

School of Chemistry and Biochemistry
Georgia Institute of Technology
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USA

E-mail: anton.petrov@biology.gatech.edu
Phone: +1 404 556 3507

Career objective:

Pursue a scientific career in academia

Education:

- 1999 - 2004** **Ph.D. in Chemistry** University of Louisville, Louisville, KY
emphasis: biophysical/theoretical/computational/quantum chemistry
Graduate Advisor: Prof. George R. Pack
- 1997 - 1999** **M.Sc. in Chemistry** Perm State University, Perm, Russia
emphasis: physical chemistry
Graduate Advisor: Prof. Nataliya Skryabina
- 1993 - 1997** **B.Sc. in Chemistry** Perm State University, Perm, Russia
Graduate Advisor: Prof. Nataliya Skryabina

Awards and Honors:

- 2010** **Co-PI of Computational Grant: "RNA-Magnesium Assembly"** NASA Advanced Supercomputing (NAS) Division, NASA.
- 2009** **Co-PI of Computational Grant: "RNA-Magnesium Assembly"** NASA Advanced Supercomputing (NAS) Division, NASA.
- 2009** **PVA meeting Grant to Attend XXIst Conference on Phage/Virus Assembly**, Annecy, France
- 2004** **The Graduate Dean's Citation**, Graduate College, University of Louisville, Louisville, KY
- 2004** **John M. Houchens Prize for Outstanding Dissertation**, Graduate College, University of Louisville, Louisville, KY.
- 1999** **M.Sc. Honor Diploma**, Perm State University, Perm, Russia.
- 1999** **Sorors Student Award of Open Society Foundation**, Moscow, Russia
- 1999** **Government of Russia Scholarship**, Moscow, Russia
- 1998** **President of Russia Scholarship**, Moscow, Russia
- 1997** **B.Sc. Honor Diploma**, Perm State University, Perm, Russia
- 1997** **Perm City Administration Award**, Perm, Russia

Research Experience:

- 2014 - present** **Research Scientist**
Research Group of Prof. Nicholas V. Hud
School of Chemistry and Biochemistry
Georgia Institute of Technology
Atlanta, Ga 30332
Origin of Life and Evolution. Collaborating with a team of graduate and undergraduate students developing computational methods to analyze properties of prebiotic compounds, developing Molecular Origins Database
- 2011 - present** **Research Scientist**
Research Group of Prof. Loren Dean Williams
School of Chemistry and Biochemistry
Georgia Institute of Technology
Atlanta, Ga 30332
Origin of Life and Evolution. Evolutionary analysis of ribosomes. Developing models of ribosomal evolution
RiboZones: Development of a toolkit to study structure ribosomes, including a web server RiboVision.
Supervise a team of graduate and undergraduate students focusing on the different aspects of ribosome.
Elucidating role of proteins and metal cations on a stability the ribosomes.

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Research Experience:**2006–2011 Research Scientist**

Research Group of Prof. Stephen C. Harvey
School of Biology
Georgia Institute of Technology
Atlanta, Ga 30332

Modeling stages of the bacteriophages' lifecycle. Molecular and Langevin Dynamics simulations of DNA packaging into and ejection from bacteriophages using YUP and LAMMPS packages

Prediction of 3D structure of viruses. Modeling of all-atom structure of Pariacoto Virus

Development of coarse-grained models for DNA and RNA. Designing the electrostatic potentials for the repulsive and attractive modes

Study of DNA and RNA condensation

2004–2006 Postdoctoral Fellow

Research Group of Prof. Stephen C. Harvey
School of Biology
Georgia Institute of Technology
Atlanta, Ga 30332

Development of force field assembler for YUP package: a molecular mechanics tool for the coarse grain modeling

Development of the electrostatic component of the force field for the coarse grained DNA models

1999–2004 Research Graduate Assistant

Research Group of Prof. George R. Pack
Department of Chemistry
University of Louisville
Louisville, Ky 40206

Study of interactions between ions and nucleic acids: ab-initio methods, DFT theory, polarized continuum models, molecular dynamics simulations

Calculation of the protonation states in nucleic acids: UHBD, APBS packages, Molecular dynamics simulations using AMBER

Theoretical investigation of properties of the Poisson Boltzmann equation

UV spectroscopy:(DNA and RNA melting curves)

1997-1999**Research Graduate Assistant**

Research Group of Prof. Nataliya Ye. Skryabina
Department of Chemistry
Perm State University
Perm, Russia, 614071

X-Ray analysis of the amorphous alloys: calculation of the radial distribution functions

Corrosion studies of the amorphous alloys

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Peer-Reviewed Journal Articles (H-index 15, Google Scholar):

