GEORGII OBLAPENKO

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Ph.D. (Mechanics of Fluid, Gas and Plasma) ⋄ Postdoctoral Research Fellow
University of Texas at Austin ⋄ Oden Institute for Computational Engineering and Sciences

EDUCATION

Saint-Petersburg State University *September 2015 — April 2017*
Ph.D. degree (in Physical and Mathematical Sciences)
Area of research: Mechanics of Fluids, Gases and Plasma
Department of Hydroaeromechanics
Research supervisor: Prof. Kustova E.V.

Saint-Petersburg State University *September 2013 — June 2015*
Masters degree (with excellence) in Mechanics and Mathematical Modelling
Area of specialization: Molecular Kinetic Theory of Fluids and Gases
Department of Hydroaeromechanics
Research supervisor: Prof. Kustova E.V.

Saint-Petersburg State University *September 2009 — June 2013*
Bachelors degree in Mathematics and Mechanics
Department of Hydroaeromechanics
Research supervisor: Prof. Kustova E.V.

WORK EXPERIENCE

University of Texas at Austin January 2019 – Present
Postdoctoral Research Fellow *Oden Institute for Computational Engineering and Sciences*
Development of a hybrid Discrete Velocity Method/Direct Simulation Monte Carlo code for modelling of ionized rarefied gas flows.

University of Texas at Austin July 2018 – January 2019
Scientific Consultant *Oden Institute for Computational Engineering and Sciences*
Development of a hybrid Discrete Velocity Method/Direct Simulation Monte Carlo code.

Saint-Petersburg State University September 2015 – December 2017
Assistant engineer *Department of Hydroaeromechanics*
Lead developer of a C++ library aimed at kinetic theory computations. Implementation of state-to-state models in Direct Simulation Monte Carlo (DSMC) codes, development of simplified models for vibrational relaxation rates, and numerical modelling of reaction rates in viscous gas flows.

Saint-Petersburg State University April 2013 – September 2015
Assistant researcher *Department of Hydroaeromechanics*
Development of theoretical models of reaction rates in viscous gas flows and their numerical modelling.

Internships

- **DLR, Göttingen, Germany (November 2017–January 2018)**. Implementation of new model for vibrational relaxation rates of nitrogen and oxygen in the DLR-TAU solver.
- **The Federal University of Parana, Curitiba, Brazil (October 2016).** Study of the influence of variable diameters of vibrationally excited molecules on relaxation processes.
- **Khristianovich Institute of Theoretical and Applied Mechanics, Novosibirsk, Russia (February 2016).** Implementation of state-to-state models of non-equilibrium processes in DSMC code.

TECHNICAL SKILLS

Rarefied gas dynamics	Numerical modelling, DSMC, DVM, Chapman–Enskog method
Programming languages	Python, Fortran, C++, Julia, MATLAB, Javascript
Other	Machine learning, digital signal processing

ACADEMIC ACHIEVEMENTS

Author and co-author of 22 publications in SCOPUS/Web of Science-indexed peer-reviewed journals and conference proceedings. Participant of 13 international and and 7 all-Russian conferences.

Reviewer for Computers and Fluids, Acta Astronautica, Computer Methods in Applied Mechanics and Engineering, Physics of Fluids.

Seminar talks/lectures:

1. Center for Computational Engineering Science, Mathematics Division, RWTH Aachen, 2019 (Aachen, Germany)
2. Department of Aerospace Engineering and Engineering Mechanics, University of Texas at Austin, 2019 (Austin, TX, USA)
3. Oden Institute for Computational Engineering and Sciences, University of Texas at Austin, 2019 (Austin, TX, USA)

Research and travel grants:

Personal grants:

1. Humboldt postdoctoral research fellowship (DLR, Göttingen, Germany), 2021–2023.
2. Research project "Improvements of the thermo-chemical relaxation model used by the DLR-TAU code" jointly sponsored by the DAAD and Saint-Petersburg State University, 2017
3. Research project "Influence of variable diameters of vibrationally excited molecules on relaxation processes in strongly non-equilibrium gas flows" jointly sponsored by the Santander Bank and Saint-Petersburg State University, 2016
4. Research project "Implementation of models of vibrational transitions in direct simulation methods", sponsored by the Russian Foundation for Basic Research, 2015
5. Saint-Petersburg State University travel grants (2013, 2014, 2017)

2015–2016: Participant of the ESA research project "Exploring angular-momentum phenomenology in aerothermodynamics and MHD".

