

# DANIIL ANDRIENKO

Principal Research Associate, Center for National Security Initiatives

University of Colorado Boulder ◊ Boulder, CO

U.S. citizen ◊ (979) – 412 – 4691 ◊ [daniil.andrienko@colorado.edu](mailto:daniil.andrienko@colorado.edu)

## EDUCATION

---

### Moscow Institute of Physics and Technology

PhD in Applied Physics and Mathematics, 2013  
MSc in Applied Physics and Mathematics, 2010  
BSc in Applied Physics and Mathematics, 2008

### Wright State University, Dayton, OH

PhD in Mechanical and Materials Engineering, 2014

## RESEARCH INTERESTS

---

- **Energy and Propulsion:** aerothermochemistry, fluid-material interaction, radiation transfer and directed energy, detonation and shocks, computational spectroscopy, computational chemistry;
- **Physics of Gases, Plasma and Materials:** flow actuation, magnetohydrodynamics, optical energy deposition, gas discharges, physics of interstellar space, space debris and asteroid mitigation;
- **Next-Generation Computing:** computational fluid dynamics, molecular dynamics, model reduction and optimization, asynchronous and fault-tolerant computing, physics-informed neural networks;

## RESEARCH METRICS

---

- PI and Co-PI on NSF, AFOSR, ONR, and U.S. Navy awards; total funding > \$2M.
- Research Activity Indicators: 1072 citations, H-index = 18.

## WORK EXPERIENCE

---

### University of Colorado Boulder

*Principal Research Associate*

January 2023 - present

*Boulder, CO*

- Developing externally-funded portfolio for research of materials in extreme environments and directed energy.

### University of Colorado Boulder

*Senior Research Associate*

August 2021 - January 2023

*Boulder, CO*

- Designing and executing research for material and gas-material interactions in hypersonic flows.

### Texas A&M University

*Assistant Professor*

January 2018 - July 2021

*College Station, TX*

- Directed High-Temperature Gasdynamic Laboratory with 1 postdoc, 2 graduate and 10 undergraduate students
- Authored and co-authored a dozen of proposals and white papers to AFOSR, NSF, NASA, DARPA, industry partners in the field of hypersonics and highly energetic environments
- Developed state-of-the-art computer models at the intersection of physics, engineering, and computer science.

- Close collaboration with Aerospace Laboratory for Lasers, ElectroMagnetics, and Optics resulted in several white papers and proposals and research contracts.
- Developed and taught core undergraduate classes (Thermodynamics, High-Speed Flows) and graduate (Molecular Theory of Gases), with a total of more than 500 students enrolled.
- Published 3 articles, 10 full-length articles, and 3 papers under review.
- Served in AIAA Thermophysics Committee, TAMU Research Council, Track Chair AIAA.

### **University of Michigan**

*Postdoctoral Research Fellow*

June 2014 - Dec 2017

*Ann Arbor, MI*

- Simulated new generation of solar energy harvesters with nickel particle-laden multi-phase turbulent flow.
- Developed models of state-resolved energy transfer in high-temperature air.
- Calculated high-fidelity reaction rates in oxygen-nitrogen mixtures in shock waves using Monte Carlo Method.
- Performed numerical simulation of chemical species mass and energy conservation equations in shock waves.
- Published 10 journal articles.
- Gave nearly 20 presentations to the audience of 15-50 people.
- Mentored graduate and undergraduate students, taught a graduate class.
- Collaborated with Georgia Institute of Technology, Stanford University, and University of Texas at Austin.

### **Wright State University**

*Graduate Research Assistant*

July 2011 - May 2014

*Dayton, OH*

- Developed computer models of hydrogen combustion in air.
- Developed and implemented advanced numerical algorithms for flame front capturing and flame propagation in hydrogen and carbon fuels.
- Developed computer code for modeling of high-speed chemically reacting flows.
- Revisited and improved numerical models of radiative heat transport in reentry environment.
- Adapted numerical models of radiative heat transport for unstructured grids.
- Published 3 journal articles.

### **Moscow Institute of Physics and Technology**

*Research scientist*

Aug 2013 - Nov 2013

*Moscow, Russia*

- Simulated properties of non-equilibrium air plasma.
- Accurately predicted experimentally measured critical electron concentration in the vicinity of reentry spacecraft.

### **Institute for Problems in Mechanics**

*Assistant Researcher*

Sep 2007 - July 2011

*Moscow, Russia*

- Utilized CAD software (Fluent, Comsol) to build numerical flow model in a shock tube.
- Advanced numerical methods for convective-diffusion type equations and implementation of unstructured grids for predicting the heating rates for complex shape bodies.
- Developed a series of two and three-dimensional program codes for the numerical solution of Navier-Stokes equations and radiation transfer.
- Revisited and predicted the convective and radiative heating rates to the surface of a number of spacecraft: Apollo, Soyuz, Pathfinder, Orion, FIRE II.