28. **Petrov, A.S.**; Bernier, C.R.; Kovacs N., Williams, L.D. The History of the Ribosome as revealed by Ribosomal Structure. In preparation.
27. **Petrov, A.S.**; Bernier, C.R.; Hsiao, C., Williams, L.D. Evolution of the ribosome at atomic resolution. *PNAS*, 2014, 111(28):10251. **Belongs to top 5% of all articles ranked by attention. Highlighted in 10 news outlets**
<http://www.pnas.org/content/early/2014/06/27/1407205111.abstract?tab=metrics>
26. **Petrov, A.S.**; Bernier, C.R.; Gulen, B., Waterbury, C. *et al.* Secondary Structures of rRNAs from All Three Domains of Life. *PLOS ONE*, 2014, 9(2), e88222.
25. **Petrov, A.S.**; Bernier, C.R.; Waterbury, C. *et al.* RiboVision: Visualization and Analysis of Ribosomes. *Faraday Discussions* 169, 2014, DOI:10.1039/C3FD00126A
24. **Petrov, A.S.**; Bernier, C.R.; Hershkovits, E. *et al.* Secondary Structure and Domain Architecture of the 23S and 5S rRNA. *Nucleic Acids Research*, 2013, 41(15), 7522-7535.
Highlighted in Chemistry World July 23, 2013. <http://www.rsc.org/chemistryworld/2013/07/origins-life-chemistry>
Highlighted in Astrobiology Magazine on October 7, 2013. <http://www.astrobio.net/exclusive/5728/astrobiology-in-the-folds>
23. Hsiao, C., Chou, I.-C., Okafor, C.D., Bowman, J.C., O'Neil, E.B., Athavale, S.S., **Petrov, A.S.**, Hud N.V., Wartell, R.M., Harvey, S.C., Williams, L.D. RNA with Iron(II) as a Cofactor Catalyses Electron Transfer. *Nature Chemistry*, 2013, 5, 525-528.
Highlighted in LA Times May 20, 2013. <http://www.latimes.com/news/science/sciencenow/la-sci-sn-rna-life-20130519,0,7718358.story>
22. **Petrov, A.S.**, Douglas, S., Harvey, S.C. Effects of Pulling Forces, Osmotic Pressure, Condensing Agents, and Viscosity on the Thermodynamics and Kinetics of DNA Ejection from Bacteriophages to Bacterial Cells: a Computational Study. *Journal of Physics: Condensed Matter*, 2013, 25(11), 115101.
21. Hsiao, C., Peters, J.K., Lenz, T.K. Preeprem, T., Lie, L., Gossett, J., Bowman, J.C., O'Neill E.B., **Petrov, A.S.**, Athavale, S.S., Trippe, C., Murray, J., Wartell, R., Harvey, S.C., Hud, N.V., Williams, L.D. "Molecular Paleontology: A Biochemical Model of the Ancestral Ribosome". *Nucleic Acids Research*, 2013, 41(5), 3373-3385.
20. **Petrov, A.S.**; Bernier, C.R.; Hsiao, C. *et al.* RNA-Magnesium-Protein Interactions in the Large-Ribosomal Subunit. *J. Phys.Chem. B*, 2012, 116, 8113-8120.
19. Athavale, S.S.; **Petrov, A.S.**; Hsiao, C. *et al.* RNA Folding and Catalysis Mediated by Iron(II). *PLoS One*, 2012, 7, e38024.
Highlighted in Nature News Blog June 1, 2012 and in NASA NAI Research Highlights May 31, 2012.
18. **Petrov, A.S.**, Bowman J.C., Harvey, S.C., Williams L.D. Bidentate RNA-Magnesium Clamps: On the Origin of the Special Role of Magnesium in RNA Folding. *RNA Journal*. **2011** 17(2) 291-297.
17. **Petrov, A.S.**, Harvey, S.C. Role of DNA-DNA interactions on the structure and thermodynamics of bacteriophages Lambda and P4. *J. Struct Biol*. **2011** 174 (1) 137-146.
16. Devkota B., **Petrov, A.S.**, Lemieux S., Boz, M.B., Tang, L., Johnson, J.E., Schneemann, A., Harvey, S.C. Structural and electrostatic characterization of Pariacoto Virus *Biopolymers*. **2009**, 91(7), 530-538.
15. **Petrov A.S.** Locker, C.R., Harvey, S.C. Characterization of DNA Confinement inside Bacteriophages. *Phys.Rev.E* . **2009**, 80(2), 021914.
14. Sarkar, T. Petrov, A.S. Vitko J.R., Harvey, S.C., Hud, N.V. Integration Host Factor (IHF) Dictates the Structure of Polyamine-DNA Condensates: Implications for the Role of IHF in the Compaction of Bacterial Chromatin. *Biochemistry* 2008, 48 (4), 667-675.
13. Rollins, G.C., **Petrov, A.S.**, Harvey, S.C. The Role of DNA Twist in the Packaging of Viral Genomes. *Biophysical Letters* **2008**, 94(5), L38-L40.
12. **Petrov, A.S.**, Boz, M.B., Harvey S.C. The Conformation of Double-Stranded DNA inside Bacteriophages Depends on Capsid Size and Shape. *J. Struct. Biol*. **2007**, 160, 240-248.
11. **Petrov, A.S.** Lim-Hing, K. Harvey, S.C. Packaging of Bacteriophage Epsilon15: *Structure, Forces and Thermodynamics.* *Structure* **2007**, 15, 807-812.
10. **Petrov, A.S.**, Harvey, S.C. Structural and Thermodynamic Principles of Viral Packaging. *Structure* **2007**, 15, 21-27.

