

# Nikolai V. Priezjev

ASSISTANT PROFESSOR

## PERSONAL

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## EDUCATION

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*Brown University*

**Ph. D. in Physics**, 2002

- Thesis title: "Simulations of nematic liquid crystals: confined geometries, phase transitions and topological defects". Thesis advisor: Prof. Robert A. Pelcovits

**M. S. in Physics**, 1999

*Moscow Institute of Physics and Technology (MIPT)*

**B. S. in Physics and Applied Mathematics**, 1997

## RESEARCH INTERESTS

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*Michigan State University, Department of Mechanical Engineering, 2005-present*

**Assistant Professor**

- Molecular simulations of complex fluids, interfacial phenomena, slip boundary conditions, transport phenomena in micro and nanofluidic systems, thermocapillary fluid motion, hybrid multiscale methods, liquid crystals, and statistical mechanics.

*Princeton University, Department of Chemical Engineering, 2002-2005*

**Research Associate**

- Transport phenomena in micro- and nanofluidic systems: slip at the liquid/solid interface, thermocapillary fluid motion, dynamical and structural properties of confined fluids.

*Brown University, Physics Department, 1997-2002*

**Research Assistant**

- Theoretical soft condensed matter physics with emphasis on liquid crystals. Numerical techniques such as Monte Carlo and molecular dynamics simulations were used to study a variety of problems involving nematic liquid crystals: phase transitions, coarsening dynamics, effect of confined geometries and topological defects.
- Systems with quenched random disorder. Methods from combinatorial optimization were implemented to find exact ground states of the strongly screened vortex glass model.

## Reviewed journal papers:

1. N. V. Priezjev, "Shear rate threshold for the onset of boundary slip in dense polymer films", manuscript in preparation (2008).
2. A. Niavarani and N. V. Priezjev, "The effective slip length and vortex formation in laminar flow over a rough surface", submitted to *Physics of Fluids* (2008). (Preprint is available at <http://arxiv.org/abs/0810.1552>).
3. A. Niavarani and N. V. Priezjev, "Rheological study of polymer flow past rough surfaces with slip boundary conditions", *Journal of Chemical Physics* **129**, 144902 (2008).
4. A. Niavarani and N. V. Priezjev, "Slip boundary conditions for shear flow of polymer melts past atomically flat surfaces", *Physical Review E* **77**, 041606 (2008).
5. N. V. Priezjev, "Effect of surface roughness on rate-dependent slip in simple fluids", *Journal of Chemical Physics* **127**, 144708 (2007).
6. N. V. Priezjev, "Rate-dependent slip boundary conditions for simple fluids", *Physical Review E* **75**, 051605 (2007).
7. N. V. Priezjev and S. M. Troian, "Nanodroplet migration by thermal tuning of the liquid-solid interfacial tension", to be submitted to *Physical Review E* (2008).
8. N. V. Priezjev and S. M. Troian, "Influence of periodic wall roughness on the slip behaviour at liquid/solid interfaces: molecular scale simulations versus continuum predictions", *Journal of Fluid Mechanics* **554**, 25 (2006).
9. N. V. Priezjev, A. A. Darhuber and S. M. Troian, "Slip behavior in liquid films on surfaces of patterned wettability: Comparison between continuum and molecular dynamics simulations", *Physical Review E* **71**, 041608 (2005).
10. N. V. Priezjev and S. M. Troian, "Molecular origin and dynamic behavior of slip in sheared polymer films", *Physical Review Letters* **92**, 018302 (2004).
11. N. Akino, C. Giardina, J. M. Kosterlitz, and N. V. Priezjev, "Numerical study of random superconductors", *Physica C* **408**, 484 (2004).
12. C. Giardina, N. V. Priezjev and J. M. Kosterlitz, "Strongly screened vortex lattice model with disorder" (2003). (Preprint is available at <http://arxiv.org/abs/cond-mat/0202487>).
13. N. V. Priezjev, G. Skacej, R. A. Pelcovits, and S. Zumer, "External and intrinsic anchoring in nematic liquid crystals: A Monte Carlo study", *Physical Review E* **68**, 041709 (2003).
14. I. Amimori, N. V. Priezjev, R. A. Pelcovits, and G. P. Crawford, "Optomechanical properties of stretched polymer dispersed liquid crystal films for scattering polarizer applications", *Journal of Applied Physics* **93**, 3284 (2003).
15. P. A. Kosyrev, J. Qi, N. V. Priezjev, R. A. Pelcovits, and G. P. Crawford, "Virtual surfaces, director domains and the Fréedericksz transition in polymer stabilized nematic liquid crystals", *Applied Physics Letters* **81**, 2986 (2002).
16. N. V. Priezjev and R. A. Pelcovits, "Coarsening dynamics of biaxial nematic liquid crystals", *Physical Review E* **66**, 051705 (2002).
17. N. V. Priezjev and R. A. Pelcovits, "Disclination loop behavior near the nematic-isotropic phase transition", *Physical Review E* **64**, 031710 (2001).