1. **D Andrienko**, ID Boyd, JN Maser, S Shepard, “Interaction of a high energy laser with metals in reacting atmospheres”, AIAA Paper 2023-1492, [DOI](#)
2. **D Andrienko**, R Sahu, A Tropina, RB Miles, K Hara, “Computational fluid dynamic model of electron transpiration cooling in weakly ionized air flows”, AIAA Paper 2021-0684, [DOI](#)
3. AJ Fangman, **D Andrienko**, “A state-to-state and multi-temperature study of air thermochemistry”, AIAA Paper 2021-0316, [DOI](#)
4. **D Andrienko** “The importance of O<sub>3</sub> excited potential energy surfaces in O<sub>2</sub>–O high-temperature kinetics”, The Journal of chemical physics 152 (4), 044305, 2020 [DOI](#)
5. AJ Fangman **D Andrienko** “Vibrational-specific model of N<sub>2</sub>–N and N<sub>2</sub>–N<sub>2</sub> interactions in post-shock conditions”, Journal of Thermophysics and Heat Transfer, [DOI](#)
6. SF Gimelshein, IJ Wysong, **D Andrienko** et al. “Kinetic and Continuum Modeling of High Temperature Relaxation of O<sub>2</sub> and N<sub>2</sub> Binary Mixtures”, Journal of Thermophysics and Heat Transfer, [DOI](#)

## [PEER-REVIEWED JOURNAL ARTICLES](#)

---

1. J. W. Streicher, D. P. Merrell, C. L. Strand, R. K. Hanson, T. T. Aiken, **D. A. Andrienko** “Vibrational-state-resolved relaxation and chemistry of carbon monoxide and nitrogen mixtures from 2000–10 250 K probing carbon monoxide in the ground to twelfth excited state”, *Physics of Fluids* 37 (9), 2025
2. **D Andrienko** “The importance of O<sub>3</sub> excited potential energy surfaces in O<sub>2</sub>–O high-temperature kinetics”, The Journal of chemical physics 152 (4), 044305, 2020, [DOI](#)
3. F Esposito, M Panesi, I Boyd, **D Andrienko**, K Neitzel “Heavy Particle Elementary Processes in Hypersonic Flows” in ”Hypersonic Meteoroid Entry Physics”, in ”Hypersonic Meteoroid Entry Physics”, IOP Publishing, 2019. [DOI](#)
4. **D Andrienko**, ID Boyd “Vibrational energy transfer and dissociation in O<sub>2</sub>–N<sub>2</sub> collisions at hyperthermal temperatures”, Journal of chemical physics 148 (8), 084309, 2018 [DOI](#)
5. **D Andrienko**, ID Boyd “State-specific dissociation in O<sub>2</sub>–O<sub>2</sub> collisions by quasiclassical trajectory method”, Chemical Physics 491, 74-81, 2017 [DOI](#)
6. K Neitzel, **D Andrienko** and ID Boyd “Aerothermochemical Nonequilibrium Modeling for Oxygen Flows”, Journal of Thermophysics and Heat Transfer, 31 (3), 634-645, 2016
7. **D Andrienko** and ID Boyd “Kinetic models of oxygen thermochemistry based on quasi-classical trajectory method”, Journal of Thermophysics and Heat Transfer, 2016 [DOI](#)
8. **D Andrienko** and ID Boyd “Thermal relaxation of molecular oxygen in collisions with nitrogen atoms”, Journal of Chemical Physics, Vol. 145 (1), 014309, 2016, [DOI](#)
9. I Ulusoy, **D Andrienko**, ID Boyd and R Hernandez “Quantum and quasi-classical collisional dynamics of O<sub>2</sub>–Ar at high temperatures”, Journal of Chemical Physics, Vol. 144 (23), 234311, 2016, [DOI](#)
10. **D Andrienko** and ID Boyd “Rovibrational energy transfer and dissociation in O<sub>2</sub>–O collisions”, Journal of Chemical Physics, Vol. 144 (10), 104301, 2016, [DOI](#)
11. **D Andrienko** and ID Boyd “High Fidelity Modeling of Thermal Relaxation and Dissociation of Oxygen”, Physics of Fluids, Vol. 27, 116101, 2015, [DOI](#)
12. **D Andrienko** and ID Boyd “Master Equation Study of Vibrational and Rotational Relaxation of Oxygen”, Journal of Thermophysics and Heat Transfer, Vol. 30 (3), pp. 533-552, 2016, [DOI](#)
13. **D Andrienko**, ST Surzhikov and JS Shang “View-factor approach as a radiation model for the re-entry flowfield”, Journal of Spacecraft and Rockets, Vol. 53 (1), pp.74-83, 2016, [DOI](#).
14. **D Andrienko** and ID Boyd, “Investigation of Oxygen Vibrational Relaxation by Quasi-Classical Trajectory Method”, Chemical Physics, Vol. 459, pp. 1-13, 2015, [DOI](#)
15. JS Shang, **D Andrienko**, PG Huang and ST Surzhikov “A computational approach for hypersonic nonequilibrium radiation utilizing space partition algorithm and Gauss quadrature”, Journal of Computational Physics, Vol. 266, pp 1–21, 2014, [DOI](#)
16. **D Andrienko**, ST Surzhikov and JS Shang “Spherical Harmonics Method Applied to the Multi-Dimensional Radiation Transfer Equation”, Journal of Computer Physics Communications, Vol. 184, No 10, pp.2287-2298, 2013, [DOI](#)
17. **D Andrienko** and ST Surzhikov “P<sub>1</sub> approximation applied to Radiative heating of Descent Spacecraft”, Journal of Spacecraft and Rockets, Vol. 49, No. 6, pp. 1088-1098, 2012, [DOI](#)

