Denis A. Silantyev

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EDUCATION

PhD (with distinction) in Applied Math	**Dec 2017**
The University of New Mexico (UNM)	GPA 4.10

Thesis "Nonlinear waves, instabilities and singularities in plasma and hydrodynamics"
Adviser – Pavel Lushnikov (http://math.unm.edu/~plushnik/)

MS in Applied Math	**July 2011**
The University of New Mexico (UNM)	GPA 4.03
MS (with distinction) in System Analysis and Management	**June 2009**
The Moscow Institute of Physics and Technology (MIPT), Moscow, Russia	GPA 3.90
BS (with distinction) in Applied Mathematics and Physics	**June 2007**
The Moscow Institute of Physics and Technology (MIPT), Moscow, Russia	GPA 3.95

RESEARCH INTERESTS

- Nonlinear wave dynamics, instabilities and collapses in optics, plasma and hydrodynamics
- Plasma kinetics and rarefied gas dynamics
- Laser-plasma interaction, laser fusion
- Free surface hydrodynamics
- Numerical methods including spectral methods, adaptive and nonuniform grids, multi-precision computations (see Multiprecision FFT benchmarks), Monte Carlo, PIC methods
- Scientific computing, high-performance computing (HPC)
- Pattern formation in nonlinear optics, thermodynamics and biology
- Multi-agent systems, social systems

RESEARCH EXPERIENCE

Postdoctoral Associate	**Sep 2017**
Courant Institute, New York University (NYU), New York City, NY	**- Present**

- Researched accelerated Monte Carlo methods for plasma kinetics and rarefied gas dynamics including negative mass particle methods, variance reduction techniques and optimization problems; designed codes and performed numerical simulations
- Investigated how to combine conformal maps and numerical tools that analyze the structure of complex singularities of PDE solutions to accelerate spectral numerical methods for solving PDEs with high efficiency and precision
- Designed algorithms and performed numerical simulations of weak nonlinear wave turbulence in 2D Nonlinear Schrödinger Equation (NLSE)

Research Assistant	**Aug 2010**
The University of New Mexico (UNM), Albuquerque, NM	**- June 2017**

- Designed algorithms and codes to simulate collapse dynamics for various versions of Nonlinear Schrödinger Equation (NLSE), laser-plasma interaction and Langmuir waves filamentation
- Analyzed instabilities in nonlinear optics and plasma
- Investigated water waves solutions' analytical structure with analytic and numerical methods
- Performed numerical simulations and analysis in preparation for grant submissions on collapse dynamics, quantum field effects for Bose-Einstein condensation, and Langmuir waves

filamentation in plasmas
- Research was supported by **NSF DMS, NSF PHY and DOE grants** (PI Pavel Lushnikov)

Research Assistant   **Aug 2010**
The New Mexico Consortium (NMC), Los Alamos, NM   **- Dec 2013**
- Designed and implemented efficient numerical algorithms for solving Vlasov-Poisson multi-dimensional system and its reduced form
- Performed simulations to analyze laser-plasma interaction, transverse instabilities and Langmuir wave collapse

Summer Research Internship   **July 2013**
The New Mexico Consortium (NMC), Los Alamos, NM   **-Aug 2013**
- Analyzed properties and instabilities of the reduced Vlasov-Poisson multi-dimensional model proposed by Harvey Rose at Los Alamos
- Designed algorithms and codes for numerical simulations of the model and performed simulations to analyze model's properties, transverse instabilities and Langmuir wave collapse

TEACHING EXPERIENCE

Postdoctoral Associate   **Sep 2017**
Courant Institute, New York University (NYU), New York City, NY   **- Present**
- Taught Algebra&Calculus (115 students), Calculus III (32 and 35 students)
- Prepared and graded exams, quizzes and homework assignments
- Used online tools such as WebAssign, GradeScope, Zoom and NYUClasses (Sakai) to teach, manage and organize classes and provide a weekly feedback to students