18. N. V. Priezjev and R. A. Pelcovits, "Cluster Monte Carlo simulations of the nematic-isotropic phase transition", *Physical Review E* **63**, 062702 (2001).
19. N. V. Priezjev and R. A. Pelcovits, "Surface extrapolation length and director structures in confined nematics", *Physical Review E* **62**, 6734 (2000).

#### Proceedings:

1. P. A. Kossyrev, J. Qi, N. V. Priezjev, R. A. Pelcovits, and G. P. Crawford, "Modeling electro-optic performance in polymer stabilized nematic liquid crystal display configurations", *Asian Symposium on Information Display 2002 Proceedings* **7**, 371-374 (2002).
2. P. A. Kossyrev, J. Qi, N. V. Priezjev, R. A. Pelcovits, and G. P. Crawford, "Model of Fréedericksz transition and hysteresis effect in polymer stabilized nematic liquid crystal configurations for display applications", *Society for Information Display Digest* **32**, 506-509 (2002).
3. I. Amimori, J. N. Eakin, N. V. Priezjev, R. A. Pelcovits, and G. P. Crawford, "Optical and mechanical properties of stretched PDLC films for scattering polarizers", *Society for Information Display Digest* **33**, 834-837 (2002).

#### PRESENTATIONS

*(underline indicates presenter)*

#### Talks at conferences and seminars:

1. A. Niavarani and N. V. Priezjev, "*The effective slip length and vortex formation in laminar flow over a rough surface*", APS 61<sup>st</sup> DFD Meeting, Session AN: Micro Fluids I, San Antonio, TX, November 23, 2008.
2. N. V. Priezjev and A. Niavarani, "*Velocity-dependent friction at the interface between a polymer melt and a solid substrate: A molecular dynamics study*", AIChE Meeting, Session #562 Solid-Liquid Interfaces, Philadelphia, PA, November 19, 2008.
3. N. V. Priezjev, "*Slip boundary conditions for shear flow of simple fluids and polymer melts past atomically smooth surfaces: A molecular dynamics study*", University of Michigan, Complex Fluids Seminar, April 18, 2008.
4. N. V. Priezjev and A. Niavarani, "*Velocity-dependent friction coefficient at the interface between a polymer melt and a solid substrate*", APS March Meeting, Session J9, Fluid Structure and Properties, New Orleans, LA, March 11, 2008.
5. A. Niavarani and N. V. Priezjev, "*Slip behavior of the confined polymer melt near periodically roughened surface: comparison between molecular dynamics and continuum simulations*", APS March Meeting, Session D18, Polymers at Surfaces, New Orleans, LA, March 10, 2008.
6. N. V. Priezjev and A. Niavarani, "*Molecular dynamics simulations of the shear-rate-dependent slip length in thin liquid films*", APS 60<sup>th</sup> DFD Meeting, Session EN, Nano- Fluids, Salt Lake City, Utah, November 18, 2007.
7. A. Niavarani and N. V. Priezjev, "*Slip behavior of the confined polymer melt near periodically roughened surface: comparison between molecular dynamics and continuum simulations*", APS 60<sup>th</sup> DFD Meeting, Session KA, Micro Fluids, Salt Lake City, Utah, November 20, 2007.
8. N. V. Priezjev, "*To slip or not to slip?*", George Mason University, College of Science Seminar, Department of Mathematics, April 12, 2007.