18. **D Andrienko** and ST Surzhikov “The unstructured two-dimensional grid-based computation of selective thermal radiation in CO<sub>2</sub>-N<sub>2</sub> mixture flows”, *Journal of High Temperature*, Vol. 50, No. 4, pp.545-555, 2012, [DOI](#)
19. **D Andrienko** and ST Surzhikov “The heat transfer equation formulated through the P<sub>1</sub>-approximation of spherical harmonics method for nonscattering media” *Physical and chemical kinetics*, Vol. 9, 2010.
20. **D Andrienko** and ST Surzhikov, “Comparing the heat transfer equation solution, obtained by the spherical harmonics method and the ray-tracing method in the complex curvilinear geometry,” *BMSTU*, Vol.3, 2010, pp.15-30.
21. **D Andrienko** “Applying the P<sub>1</sub>-approximation of spherical harmonics method for heat transfer equation,” *Journal of Thermal Processes in Engineering*, Vol. 11, No. 11, pp. 477-483, 2009.
22. **D Andrienko**, ST Surzhikov “Solving the two dimensional Poisson equation with nonlinear iterational method”, *Physical and chemical kinetics*, Vol. 7, 2008.

## TEACHING EXPERIENCE

---

- “Molecular Gas Dynamics”, University of Michigan, 2017
- “High-speed Aerodynamics” Texas A&M University, 2019
- “Thermodynamics” Texas A&M University, 2018-2021
- “Molecular Theory of Gases ”, Texas A&M University, 2019

## CONFERENCE (ABSTRACT REVIEWED) PAPERS

---

1. **D. Andrienko** “Utilizing the Master Equation Model for Non-Thermal Recombination Reactions on a Silica Surface”, *AIAA SCITECH 2026 Forum*, 2641, 2026
2. **T. Aiken, B. Durham, D. Andrienko, I. D. Boyd** “State-Resolved Analysis of Recombinative O<sub>2</sub> and N<sub>2</sub> Mixtures in Hypersonic Boundary Layers”, *AIAA AVIATION Forum and ASCEND 2025*, 3405, 2025
3. **D. Andrienko, I. D. Boyd, W. T. Burke, M. Clyde, S. Weston, I. A. Ballou** “Evaluation of the Ceramic Material Response Model Under Static and Dynamic Flow Conditions”, *AIAA AVIATION Forum and ASCEND 2025*, 3562, 2025
4. **D. Andrienko, I. D. Boyd, J. W. Streicher, R. K. Hanson** “Experimental and Computational Assessment of O<sub>2</sub> and NO Individual Vibrational States in Reflected Shock Flows”, *AIAA SCITECH 2025 Forum*, 0211, 2025
5. **M. S. Grover, P. Valentini, N. J. Bisek, S. M. Jo, R. Davuluri, A. Martin, A. Notey** “Comparative Analysis of Thermophysics Models for the Simulations of Nonequilibrium Flow”, *AIAA SCITECH 2025 Forum*, 0641, 2025
6. VT Baluckram **D Andrienko**, ID Boyd “First-principle simulation of vibrational activation and dissociation in oxygen shock flows”, *AIAA Paper 2021-0447*, [DOI](#)
7. DC van den Bekerom, D Andrienko, I Adamovich “Measurements of Vibrationally Excited Oxygen Produced in Recombining O-O<sub>2</sub>-Ar Mixtures”, *AIAA Paper 2021-1145*, [DOI](#)
8. AJ Fangman, **D Andrienko**, “A state-to-state and multi-temperature study of air thermochemistry”, *AIAA Paper 2021-0316*, [DOI](#)
9. **D Andrienko** “The importance of O<sub>3</sub> excited potential energy surfaces in O<sub>2</sub>-O high-temperature kinetics”, *The Journal of chemical physics* 152 (4), 044305, [DOI](#)
10. A Tropina, D Andrienko, RB Miles, “Modeling studies of electron transpiration cooling at high-speed flows.” *AIAA Paper 2020-3231*
11. VT Baluckram, D Andrienko “Comparison of O<sub>2</sub>-O vibrational relaxation and dissociation rate coefficients computed on potential energy surfaces of different fidelity”, *AIAA Paper 2020-0485*
12. **D Andrienko**, ID Boyd “Different Estimations of the Convective and Radiative Heating for the Martian Entry Probes”, *AIAA Paper 2019-0791* [DOI](#)
13. D Yatsukhno, S Surzhikov, **D Andrienko**, J Annaloro, P Omaly “Different Estimations of the Convective and Radiative Heating for the Martian Entry Probes”, *AIAA Paper 2019-0793* [DOI](#)
14. **D Andrienko**, ID Boyd “State-resolved characterization of nitric oxide formation in shock flows”, *AIAA Paper 2018-1233*, 2018 [DOI](#)