Teaching Assistant   **Jan 2010**
The University of New Mexico (UNM), Albuquerque, NM   **- June 2017**
- Taught Calculus I, Elements of Calculus I (60+ students), and Applied ODEs (30+ students)
- Tutored Calculus and Statistics classes
- Graded HWs for 300-500 level math classes including all 500 level courses aimed to prepare graduate student for qualifying exams (Real/Complex/Numerical Analysis, ODE/PDE)
- Prepared and graded exams, quizzes and homework assignments
- Helped students at the Calculus Table and office hours

AWARDS, RECOGNITIONS AND CERTIFICATES

- **Best Student Paper Award at The 10th IMACS International Conference on Nonlinear Evolution Equations and Wave Phenomena, University of Georgia, Athens, GA (2017)**
- Conference Travel Award from Graduate Student Association UNM (2017)
- Travel Award from ICERM for a Semester Program on "Singularities and Waves In Incompressible Fluids" at ICERM Brown University, Providence, RI (2017)
- SIAM Graduate Student Travel Award (2016)
- Student Conference Award Program (S-CAP) from Office of Career Services UNM (2016)
- Doctoral Conference Presentation Award from Office of Graduate Studies UNM (2016)
- Conference Travel Award from Graduate and Professional Student Association UNM (2016)
- **Outstanding Graduate Student Award from Math.&Stat. Department of UNM (2016)**
- Travel Award for IMA Workshop "Mathematical and Physical Models of Nonlinear Optics " from Institute For Mathematics And Its Applications, University of Minnesota, Minneapolis, MI (2016)
- Travel Award for 2015 TexAMP Conference, University of Texas at Dallas
- Travel Award for IMACS Wave-2015 Conference, University of Georgia, Athens, GA
- Travel Award for IMACS Wave-2013 Conference, University of Georgia, Athens, GA
- UNM Certificates "Responsible Conduct of Research" (2013) and "Teaching Excellence" (2010)
- Best scientific research award at All-Russian youth scientific conference "Modern problems of fundamental and applied sciences" (2009)
- Multiple awards in high school math and physics competitions including 2nd Prize in All-Russian physics competition and 1st Prize in Moscow regional physics competition (2002-2004)

SCIENTIFIC PUBLICATIONS

1. Russ E. Caflisch, Denis A. Silantyev, Yunan Yang. Adjoint DSMC for nonlinear Boltzmann equation constrained optimization. Submitted to *the Journal of Computational Physics* (2020) (https://arxiv.org/abs/2009.01363)

2. Pavel M. Lushnikov, Denis A. Silantyev, Michael Siegel. Collapse vs. blow up and global existence in the generalized Constantin-Lax-Majda equation. Submitted to *the Journal of Nonlinear Science* (2020). (https://arxiv.org/abs/2010.01201)

3. Denis A. Silantyev, Pavel M. Lushnikov, Harvey A. Rose. Langmuir wave filamentation in the kinetic regime. I. Transverse instability of Bernstein-Greene-Kruskal modes and multidimensional Vlasov simulations. *Physics of Plasmas,* **v. 24**, 042104 (2017); DOI: 10.1063/1.4979289 (https://arxiv.org/abs/1610.06137)

4. Denis A. Silantyev, Pavel M. Lushnikov, Harvey A. Rose. Langmuir wave filamentation in the kinetic regime. II. Weak and Strong Pumping of Nonlinear Electron Plasma Waves as the Route to Filamentation. *Physics of Plasmas,* **v. 24**, 042105 (2017); DOI: 10.1063/1.4979290 (https://arxiv.org/abs/1610.10071)

5. Pavel M. Lushnikov, Sergey A. Dyachenko, Denis A. Silantyev. New conformal mapping for adaptive resolving of the complex singularities of Stokes wave, *Proc. Roy. Soc. A,* **v. 473**, 2202, (2017) DOI: 10.1098/rspa.2017.0198 (https://arxiv.org/abs/1703.06343) (http://stokeswave.org/)

