solving classes, probability theory for mathematicians Faculty of Mathematics and Computer Science St. Petersburg State University	<a href="#">Materials (rus)</a>	<a href="#">Students reviews</a>
SPRING 2020	Problem solving classes, complex analysis Faculty of Mathematics and Computer Science St. Petersburg State University	<a href="#">Materials (rus)</a>	<a href="#">Students reviews</a>
2018–2019	Problem solving classes, calculus (I, II, III, IV semesters) Faculty of Mathematics and Computer Science St. Petersburg State University	<a href="#">Materials (rus)</a>	<a href="#">Students reviews</a>
JAN 2019	Lecturer of the course «Random walks» in <a href="#">Educational Program in mathematics and computer science</a> at «Sirius», Sochi, Russia		
NOV 2019	Assistant to the course «Dynamical systems» in COMSATS University Islamabad, Lahore Campus, Pakistan. <a href="#">ICTP-CUI Visiting Scholars Program for Training and Research in Math</a>		
2014–2018	Problem solving classes, calculus (I, II, III, IV semesters) for physicists. St. Petersburg Academic University	<a href="#">Materials III, IV</a>	
2012–2014	Problem solving classes, PDEs for physicists St. Petersburg Polytecnic University		
2012–2017	Teaching <i>Olympiad Mathematics</i> in “ <a href="#">Formulo de Integreco</a> ”, International educational center for gifted high-school students.	<a href="#">Materials (eng)</a>	

## ADDITIONAL EXPERIENCE

---

Organizational:	<ul style="list-style-type: none"> <li>co-organizer of seminar “Applied and Computational Mathematics” at IMPA</li> <li>co-organizer of the seminar <a href="#">«Industrial Mathematics»</a> from Feb 2019 till Feb 2022 at Chebyshev Laboratory, St. Petersburg, Russia. See also <a href="#">YouTube</a></li> </ul>
Industrial:	I was a part of a long-term industrial project in Chebyshev Laboratory on Enhanced Oil Recovery (EOR) methods jointly with petroleum company «Gazprom Neft» in 2018–2021 in St. Petersburg, Russia
Teamwork:	I have experience working in a team of 13 people (2 professors, 6 mathematicians from students to postdocs, 3 numerical modellers, 1 chemist, 1 physicist) and leading a subproject of 5 people. Usually I am the leader of the group of 2-3 people
Programming:	COMSOL Multiphysics, Matlab, Git, basics of Python. Among numerical methods I worked with FEM, FVM, FDM
Adaptivity:	I easily adapt to different countries. I have been to almost all European countries, India, China, Pakistan, Egypt, Mexico. Now I am a postdoc in Brazil
Olympiads:	At school I frequently was the winner of city olympiads in maths, physics, chemistry and informatics. Several times I was the winner of math olympiad of republic level. I was actively teaching olympiad mathematics during my university studies
Thesis committee:	PhD thesis: Júlia Domingues Lemos (IMPA, 2022). Master thesis: Giulia Carvalho Fritis (UFJF, 2023), Temirlan Abildaev (SPSU, 2020). Bachelor thesis: Alexander Tarasov (SPbSU, 2019), Tatyana Moseeva (SPSU, 2020).

## LANGUAGES

---

RUSSIAN:	Native speaker
ENGLISH:	Fluent
PORTUGUESE:	Proficient. <a href="#">Avançado superior na preparação Celpe-Bras</a> , October 2022
SPANISH:	Proficient. Intermediate talking, proficient reading and writing