15. **D Andrienko**, ID Boyd “Dissociation of oxygen and nitrogen in a bimolecular reaction at hypersonic temperatures”, AIAA Paper 2018-0240, 2018 [DOI](#)
16. D Yatsukhno, S Surzhikov, O Bessonov, **D Andrienko**, J Annaloro “Radiative Gas Dynamics of Exomars at Angle of Attack in view of Turbulent Heating”, AIAA Paper 2018-0982, 2018 [DOI](#)
17. **D Andrienko**, ID Boyd “Master equation simulation of O<sub>2</sub>-N<sub>2</sub> collisions on an ab-initio potential energy surface”, AIAA Paper 2017-3163, 2017 [DOI](#)
18. **D Andrienko**, ID Boyd “Simulation of oxygen dissociation on a six-dimensional O<sub>4</sub> potential energy surface”. AIAA Paper 2017-3487, 2017 [DOI](#)
19. **D Andrienko**, ID Boyd “State-resolved O<sub>2</sub>-N<sub>2</sub> kinetic model at hypersonic temperatures”, AIAA Paper 2017-0659, 2017 [DOI](#)
20. IS Ulusoy, **D Andrienko**, ID Boyd, R Hernandez “Quantal treatment of O<sub>2</sub>-Ar vibrational relaxation at hypersonic temperatures”, AIAA Paper 2017-0661, 2017 [DOI](#)
21. **D Andrienko**, ID Boyd, “Vibrational relaxation and dissociation in O<sub>2</sub>-O mixtures”, AIAA Paper 2016-4021, June 2016, [DOI](#)
22. K. Neitzel, **D Andrienko**, ID Boyd, “Thermochemical Nonequilibrium Modeling for Hypersonic Flows Containing Oxygen”, AIAA Paper 2016-4023, June 2016, [DOI](#)
23. **D Andrienko**, ID Boyd, “High Fidelity Modeling of Thermal Relaxation and Dissociation of Oxygen”, AIAA Paper 2016-0736, January 2016, [DOI](#)
24. **D Andrienko**, ID Boyd, “Simulation of O<sub>2</sub>-N Collisions on ab-initio Potential Energy Surfaces”, AIAA Paper 2016-1249, January 2016, [DOI](#)
25. **D Andrienko**, ID Boyd, “Master Equation Study of Vibrational and Rotational Relaxation of Oxygen,” AIAA Paper 2015-3252, June 2015, [DOI](#)
26. **D Andrienko**, ID Boyd, “Vibrational Relaxation and Dissociation of Oxygen in Molecule-Atom Collisions,” AIAA Paper 2015-3251, June 2015, [DOI](#)
27. K Neitzel, **D Andrienko**, ID Boyd, “Modeling Fidelity for Oxygen Nonequilibrium Thermochemistry in Reflected Shock Tube Flows”, AIAA Paper 2015-2509, June 2015, [DOI](#)
28. JS Shang, **D Andrienko**, ST Surzhikov, and PG Huang “An efficient computational approach to hypersonic nonequilibrium radiation utilizing Gaussian Quadrature and Space Partition” AIAA paper 2013-2587, January 2013, [DOI](#)
29. **D Andrienko**, Shang JS, Huang PG, Katta V “Compressible counter-flowing hydrogen-air combustion,” 51<sup>st</sup> AIAA paper 2013-293, January 2013, [DOI](#)
30. **D Andrienko**, Surzhikov ST, Shang JS “Three-dimensional Radiative Heating of Descent Space Vehicle Based on Spherical Harmonics Method with Unstructured Grids,” 50<sup>th</sup> AIAA meeting, Nashville, TN, January 2012, [DOI](#)
31. **D Andrienko**, Surzhikov ST “Models of spectral radiation heat transfer for Martian space vehicles,” Proceedings of 7th International Planetary Probe Workshop (on CD), 2010, Barcelona, Spain, 12-18 June.
32. ST Surzhikov, **D Andrienko** “Aerothermodynamics of descent space vehicles at strong coupled radiative-gasdynamic interaction,” Proceedings of 7th International Planetary Probe Workshop (on CD), 2010, Barcelona, Spain, 12-18 June.
33. **D Andrienko** “Solving the heat transfer equation in non-scattering media using spherical harmonics method,” Proceedings of “Problems of gasdynamic and heat transfer in aerospace technologies”, 2009, Vol. 2, pp. 172-175.
34. **D Andrienko**, ST Surzhikov “Two-dimensional radiation heat transfer to Martian space vehicle,” Proceedings of the 3rd International Workshop on Radiation of High Temperature Gases in Atmospheric Entry (on CD), 2009, October 3-7, Iraklion, Greece.
35. **D Andrienko**, ST Surzhikov “The heat transfer equation formulated through the p<sub>1</sub>-approximation of spherical harmonics method for non-scattering media,” Proceedings of 2<sup>nd</sup> scientific school-seminar “Aerophysics and physical mechanics of classical and quantum systems”, 2008, pp. 172-175.