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Peer-Reviewed Journal Articles (continued):

9. Tan, R. K.-Z. , **Petrov, A.S.**, Harvey, S. C. YUP: a Molecular Simulation Program for Coarse-Grained and Multi-Scaled Models. *J. Chem. Theory and Comp.* **2006**, 2, 529-540.
8. **Petrov, A.S.**, Lamm, G. Pack, G.R. Calculation of Binding-Free Energy for Mg-RNA Interactions. *Biopolymers*, **2005**, 77, 137-154.
7. **Petrov A. S.**, Funseth-Smotzer, J., Pack G.R. Computational Study of Dimethyl Phosphate Anion and Its Complexes with Water, Magnesium and Calcium. *Intl. J. Quant.Chem.* **2005**, 102, 645-655.
6. **Petrov A.S.**, Lamm G., Pack G.R. The Triplex-Hairpin Transition of Cytosine-Rich DNA Molecules. *Biophys. J.* **2004**, 87, 3954-3973.
5. **Petrov A.S.** Lamm, G. Pack, G.R. Magnesium-DNA Binding in Solution. *J. Phys. Chem. B.*, **2004**, 108, 6072-6081.
4. **Petrov A.S.** Lamm, G. Pack, G.R. Water-Mediated Guanine-Magnesium Interactions. *J. Phys. Chem. B.*, **2002**, 106, 3294-3300.
3. Kanunnikova O.M., Skryabina N.Y., Gilmudinov F.Z., **Petrov A.S.** Bayiankin V.Y. Segregation processes in superficial layers amorphous alloy Fe 78 Si 13,5 B 4 Nb 3,5 Cu 1 under electrolytic hydrogenation. *Izvestiya Higher School Colour Metall.*, **2000**, 4, 57-62.
2. Skryabina N.Y., Pimenova N.V., **Petrov A.S.** Cathodic Treatment of the Surface of the Amorphous Ribbon Co71Ni11.7Fe5.3Si8.6B3.4 in sulfuric electrolyte. *Int. J. Hydr. Ener.*, **1999**, 24, 801-804.
1. Skryabina N.E., Pimenova N.V., **Petrov A.S.** Determination of the Hydrogen Diffusion Coefficient and Solubility in the Fe(78)Nb(3.5)Cu(1)Si(13.5)B(4) Amorphous Alloy. *Russ. J. Electrochem.* **1998**, 34, 1083-1085.

Books Chapters and Reviews:

4. Harvey, S.C., **Petrov, A.S.**, Devkota, B., Boz, M.B Computational Approaches to Modeling Viral Structure and Assembly, *Methods in Enzymology*, **2011** 487, 513-543.
3. Harvey, S.C., **Petrov, A.S.**, Devkota, B., Boz, M.B., Viral Assembly: A Molecular Modeling Perspective, *Physical Chemistry Chemical Physics*, **2009**, 11, 10553-10564.
2. **Petrov A.S.** Harvey S.C. Packaging Double-Helical DNA into Viral Capsids: Structures, Forces and Energetics. *Biophys. J.* **2008**, 95, 497-502.
1. Tan, R. K.-Z. , **Petrov, A.S.**, Devkota, B., Harvey, S. C. Coarse-Grained Models for Nucleic Acids and Large Nucleoprotein Assemblies. In *Coarse-graining in Condensed Phase and Biomolecular Systmes* Ed. Greg Voth. CRC Press, Boca Raton, **2008**

Invited Meetings and Talks:

- 05/06-05/09, 2014 *RiboVision: Visualization and Analysis of Ribosomes. Faraday Discussions 169, Nottingham, UK*
- 06/17 – 06/20, 2013 *Molecular Paleontology of Ribosome. Emergence in Chemical Systems, Anchorage, AL*
- 06/11 – 06/15, 2013 *Secondary Structure and Domain Architecture of the 23S and 5S rRNAs. Albany 2013: the 18th Conversation. Albany, NY*
- 04/16 – 04/20, 2013 *Ribosomal Protein L2: Its Role Function and Evolution. AbSciCon 2013. Atlanta, Ga*
- 08/16 – 08/20, 2010 *Computational studies of DNA ejection from bacteriophages to bacterial Cells. Mathematical Virology Workshop, Ambleside, UK.*
- 12/15, 2010 *Role of cations in the genome packaging and DNA ejection from bacteriophages. Carnegie Mellon University, Pittsburgh, Pa*
- 09/29, 2009 *Role of cations in the genome packaging and DNA ejection from bacteriophages. Institut de Biologie et Chimie des Protéines, Lyon, France*
- 09/21, 2007 *Computer Simulations Reveal the Structural and Thermodynamic Principles of Organization of dsDNA Bacteriophages. Departmental Seminar Series. Department of Chemistry, University of Louisville, Louisville, KY*
- 04/09, 2009 *The Structure and Thermodynamic Properties of dsDNA Bacteriophages. Molecular Biophysics Series. Georgia Institute of Technology, Atlanta, GA*
- 02/18 – 02/23, 2006 *Computer Simulations of the DNA Packaging into Viral Capsids. 50th Annual Biophysical Society Meeting. Salt Lake City, Utah (platform co-chair)*
- 12/03 – 12/07, 2005 *The Role of the Electrostatic Interaction in the Genome Packaging of dsDNA Bacteriophages. M2CELL International Meeting, Fontevraud. France*

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Teaching Experience:

- 2012-2013** Part-Time Instructor for 4521/6582 Biophysical Chemistry course at Georgia Institute of Technology
2011 Assistant Instructor (to Prof. Lieberman) for 4521/6582 Biophysical Chemistry course at Georgia Institute of Technology
2006 Chair of the Molecular Simulation Discussion Group Georgia Institute of Technology
2000 - 2003 TA for undergraduate General Chemistry, Physical Chemistry, Physical Chemistry for pre-med students UofL
1999 Part-Time Lecturer for X-Ray Analysis course for undergraduate students, Perm University, Russia

Mentoring:**Graduate Students**

Chad Bernier (2010-present); Chris Waterbury (2011-2013); Ashlyn Norris (2013-present), Nicholas Kovac (2013-present), Blacki Li Migliozi (2012), Scott Douglas (2009-2012); Denise Enekwa (2009-2011).

Undergraduate Students

Peter Mannion (2014-present), April Lee (2012-present); Xiao Xiong (2012); Lawrence Freil (2012); Lan Wang (2012); Ai Li (2012); James Jett (2012), Geoff Rollins (2007-2008); Geoff won Georgia Institute of Technology President's undergraduate Research Award); Krista Lim-Hing (2006-2007)

Online Resources:

- RiboVIsion** <http://apollo.chemistry.gatech.edu/RiboVIsion/>
Ribosome Gallery <http://apollo.chemistry.gatech.edu/RibosomeGallery/>
Evolution of Ribosome <https://www.youtube.com/watch?v=ei6qGLBTsKM>

Professional Activities:

- 2003 – present** Member of Biophysical Society
2014 – present Member of Royal Chemical Society

Professional References:

Loren Dean Williams Professor School of Chemistry and Biochemistry	Stephen C. Harvey Professor School of Biology	Nicholas V. Hud Professor School of Chemistry and Biochemistry	George E. Fox Professor Biology and Biochemistry	Richard Wittebort per George R. Pack (deceased) Department of Chemistry
Georgia Institute of Technology 315 Ferst Dr. Atlanta Ga, 30332 loren.williams@chemistry.gatech.edu Phone: (404) 894-9752	Georgia Institute of Technology 310 Ferst Dr. Atlanta Ga, 30332 steve.harvey@gatech.edu Phone: (404) 385-4498	Georgia Institute of Technology 315 Ferst Dr. Atlanta Ga, 30332 hud@chemistry.gatech.edu Phone: (404) 385-1162	University of Houston HSC Rm 424. Houston, Tx 77240 fox@uh.edu Phone: (713) 743-8363	University of Louisville 2320 S. Brook Str. Louisville, Ky 40292 richard.wittebort@louisville.edu Phone: (502) 852-6613