9. N. V. Priezjev, “*Slip behavior at liquid/solid interfaces: Comparison between continuum and molecular dynamics simulations*”, University of Michigan–Dearborn, Department of Mechanical Engineering, March 30, 2007.
10. N. V. Priezjev, “*Effect of surface roughness on shear-rate-dependent slip flow of simple fluids*”, APS March Meeting, Session U29: Suspensions and Fluid Dynamics, Denver, CO, March 8, 2007.
11. N. V. Priezjev, “*Effect of surface roughness on shear-rate-dependent slip flow of simple fluids*”, APS 59<sup>th</sup> DFD Meeting, Session KC, Microfluidics, Tampa, FL, November 20, 2006.
12. N. V. Priezjev, “*Influence of surface conditions on the slip behavior at liquid/solid interfaces: Comparison between continuum and molecular dynamics simulations*”, Michigan State University, Applied and Interdisciplinary Mathematics Seminar, November 14, 2006.
13. N. V. Priezjev, “*Influence of surface conditions on the slip behavior at liquid/solid interfaces: Comparison between continuum and molecular dynamics simulations*”, Michigan State University, CMP Seminar, Physics Department, October 9, 2006.
14. A. A. Darhuber, N. V. Priezjev and S. M. Troian, “*Slip behavior at liquid/solid interfaces: hydrodynamic predictions versus molecular-dynamics simulations*”, 5<sup>th</sup> International Symposium on contact angle, wettability and adhesion, Session on Colloids, Powders and Droplets: Fractal and Wetting Aspects, Toronto, Canada, June 21, 2006.
15. N. V. Priezjev and S. M. Troian, “*Source of shear-dependent slip at liquid/solid interfaces*”, APS March Meeting, Session: Microfluidics, Baltimore, MD, March 15, 2006.
16. N. V. Priezjev and S. M. Troian, “*Dynamic response of the slip length at liquid/solid interfaces*”, MRS Fall Meeting, Session N1: Dynamics in Small Confined Systems, Boston, MA, November 28, 2005.
17. N. V. Priezjev and S. M. Troian, “*Source of shear-dependent slip at liquid/solid interfaces*”, APS 58<sup>th</sup> DFD Meeting, Session FC, Microfluidics: Slip Flow, Chicago, IL, November 21, 2005.
18. N. V. Priezjev, “*Slip behavior in liquid nanoscale films: influence of molecular ordering, wall roughness and patterned surface energy*”, Michigan State University, Department of Chemical Engineering and Materials Science, October 13, 2005.
19. N. V. Priezjev, “*Slip behavior in liquid nanoscale films: influence of molecular ordering, wall roughness and patterned surface energy*”, Northwestern University, Department of Engineering Sciences and Applied Mathematics, September 30, 2005.
20. N. V. Priezjev, “*Slip behavior in liquid nanoscale films: influence of molecular ordering, wall roughness and patterned surface energy*”, University of Michigan, Complex Fluids Seminar, September 21, 2005.
21. N. V. Priezjev, “*Slip behavior in liquid nanoscale films: influence of molecular ordering, wall roughness and patterned surface energy*”, Michigan State University, Department of Mechanical Engineering, May 6, 2005.
22. N. V. Priezjev, “*Slip behavior in liquid nanoscale films: influence of molecular ordering, wall roughness and patterned surface energy*”, APS March Meeting, Session U6, Physics of Slip Phenomena at Liquid/Solid Interfaces, Los Angeles, CA, March 24, 2005.
23. N. V. Priezjev, “*Slip behavior in liquid nanoscale films: influence of molecular ordering, wall roughness and patterned surface energy*”, Brown University, Physics Department, April 21, 2005.