## INVITED TALKS AND SEMINARS

---

- “Multi-physics modeling of refractory ceramic materials for hypersonic and directed energy environments,” AFRL seminar, 2023
- “Plasma in extreme environments for National Security,” Center for Integrated Plasma Studies, 2023

- “State-resolved models of chemically reactive air flows”, GEC workshop, 2019
- “State Resolved Analyses of High Temperature Energy Transfer Processes in Oxygen”, Society of Engineering Science 52nd Technical Meeting, Oct 26-28, 2015
- “High fidelity models of oxygen chemistry in hypersonic flows” University of Texas Arlington, 2016
- “High fidelity models of oxygen chemistry”, FlowPAC Seminar Series, University of Notre Dame, October 15, 2015
- “Multi-Scale Modeling of Nonequilibrium Gas Flows” Texas A&M University, 2017

## **REVIEWER - ACADEMIC JOURNALS**

---

- **Chemical Physics** - Elsevier
- **Chemical Physics Letters** - Elsevier
- **Journal of Chemical Physics** - American Institute of Physics
- **Physics of Fluids** - American Institute of Physics
- **AIAA Journal** - American Institute of Aeronautics and Astronautics
- **Journal of Thermophysics and Heat Transfer** - American Institute of Aeronautics and Astronautics
- **Journal of Spacecraft and Rockets** - American Institute of Aeronautics and Astronautics
- **Atmosphere** - Multidisciplinary Digital Publishing Institute
- **International Journal of Heat and Mass Transfer** - Elsevier
- **Journal of Applied Mathematics and Physics** - Scientific Research
- **International Journal of Hydrogen Energy** - Elsevier

## **REVIEWER - GOVERNMENT AGENCIES**

---

- AFOSR, NSF, ONR

## **PROFESSIONAL ASSOCIATION**

---

- AIAA - Senior Member
- SPIE, APS - Member

## **SCHOLARSHIP AND AWARDS**

---

- Final year Ph.D. student assistantship, stipend and full tuition, Wright State University, 2013 – 2014 year
- Tuition waiver academic award, Wright State University, 2012 – 2013
- Research associate, Universal Technology Corp., Subcontract agreement 12-5590-0004-C1 (Wright State University, PI JS Shang), 2011-2013.
- Radiation at Hypersonic Flow Conditions, Research Assistantship, Prof. J.S. Shang, Prof. P.G. Huang, Wright State University, Sep 2012 - July 2013.
- Best Presentation (Central Institute of Airplane Engine Manufactory, Moscow, 2011)
- Annual student fellowship (Dynasty, Non-Profit Foundation, Moscow, 2010)
- Annual award: outstanding student contribution, Institute for problems in mechanics, Moscow, 2008, 2009, 2010