

# GEORGII OBLAPENKO

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Ph.D. (Mechanics of Fluid, Gas and Plasma)

University of Texas at Austin ◇ Oden Institute for Computational Engineering and Sciences

## EXPERIENCE

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### 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
- Rarefied gas flow modelling

### 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
- Numerical modeling 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
- Numerical modeling of reaction rates in viscous gas flows

### GODA New Media Artist Collective

October 2016 – Present

*Programmer, sound designer*

- Design of interactive installations, concept creation
- Programming (Python, MAX/MSP, Arduino)
- Sound design, soundtrack work

### Freelance

September 2013 – June 2014

*Web developer*

- Creation of educational online games
- Creation of online interface for an interactive remote laboratory

### Internships

- **DLR, Göttingen, Germany (November 2017–January 2018).** Implementation of modern models of physico-chemical process rates in the DLR-TAU solver.
- **The Federal University of Parana, Curitiba, Brazil (October 2016).** Studied the influence of variable diameters of vibrationally excited molecules on relaxation processes.
- **Khristianovich Institute of Theoretical and Applied Mechanics, Novosibirsk, Russia (February 2016).** Worked on implementation of state-to-state models of non-equilibrium processes in DSMC code.

## TECHNICAL SKILLS

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### Brief overview:

<b>Computer languages</b>	Python, C++, Fortran, Julia, MATLAB MAX/MSP, L <sup>A</sup> T <sub>E</sub> X, Javascript, HTML, CSS
<b>Tools</b>	Unix command-line tools, Paraview
<b>Skills</b>	Numerical modeling, machine learning, digital signal processing
<b>Online profiles</b>	<a href="https://github.com/knstmrd">https://github.com/knstmrd</a> <a href="https://github.com/godacollective">https://github.com/godacollective</a> <a href="https://www.kaggle.com/kunstmord">https://www.kaggle.com/kunstmord</a> <a href="https://www.linkedin.com/in/george-oblapenko">https://www.linkedin.com/in/george-oblapenko</a>

### Detailed:

#### Numerical modeling

- Experience in implementing various numerical algorithms in C++, Python, Fortran, Julia and MATLAB
- Well-acquainted with numerical/scientific libraries for Python (Numpy, Scipy) and C++ (Armadillo, GSL, Boost numerical libraries)

#### Machine learning

- Experience in working with data-processing tools, various classification and regression algorithms in Python (Pandas, scikit-learn, XGBoost, LightGBM, Catboost); experience with audio processing, computer vision (OpenCV), and text processing (NLTK, Gensim)
- Experience with deep learning (PyTorch, Keras)
- Regular participant in Kaggle competitions (14 to date)

#### Kinetic theory

- Experience in application of kinetic theory to non-equilibrium flow modeling (rate coefficient and transport properties computation)
- One of the lead developers of the **KAPPA** kinetic theory library (C++)
- Experience in CFD simulations of strongly non-equilibrium reacting gas flows and implementation of various models of thermo-chemical relaxation in CFD code
- Experience in DSMC modeling of non-equilibrium rarefied gas flows and development of DSMC and Discrete Velocity Method codes

#### Digital Signal Processing

- Experience in DSP in Python (Librosa, YAAFE)
- Experience in implementation of various audio processing algorithms in C++, Python, MAX/MSP

#### Miscellaneous

- Web development: familiar with Django and Django REST framework, experience working with Javascript, React, HTML, CSS
- iOS app development: basic knowledge of Swift, AudioKit, SpriteKit

## EDUCATION

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### **Saint-Petersburg State University**

*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**

*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**

*June 2013*

Bachelors degree in Mathematics and Mechanics

Department of Hydroaeromechanics

Research supervisor: Prof. Kustova E.V.

## RESEARCH GRANTS

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

Participant of the ESA research project “Exploring angular-momentum phenomenology in aerothermodynamics and MHD” (as a subcontractor to the DLR), 2015–2016.

### **Own research and travel grants:**

1. 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, 2017–2018
2. 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
3. Research project “Implementation of models of vibrational transitions in direct simulation methods”, 2015–2016, sponsored by the Russian Foundation for Basic Research
4. Saint-Petersburg State University travel grants (2013, 2014, 2017)

### **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)

## PUBLICATIONS, CONFERENCE PARTICIPATION

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Author and co-author of 14 publications in SCOPUS/Web of Science-indexed peer-reviewed journals, participant of 7 international and 7 all-Russian conferences.