24. N. V. Priezjev and S. M. Troian, “*Droplet migration by modulation of the liquid-solid interfacial energy*”, APS 57<sup>th</sup> DFD Meeting, Session KP, Surface Tension, Seattle, WA, November 23, 2004.
25. N. V. Priezjev, A. A. Darhuber and S. M. Troian, “*Slip flow on surfaces of mixed wettability: comparison between continuum and molecular dynamics simulations*”, APS 57<sup>th</sup> DFD Meeting, Session AC, Microfluid Dynamics: Micropatterned Surfaces and Wettability, Seattle, WA, November 21, 2004.
26. A. A. Darhuber, N. V. Priezjev and S. M. Troian, “*Microfluidic drag reduction mediated by superhydrophobic surfaces*”, SPIE Optics East Symposium, Philadelphia, October 25–28, 2004.
27. N. V. Priezjev and S. M. Troian, “*Origin of slip phenomena in sheared nanoscale films*”, 8<sup>th</sup> Complex Fluids Symposium, Princeton University, PMI, May 1, 2004.
28. N. V. Priezjev and S. M. Troian, “*Droplet propulsion by thermal modulation of the liquid-solid interfacial energy*”, APS March Meeting, Session V22, Complex Fluids, Montreal, Canada, March 25, 2004.
29. N. V. Priezjev, A. A. Darhuber and S. M. Troian, “*Effect of hydrophobically patterned substrates on the slip behavior of liquids subject to planar shear*”, APS March Meeting, Session W34, Multiscale Phenomena for Fluids and Solids, Montreal, Canada, March 25, 2004.
30. N. V. Priezjev and S. M. Troian, “*Influence of surface corrugation on the slip length in sheared liquid films*”, APS March Meeting, Session S22, Fluid Dynamics and Properties, Montreal, Canada, March 24, 2004.
31. N. V. Priezjev and S. M. Troian, “*Molecular origin and dynamic behavior of slip in short polymer films*”, APS 56<sup>th</sup> DFD Meeting, Session on Computational Fluid Dynamics, Meadowlands, NJ, November 25, 2003.
32. N. V. Priezjev and S. M. Troian, “*Influence of surface boundary curvature and local slip in sheared fluid flow*”, APS 56<sup>th</sup> DFD Meeting, Session on Computational Fluid Dynamics, Meadowlands, NJ, November 25, 2003.
33. N. V. Priezjev and S. M. Troian, “*Equilibrium and dynamical behavior of slip in polymer films*”, ASME, Session on Tribology: Surface Friction, paper TRIB-1, Washington, D.C., November 16, 2003.
34. N. V. Priezjev and S. M. Troian, “*Equilibrium and dynamical behavior of slip in polymer films*”, ASME, Session on Modeling and Simulation of Micro-/Nano-Scale Fluid Dynamics, paper AMD.1C, Washington, D.C., November 19, 2003.
35. N. V. Priezjev, “*Molecular origin and dynamic behavior of slip in sheared polymer films*”, Princeton University, Physics Department, Brown Bag Seminar, October 7, 2003.
36. N. V. Priezjev and S. M. Troian, “*Molecular origin and dynamic behavior of slip in short polymer films*”, 14<sup>th</sup> Complex Fluid Workshop, University of Massachusetts, Boston, MA, March 2003.
37. N. V. Priezjev and S. M. Troian, “*Molecular origin and dynamic behavior of slip in short polymer films*”, APS March Meeting, Session P13, Micro/Nano- Fluidics, Austin, TX, 2003.
38. N. V. Priezjev and R. A. Pelcovits, “*Coarsening dynamics of biaxial nematics*”, APS March Meeting, Session Q26, Indianapolis, IN, 2002.
39. N. V. Priezjev, “*Disclination loop behavior near the nematic-isotropic phase transition*”, Boston University, Physics Department, January 20, 2002.

