

# Egor Demidov

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orcid.org/0000-0003-3082-488X | scholar.google.com/citations?user=vZx\_CiUAAAAJ

## Education

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- New Jersey Institute of Technology**, PhD in Chemistry Sep 2023 to present
- Research Assistantship
- New Jersey Institute of Technology**, BS in Chemical Engineering Sep 2019 to May 2023  
Minor in Computer Science
- Albert Dorman Honors Scholar
  - Magna Cum Laude

## Publications

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- Alexei F. Khalizov, Ella V. Ivanova, **Egor V. Demidov**, Ali Hasani, Jeffrey H. Curtis, Nicole Riemer, Gennady Y. Gor  
“An unaccounted pathway for rapid aging of atmospheric soot”  
*Submitted to Environmental Science and Technology*, **2025**
- Ashoka Karunarathne, **Egor V. Demidov**, Ali Hasani, Alexei F. Khalizov  
“Mechanical properties of bare and coated soot aggregates probed by atomic force microscopy”  
*Journal of Aerosol Science*, **2025**, 185, 106523, 10.1016/j.jaerosci.2024.106523
- Egor V. Demidov**, Gennady Y. Gor, Alexei F. Khalizov  
“Discrete element method model of soot aggregates”  
*Physical Review E*, **2024**, 110, 054902, 10.1103/PhysRevE.110.054902
- Egor V. Demidov**, Ogochukwu Y. Enekwizu, Ali Hasani, Chong Qiu, Alexei F. Khalizov  
“Differences and similarities in optical properties of coated fractal soot and its surrogates”  
*Journal of Aerosol Science*, **2024**, 180, 106392, 10.1016/j.jaerosci.2024.106392

## Conference Proceedings (presenting Authors Underlined)

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- Alexei F. Khalizov, Ella V. Ivanova, **Egor V. Demidov**, Ali Hasani, Jeffrey Curtis, Nicole Riemer, Gennady Y. Gor  
“An unaccounted pathway for rapid aging of atmospheric soot”  
*43<sup>rd</sup> Regional Meeting on Kinetics and Dynamics, Newark, NJ, Jan 2025*
- Alexei F. Khalizov, Ella V. Ivanova, **Egor V. Demidov**, Ali Hasani, Jeffrey Curtis, Nicole Riemer, Gennady Y. Gor  
“An unaccounted pathway for rapid aging of atmospheric soot”  
*American Geophysical Union Fall Meeting 2024, Washington, DC, Dec 2024*
- Alexei F. Khalizov, Ali Hasani, **Egor V. Demidov**  
“Soot restructuring in condensation-evaporation cycles”  
*American Association for Aerosol Research 42<sup>nd</sup> Annual Conference, Albuquerque, NM, Oct 2024*
- Ella V. Ivanova, **Egor V. Demidov**, Nicole Riemer, Gennady Y. Gor, Alexei F. Khalizov  
“Capillary condensation as an unaccounted pathway for rapid aging of atmospheric soot”  
*American Association for Aerosol Research 42<sup>nd</sup> Annual Conference, Albuquerque, NM, Oct 2024*
- Ogochukwu Y. Enekwizu, **Egor V. Demidov**, Arthur J. Sedlacek, Ernie R. Lewis, Alexei F. Khalizov  
“Reconciling measured and modeled optical properties of black carbon”

*American Association for Aerosol Research 42<sup>nd</sup> Annual Conference, Albuquerque, NM, Oct 2024*

Egor V. Demidov, Gennady Y. Gor, Alexei F. Khalizov

“Discrete element method model for restructuring of soot aggregates”

*American Association for Aerosol Research 42<sup>nd</sup> Annual Conference, Albuquerque, NM, Oct 2024*

Ogochukwu Y. Enekwizu, Egor V. Demidov, Arthur J. Sedlacek, Ernie R. Lewis, Alexei F. Khalizov

“Reconciling measured and modeled optical properties of black carbon”

*Pacific Northwest National Laboratory Environmental Molecular Sciences Laboratory User Meeting, online, Oct 2024*

Egor V. Demidov, Gennady Y. Gor, Alexei F. Khalizov

“Modeling of soot restructuring”

*Pacific Northwest National Laboratory Environmental Molecular Sciences Laboratory User Meeting, online, Oct 2024*

Egor V. Demidov, Gennady Y. Gor, Alexei F. Khalizov

“Discrete element method model for restructuring of atmospheric soot aggregates”

*American Chemical Society Middle Atlantic Regional Meeting 2024, University Park, PA, Jun 2024*

Egor V. Demidov, Ali Hasani, Gennady Y. Gor, Alexei F. Khalizov

“Development of a model for restructuring of fractal soot aggregates and its parameterization using AFM experiments”

*42<sup>nd</sup> Regional Meeting on Kinetics and Dynamics, Hartford, CT, Jan 2024*

Egor V. Demidov, Alexei F. Khalizov

“An algorithm for evaluating fractal parameters of a single soot aggregate”

*American Association for Aerosol Research 41<sup>st</sup> Annual Conference, Portland, OR, Oct 2023*

Ella V. Ivanova, Ali Hasani, Egor V. Demidov, Gennady Y. Gor, Alexei F. Khalizov

“Modeling of joint capillary condensation of trace chemicals and water on fractal soot aggregates”