2013–2017: Participant of 3 Saint-Petersburg University grants, 1 Russian Science Foundation grant and 3 Russian Foundation for Basic Research grants (not including personal grants).

Stipends and awards:

- Stipend of the Russian President for students and PhD students studying disciplines corresponding to the prioritized areas of modernization of Russian economics (2017)
- Stipend of the Russian Government for students and PhD students studying disciplines corresponding to the prioritized areas of modernization of Russian economics (2016)
- Stipend of the Russian Government for students and PhD students (2016)
- Winner of the Saint-Petersburg Government Grant Competition for Students and Graduate Students (2013)

A) Peer-reviewed publications:

1. Sarna N., Oblapenko G., Torrilhon M. (2021): Moment Method for the Boltzmann Equation of Reactive Quaternary Gaseous Mixture. Accepted in: Physica A: Statistical Mechanics and its Applications.
2. Oblapenko G., Goldstein D., Varghese P., Moore C. (2021): Velocity-space Hybridization of DSMC and a Quasi-Particle Boltzmann Solver. Accepted in: Journal of Thermophysics and Heat Transfer.
3. Oblapenko G., Kustova E.V. (2020): Influence of angular momentum on transport coefficients in rarefied gases. In: Physica A: Statistical Mechanics and its Applications, Vol. 553, p. 124673.
4. Oblapenko G., Goldstein D., Varghese P., Moore C. (2020): A velocity space hybridization-based Boltzmann equation solver. In: Journal of Computational Physics, Vol. 408, p. 109302.
5. Campoli L., Oblapenko G.P., Kustova E.V. (2019): Overview and perspectives of KAPPA library. In: AIP Conference Proceedings, Vol. 2132, No. 1, p. 150005.
6. Oblapenko G.P., Kustova E.V., Hannemann K., Hannemann. V. (2019): Assessment of recent thermo-chemical relaxation models using the DLR-TAU code. In: AIP Conference Proceedings, Vol. 2132, No. 1, p. 140006.
7. Oblapenko G.P. (2018): Calculation of Vibrational Relaxation Times Using a Kinetic Theory Approach. In: The Journal of Physical Chemistry A, Vol. 122, No. 50, pp. 9615-9625.
8. Campoli L., Oblapenko G.P., Kustova E.V. (2018): KAPPA: Kinetic approach to physical processes in atmospheres library in C++. In: Computer Physics Communications, Vol. 236, pp. 244-267.
9. Istomin V.A., Oblapenko G.P. (2018): Transport coefficients in high-temperature ionized air flows with electronic excitation. In: Physics of Plasmas, Vol. 25, No. 1, p. 013514.
10. Kremer G.M., Kunova O.V., Kustova E.V., Oblapenko G.P. (2018): The influence of vibrational state-resolved transport coefficients on the wave propagation in diatomic gases. In: Physica A: Statistical Mechanics and its Applications, Vol. 490, pp. 92-113.
11. Shoev G., Oblapenko G., Kunova O., Mekhonoshina M., Kustova E. (2018): Validation of vibration-dissociation coupling models in hypersonic non-equilibrium separated flows. In: Acta Astronautica, Vol. 144, pp. 147-159.
12. Kustova E.V., Mekhonoshina M.A., Oblapenko G.P. (2017): On the applicability of simplified state-to-state models of transport coefficients. In: Chemical Physics Letters, Vol. 686, pp. 161-166.
13. Oblapenko G.P., Kashkovsky A.V., Bondar Ye.A. (2017): State-to-state models of vibrational relaxation in Direct Simulation Monte Carlo (DSMC). In: Journal of Physics: Conference Series, Vol. 815, No. 1, p. 012011.
14. Kustova E.V., Oblapenko G.P. (2016): Vibration-dissociation Coupling in Multi-Temperature Viscous Gas Flows. In: AIP Conference Proceedings, Vol. 1786, No. 1, p. 150004.
15. Baikov B.S., Bayalina D.K., Kustova E.V., Oblapenko G.P. (2016): Inverse Laplace Transform as a Tool for Calculation of State-specific Cross Sections of Inelastic Collisions. In: AIP Conference Proceedings, Vol. 1786, No. 1, p. 090005.
16. Shoev G.V., Bondar Ye.A., Oblapenko G.P., and Kustova E.V. (2016): Development and testing of a numerical simulation method for thermally nonequilibrium dissociating flows in ANSYS Fluent. In: Thermophysics and Aeromechanics, Vol. 23, No. 2, pp. 151-163.
17. Kustova E.V., Oblapenko G.P. (2016): Mutual effect of vibrational relaxation and chemical reactions in viscous multitemperature flows. In: Physical Review E – Statistical, Nonlinear, and Soft Matter