40. N. V. Priezjev and R. A. Pelcovits, “*Coarsening dynamics of biaxial nematic liquid crystals*”, 9<sup>th</sup> Complex Fluid Workshop, Harvard University, Cambridge, MA, December 2001.
41. N. V. Priezjev and R. A. Pelcovits, “*Coarsening dynamics of biaxial nematics*”, 86<sup>th</sup> Stat. Mechanics Meeting, Rutgers University, NJ, December 18, 2001.
42. N. V. Priezjev and R. A. Pelcovits, “*Disclination loop behavior near the nematic-isotropic phase transition*”, DCOMP 01, Session H4, Phase Transitions and Computational Methods, MIT, June 26, 2001.
43. N. V. Priezjev and R. A. Pelcovits, “*Surface extrapolation length and director structures in confined nematics*”, APS March Meeting, Session W19, Liquid Crystals: Surfaces and Confined Geometry, Seattle, WA, March 15, 2001.
44. N. V. Priezjev and R. A. Pelcovits, “*Surface extrapolation length and director structures in confined nematics*”, University of Colorado at Boulder, July 16, 2000.
45. N. V. Priezjev and R. A. Pelcovits, “*Surface extrapolation length and director structures in confined nematics*”, 2<sup>th</sup> Complex Fluid Workshop, Amherst University, June 15, 2000.
46. N. V. Priezjev and R. A. Pelcovits, “*Surface extrapolation length in confined nematic liquid crystals*”, University of Ljubljana, Physics Department, Slovenia, February 26, 2000.

Poster presentations:

1. N. V. Priezjev and S. M. Troian, “*Effect of boundary curvature and local slip in nano-fluidic shear flow*”, APS March Meeting, Poster Session R1, Austin, TX, 2003.
2. N. V. Priezjev and R. A. Pelcovits, “*Disclination loop behavior near the nematic-isotropic phase transition*”, APS March Meeting, Poster Session P33, Indianapolis, IN, 2002.
3. N. V. Priezjev and R. A. Pelcovits, “*Disclination loop behavior near the nematic-isotropic phase transition*”, STATPHYS 21, Cancun, Mexico, July 19, 2001.

SHORT COURSES AND WORKSHOPS ATTENDANCE

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- Participant at the Boulder Summer School for Condensed Matter and Materials Physics “*Introduction to Superconductivity: Fundamentals and Applications*”, July 2-29, 2000.
- Grants 101: Professional Grant Proposal Writing Workshop at the University of Michigan, Ann Arbor, MI, August 21-23, 2006.
- Graduate Assistance in Areas of National Need (GAANN) Workshop, Department of Education, Washington, DC, September 28-29, 2006.
- National Effective Teaching Institute (NETI) Workshop and the ASEE Conference, Honolulu, Hawaii, June 21-27, 2007.

AWARDS

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- Michigan State Univ. Intramural Research Grants Program (IRGP) Award 2005-2007.
- American Chemical Society – Petroleum Research Fund (PRF) Grant 2008-2010.

## PROFESSIONAL ACTIVITIES

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- Referee for *Physical Review E*, *Physical Review Letters*, *Europhysics Letters*, *Journal of Computational Physics*, *Journal of Chemical Physics*, *Microfluidics and Nanofluidics*, *Journal of Colloid and Interface Science*, *Physics of Fluids*, *Journal of Fluid Mechanics*, *Langmuir*, *Mathematical Modeling of Natural Phenomena*, *Structural and Multidisciplinary Optimization*.
- Member of American Physical Society (APS), Material Research Society (MRS), American Society of Engineering Education (ASEE).