6. Pavel M. Lushnikov, Harvey A. Rose, Denis A. Silantyev, Natalia Vladimirova. Vlasov multi-dimensional model dispersion relation. *Physics of Plasmas*, **v. 21**, 072103 (2014). DOI: 10.1063/1.4886122 (https://arxiv.org/abs/1311.6438)

7. Denis A. Silantyev. Diffusion influence in movement of the big mass of people. *The proceedings of the 52nd scientific MIPT conference «Modern problems of fundamental and applied sciences»*, Part XI, Moscow, MIPT, 37-40 (2009) https://mipt.ru/upload/05b/11-FIBS-arpg5tlxag0.pdf

8. Albert Yu. Silantyev, Denis A. Silantyev. Imitating Stochastic Modeling of Crowd Movement. *Control Systems and Information Technology,* **vol.2(14)**, 84-86 (2004) http://www.sbook.ru/suit/contents/040200.pdf

   Also published in the electronic scientific journal "*Systems Engineering*", **vol. 2**, (2004) http://systech.miem.edu.ru/2004/n2/Silantiev2.htm

PUBLICATIONS IN PREPARATION

1. Denis A. Silantyev, Pavel M. Lushnikov. Elliptic conformal mapping for adaptive resolving of the complex singularities of Stokes wave

2. Russ E. Caflisch, Lorenzo Pareschi, Denis A. Silantyev. Control variate Monte Carlo methods for homogeneous kinetic equations

3. Denis A. Silantyev, Russ E. Caflisch. Particle simulation of Coulomb collisions: Comparing numerical methods of Takizuka & Abe vs. Nanbu vs. Bobylev & Nanbu

4. Sergey A. Dyachenko, Vera M. Hur, Denis A. Silantyev. On the maximal angle on the free surface of the stokes wave with constant vorticity

5. Denis A. Silantyev. Exact harmonic BGK solutions of Vlasov-Poisson system

CONFERENCES AND INVITED TALKS

1. *Obtaining Stokes wave with high-precision using conformal maps and spectral methods on non-uniform grids,* Applied Math Colloquium, New Jersey Institute of Technology, Jan 12 2021 (invited talk)

2. *Generalized Constantin-Lax-Majda equation: Collapse vs. blow up and global existence.* Courant Institute, NYU, NY, Dec 17 2020 (Modeling & Simulation seminar talk)

3. *Exploring electron plasma waves via numerical simulations*, Seminar at The Laboratory for Laser Energetics (LLE) of the University of Rochester, NY, Dec 2020 (invited talk)

4. *Speeding up spectral numerical solutions of ODEs and PDEs with near-singular solutions via conformal maps.* Courant Institute, NYU, NY, May 09 2019 (Modeling & Simulation seminar talk)

5. *A Monte Carlo method with negative particles for Coulomb collision.* Direct Simulation Monte Carlo 2019 Conference, Santa Fe NM, Sep 22-25 2019 (invited talk)

6. *Powerful conformal maps for adaptive resolving of the complex singularities of Stokes wave.* 11th IMACS International Conference on Nonlinear Waves, University of Georgia, Athens, GA, Apr 17-19 2019 (session organizer + invited talk)

7. *Powerful conformal maps for adaptive spectral resolving of the complex singularities of Stokes wave,* Applied Math Days 2019, Rensselaer Polytechnic Institute, Apr 17-19 2019 (invited talk)

8. *Obtaining Stokes wave with high-precision using conformal maps and spectral methods on non-uniform grids,* Analysis Physics Logic Seminar, Virginia Commonwealth University, Jan 25 2019 (invited talk)

9. *Nonlinear Langmuir wave filamentation in the kinetic regime,* SIAM NWCS 2018 Conference (Nonlinear Waves and Coherent Structures), Orange County, CA, June 11-14 2018 (session organizer + invited talk)