Physics, Vol 93, No. 3, p. 033127.

18. Kustova E.V., Nagnibeda E.A., Oblapenko G.P., Savelev A.S., Sharafutdinov I.Z. (2016): Advanced models for vibrational–chemical coupling in multi-temperature flows. In: Chemical Physics, Vol. 464, pp. 1-13.
19. Kustova E.V., Oblapenko G.P. (2015): Reaction and internal energy relaxation rates in viscous thermochemically non-equilibrium gas flows. In: Physics of Fluids, Vol. 27, No. 1, p. 016102.
20. Kustova E.V., Oblapenko G.P. (2014): Rates of VT Transitions and Dissociation and Normal Mean Stress in a Non-equilibrium Viscous Multitemperature N_2/N Flow. In: AIP Conference Proceedings, Vol. 1628, No. 1, pp. 602-609.
21. Kustova E.V., Oblapenko G.P. (2013): Normal mean stress and rates of slow process in chemically and vibrationally non-equilibrium multi-temperature gas flows. In: Vestnik of the Saint-Petersburg University, Vol. 2, p. 111-120. (In Russian).

C) Publications without peer-review process:

1. Oblapenko G.P., Goldstein D., Varghese P., Moore C. (2021): Modeling of Ionized Gas Flows with a Velocity-space Hybrid Boltzmann Solver. In: Proceedings of the AIAA Scitech Forum.
2. Oblapenko G.P., Goldstein D., Varghese P., Moore C. (2020): Velocity-space Hybridization of DSMC and a Boltzmann Solver. In: Proceedings of the AIAA Scitech Forum, Orlando, Florida.
3. Hannemann K., Schramm J. M., Riedl P., Hannemann V., Oblapenko G. (2018): Thermal Non-equilibrium Effects on Spherically Blunted Cone Flows. In: Proceedings of the 12th International Workshop on Shock Tunnel Technology.
4. Istomin V.A., Kustova E.V., Oblapenko G.P. (2017): State-resolved transport properties of electronically excited high-temperature flows behind strong shock waves. In: Proceedings of the 31st International Symposium on Shock Waves, Nagoya, Japan.
5. Oblapenko G.P., Kashkovsky A.V., Bondar Y.A. (2017): State-to-state models of physico-chemical processes in direct simulation Monte Carlo (DSMC) computations of 2-dimensional flows. In: Proceedings of the European Conference for Aeronautics and Space Sciences (EUCASS), Milan, Italy.
6. Kustova E.V., Oblapenko G.P., Sharafutdinov I.Z. (2015): Vibrational relaxation models for non-equilibrium multi-temperature flows. In: Physico-chemical Kinetics in Gas Dynamics, p. 1-10. (In Russian).
7. Kustova E.V.,Oblapenko G.P. (2014): Vibrational relaxation rates in multi-temperature gas flows. In: Physico-chemical Kinetics in Gas Dynamics, p. 1-4. (In Russian).