### Publications in SCOPUS/Web of Science-indexed journals:

1. *Oblapenko G.P.* Calculation of Vibrational Relaxation Times Using a Kinetic Theory Approach // The Journal of Physical Chemistry A, 2018.
2. *Campoli L., Oblapenko G.P., Kustova E.V.* KAPPA: Kinetic approach to physical processes in atmospheres library in C++ // Computer Physics Communications, 2018.
3. *Istomin V.A., Oblapenko G.P.* Transport coefficients in high-temperature ionized air flows with electronic excitation // Physics of Plasmas, 2018.
4. *Kremer G.M., Kunova O.V., Kustova E.V., Oblapenko G.P.* The influence of vibrational state-resolved transport coefficients on the wave propagation in diatomic gases // Physica A: Statistical Mechanics and its Applications, 2018.
5. *Shoev G., Oblapenko G., Kunova O., Mekhonoshina M., & Kustova E.* Validation of vibration-dissociation coupling models in hypersonic non-equilibrium separated flows // Acta Astronautica, 2018.
6. *Kustova E.V., Mekhonoshina M.A., Oblapenko G.P.* On the applicability of simplified state-to-state models of transport coefficients // Chemical Physics Letters, 2017.
7. *Oblapenko G.P., Kashkovsky A.V., Bondar Ye.A.* State-to-state models of vibrational relaxation in Direct Simulation Monte Carlo (DSMC) // Journal of Physics: Conference Series, 2017.
8. *Kustova E.V., Oblapenko G.P.* Vibration-dissociation Coupling in Multi-Temperature Viscous Gas Flows // AIP Conference Proceedings, 2016. V. 1786. P. 150004 (1–8)
9. *Baikov B.S., Bayalina D.K., Kustova E.V., Oblapenko G.P.* Inverse Laplace Transform as a Tool for Calculation of State-specific Cross Sections of Inelastic Collisions // AIP Conference Proceedings, 2016.
10. *Shoev G.V., Bondar Ye.A., Oblapenko G.P., and Kustova E.V.* Development and testing of a numerical simulation method for thermally nonequilibrium dissociating flows in ANSYS Fluent // Thermophysics and Aeromechanics, 2016.
11. *Kustova E.V., Oblapenko G.P.* Mutual effect of vibrational relaxation and chemical reactions in viscous multitemperature flows // Physical Review E – Statistical, Nonlinear, and Soft Matter Physics, 2016.
12. *Kustova E.V., Nagnibeda E.A., Oblapenko G.P., Savelev A.S., Sharafutdinov I.Z.* Advanced models for vibrational–chemical coupling in multi-temperature flows // Chem. Phys., 2016.
13. *Kustova E.V., Oblapenko G.P.* Reaction and internal energy relaxation rates in viscous thermochemically non-equilibrium gas flows // Phys. Fluids, 2015.
14. *Kustova E.V., Oblapenko G.P.* Rates of VT Transitions and Dissociation and Normal Mean Stress in a Non-equilibrium Viscous Multitemperature N<sub>2</sub>/N Flow // AIP Conference Proceedings, 2014.

### Other publications:

1. *Kustova E.V., Oblapenko G.P., Sharafutdinov I.Z.* Vibrational relaxation models for non-equilibrium multi-temperature flows // Physico-chemical Kinetics in Gas Dynamics, 2015. Vol. 16. (In Russian)

2. *Kustova E.V., Oblapenko G.P.* Vibrational relaxation rates in multi-temperature gas flows // Physico-chemical Kinetics in Gas Dynamics, 2014. Vol. 15. P. 1-4. (In Russian)
3. *Kustova E.V., Oblapenko G.P.* Normal mean stress and rates of slow process in chemically and vibrationally non-equilibrium multi-temperature gas flows // Vestn. S.-Peterb. Univ., Ser 1, 2013. P. 111-120. (In Russian)

#### **Conference and school participation:**

1. Tallinn University course on Experimental Interaction Design (Physiological Computing Technologies for Performative Arts), 2018 (Saint-Petersburg, Russia)
2. All-Russian conference on hydroaeromechanics, dedicated to S.V. Vallander's 100th anniversary, 2017 (Saint-Petersburg, Russia)
3. International conference "7th European Conference for Aeronautics and Space Sciences", 2017 (Milan, Italy)
4. International EUCASS workshop "Aerospace Thematic Workshops: Fundamentals of Aerodynamic Flow and Combustion Control by Plasmas", 2017 (Pushkin, Russia)
5. All-Russian school-seminar "Aerophysics and physical mechanics of classical and quantum systems", 2016 (Moscow, Russia)
6. International conference "30th International Symposium on Rarefied Gas Dynamics", 2016 (Victoria BC, Canada)
7. All-Russian school-seminar "Aerophysics and physical mechanics of classical and quantum systems", 2015 (Moscow, Russia)
8. All-Russian seminar "XXIV All-Russian seminar with international partnership on jet, separation, and non-stationary flows", 2015 (Novosibirsk, Russia)
9. International conference "International Scientific Conference On Mechanics "The Seventh Polyakhonv's Reading"", 2015 (Saint-Petersburg, Russia)
10. All-Russian school-seminar "Aerophysics and physical mechanics of classical and quantum systems", 2014 (Moscow, Russia)
11. International conference "29th International Symposium on Rarefied Gas Dynamics", 2014 (Xi'an, China)
12. All-Russian conference "Modern problems in rarefied gas dynamics", 2013 (Novosibirsk, Russia)
13. International conference "9th IFAC Symposium on Advances in Control Education", 2012 (Nizhniy Novgorod, Russia)
14. All-Russian conference "XIV Conference of Young Scientists on Navigation and Motion Control", 2012 (Saint-Petersburg, Russia)

## **Kaggle competition participation and results**

<b>Instant Gratification, 2019</b>	Top 8%
<b>Freesound Audio Tagging, 2019</b>	Top 37%
<b>Quora Insincere Question Classification, 2019</b>	Top 22%
<b>Freesound General-Purpose Audio Tagging Challenge, 2018</b>	Top 11%
<b>Avito Demand Prediction Challenge, 2018</b>	Top 28%
<b>WSDM - KKBox's Music Recommendation Challenge, 2017</b>	Top 46%
<b>Sberbank Russian Housing Market, 2017</b>	Top 66%
<b>TalkingData Mobile User Demographics, 2016</b>	Top 60%
<b>Liberty Mutual Group: Property Inspection Prediction, 2015</b>	Top 55%
<b>Otto Group Product Classification Challenge, 2015</b>	Top 7%
<b>Driver Telematics Analysis, 2015</b>	Top 15%(part of a team)
<b>Galaxy Zoo - The Galaxy Challenge, 2014</b>	Top 48% (part of a team)
<b>The Marinexplore and Cornell University Whale Detection Challenge, 2013</b>	Top 23%