10. *Computing Stokes wave with high-precision.* Courant Institute, NYU, NY, Feb 15 2018 (Modeling & Simulation seminar talk)

11. *Langmuir wave filamentation in the kinetic regime and multidimensional Vlasov simulations.* Shared Knowledge Conference, University of New Mexico, NM, Arp 6 2017 (poster)

12. *Langmuir wave filamentation in the kinetic regime and multidimensional Vlasov simulations.* 10th IMACS International Conference on Nonlinear Waves, University of Georgia, Athens, GA, 2017 (invited talk)

13. *Langmuir wave filamentation in the kinetic regime.* 58th Annual Meeting of the APS Division of Plasma Physics, San Jose, CA, Oct 31 2016 (poster)

14. *Transverse Instability of Electron Plasma Waves. Direct 2+2D Vlasov simulations.* Rensselaer Polytechnic Institute (RPI), Troy, NY, Aug 11 2016 (invited applied math colloquium talk)

15. *Transverse instability of electron plasma waves study via direct 2+2D Vlasov simulations.* 2016 SIAM Conference on Nonlinear Waves and Coherent Structures, Drexel University in Philadelphia, PL, Aug 8-11 2016 (invited talk)

16. The 11th AIMS Conference on Dynamical Systems, Differential Equations and Applications, Orlando, FL, July 1-5 2016 (invited talks)
    a. *Obtaining Stokes wave with high-precision using conformal maps and spectral methods on non-uniform grids.*
    b. *Transverse instability of electron plasma waves study via direct 2+2D Vlasov simulations.*

17. *Transverse Instability of Electron Plasma Waves. Direct 2+2D Vlasov simulations.* University of New Mexico (UNM), Albuquerque, NM, Apr 18 2016 (applied math colloquium talk)

18. *Obtaining Stokes wave with high-precision using conformal maps and spectral methods on non-uniform grids.* TexAMP 2015, University of Texas at Dallas, TX, Nov 6-8 2015 (poster)

19. *Removing the complex singularity from a Stokes wave.* 9th IMACS International Conference on Nonlinear Waves, University of Georgia, Athens, GA, Apr 1-4 2015 (invited talk)

20. *Langmuir waves self-focusing and kinetic effects in plasma.* AMS Sectional Meeting AMS Special Session on Nonlinear waves and singularities in water wave, optics and plasmas, University of New Mexico, NM, Apr 5-6 2014 (invited talk)

21. *Vlasov-Poisson model and its reduction for laser-plasma 2D simulation.* 8th IMACS International Conference on Nonlinear Waves, University of Georgia, Athens, GA, Mar 24-27 2013 (invited talk)

22. *Vlasov-Poisson model and its reduction for laser-plasma 2D simulation.* AMS Meeting #1089 Spring Western Sectional Meeting, University of Colorado Boulder, Boulder, CO, Apr 13-14 2013 (invited talk)

23. *Reduced Vlasov-Poisson model and its instabilities.* AMS Sectional Meeting AMS Special Session, University of Arizona, Tucson, AZ, Oct 27-28 2012 (invited talk)

24. *Reduced Vlasov-Poisson model and its instabilities.* 6ᵗʰ International Conference «SOLITONS, COLLAPSES AND TURBULENCE: Achievements, Developments and Perspectives», Novosibirsk, Russia, June 5-8 2012 (invited talk)

25. *Reduced Vlasov-Poisson model and its instabilities.* XX Scientific Session of the RAS Council on Nonlinear Dynamics, Institute of Oceanology, Russia, Dec 26 2011 (poster)

26. *Reduced Vlasov-Poisson model and its instabilities.* Workshop on Recent Progress of Waves Processes in Nature, University of Arizona, Tucson, AZ, Oct 7-9 2011 (invited talk)

27. *Crowded movement modeling.* All-Russian youth scientific conference "Modern problems of fundamental and applied sciences", Moscow Institute of Physics and Technology, Russia, 2009 (invited talk)