*American Association for Aerosol Research 41<sup>st</sup> Annual Conference, Portland, OR, Oct 2023*

Egor V. Demidov, Laurence Lu, Divjyot Singh, Alexei F. Khalizov

“Retrieval of the fractal parameters of individual soot aggregates”

*41<sup>st</sup> Regional Meeting on Kinetics and Dynamics, Amherst, MA, Jan 2023*

Egor V. Demidov, Ali Hasani, Ogochukwu Enekwizu, Chong Qiu, Alexei F. Khalizov

“Light absorption and scattering by coated combustion soot and its surrogates”

*American Geophysical Union Fall Meeting 2022, Chicago, IL, Dec 2022*

Egor V. Demidov, Alexei F. Khalizov

“Heterogeneous nucleation of a non-wetting vapor on NaCl aerosol nanoparticles and its implications on cloud forming and optical properties”

*American Chemical Society Northeast Regional Meeting 2022, Rochester, NY, Oct 2022*

Egor V. Demidov, Alexei F. Khalizov

“Predicting vapor supersaturation and particle growth rate in a laminar flow”

*40<sup>th</sup> Regional Meeting on Kinetics and Dynamics, online, Jan 2022*

Ali Hasani, Egor V. Demidov, Alexei F. Khalizov

“Different mechanisms of soot restructuring by wetting and non-wetting liquid”

*40<sup>th</sup> Regional Meeting on Kinetics and Dynamics, online, Jan 2022*

Egor V. Demidov, Ali Hasani, Ogochukwu Enekwizu, Alexei F. Khalizov

“Light scattering and absorption by soot aerosols with different morphologies and coating distributions”

102<sup>nd</sup> American Meteorological Society Annual Meeting, online, Jan 2022

Egor V. Demidov, Alexei F. Khalizov

“Methods for predicting supersaturation in a laminar flow”

102<sup>nd</sup> American Meteorological Society Annual Meeting, online, Jan 2022

Ali Hasani, Egor V. Demidov, Alexei F. Khalizov

“Different mechanisms of soot restructuring by wetting and non-wetting liquids”

American Geophysical Union Fall Meeting 2021, online, Dec 2021

Egor V. Demidov, Alexei F. Khalizov

“Enhanced light scattering and absorption by soot aerosols with different coating distributions”

American Chemical Society Middle Atlantic Regional Meeting 2021, online, Jun 2021

## Research Projects

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### Capillary condensation of vapors on fractal soot aggregates

- Conducted finite element modeling to determine vapor saturation in an aging chamber
- Helped extend the capillary condensation model to multiple components
- Created an open-source C++ library for capillary condensation on soot
- The project resulted in a publication submission

### Development of a soot restructuring model

- Developed a discrete element method (DEM) contact model for soot aggregates
- Ran simulations to parametrize the contact model on experiments
- Created an open-source C++ code for soot aggregate DEM simulations
- This project resulted in a publication and is featured in another publication

### Adsorption-induced surface stress in amorphous silica

- Compared multiple molecular dynamics potentials to find the optimal one for the system of interest
- Ran molecular simulations in LAMMPS to study the effects of hydroxylation on the surface stress in silica

### Optics of soot and its surrogates

- Designed and conducted a series of experiments to investigate the optical properties of bare and coated soot and its surrogates
- The project resulted in a publication

### Aerosol growth tube

- Designed a condenser tube with precise vapor supersaturation control
- Rates of heat and mass transfer in the condenser were simulated numerically

### Aerosol coagulation chamber

- Extended Alexei Khalizov's aerosol generation and aging system with a coagulation chamber with controlled residence time
- The coagulation chamber allowed us to investigate the mechanical differences between nascent soot aggregates and agglomerates of aggregates

## Software Projects

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### Capillary condensation web-application

- Developed a web-application that simulates capillary condensation of trace chemicals on fractal soot
- Implemented the capillary condensation model in an open-source C++ library
- Tools Used: C++, Emscripten, React

soot-dem

- Developed a discrete element method contact model for soot aggregate mechanics
- Implemented the developed contact model in an in-house code
- Tools Used: C++, OpenMP, Eigen
- The project resulted in a publication

#### **soot-dem-gui**

- Developed a graphical user interface wrapper from the soot mechanics engine
- Tools Used: C++, Qt, VTK

#### **create-latexdiff**

- Developed a GitHub action to automatically generate latexdiff files for version-controlled  $\text{\LaTeX}$  projects
- Tools Used: Docker, Bash

### **Referee Work**

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Atmospheric Pollution Research	2024
Nature Reviews Physics	2024
Physical Review Fluids	2024
Journal of Geophysical Research	2024

### **Event Organization**

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43rd Regional Meeting on Kinetics and Dynamics	Jan 2025
<ul style="list-style-type: none"> <li>• Created and maintained the <u>meeting website</u></li> <li>• Handled participant registration</li> <li>• Made the event schedule</li> <li>• Helped with space and catering arrangements</li> </ul>	

### **Areas of Expertise**

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**Computational chemistry and physics:** discrete element method, classical molecular dynamics, finite element analysis, finite difference methods, discrete dipole approximation, T-matrix, core-shell Mie scattering

**Experimental techniques:** scanning electron microscopy, electrostatic aerosol sizing, aerosol scattering measurements, contact angle measurements