Joseph Nakao
Curriculum Vitae

Swarthmore College
Dept. of Math. & Stat.
500 College Avenue
Swarthmore, PA 19081
✉ jnakao1@swarthmore.edu
⌂ jhknakao.github.io/

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ACADEMIC POSITIONS

Swarthmore College Swarthmore, PA
Assistant Professor of Mathematics (tenure track) *2023–Present*

EDUCATION

University of Delaware Newark, DE
Ph.D. Applied Mathematics *2018–2023*
  Advisor: Jingmei Qiu

Seattle University Seattle, WA
B.S. Applied Mathematics *2014–2018*
  Advisors: Yen-Lin Han (Mechanical Engineering) and Katie Oliveras (Mathematics)

AREAS OF INTEREST

- Scientific computing and numerical analysis
- Low-rank methods for time-dependent tensor equations
- Computational fluid dynamics and hyperbolic conservation laws
- Mathematical modeling

PUBLICATIONS

Journals and Conference Proceedings

A. Galindo-Olarte, W. Taitano, J.-M. Qiu, J. Nakao, and M. Pasha, "A nodal discontinuous Galerkin method with low-rank representation in phase space for the multi-scale BGK model", *In preparation.*

J. Nakao, D. Jacobs, W. Taitano, and J.-M. Qiu, "A hybrid implicit-explicit low-rank method with structure preservation for solving 1D-2V Vlasov-Fokker-Planck models", *In preparation.*

J. Nakao, G. Ceruti, and L. Einkemmer, "A Reduced Augmentation Implicit Low-rank (RAIL) integrator for solving three-dimensional diffusion and advection-diffusion equations in the Tucker tensor format", arXiv: 2503.04932, *Submitted* (2025).

J. Nakao, J.-M. Qiu, and L. Einkemmer, "Reduced Augmentation Implicit Low-rank (RAIL) integrators for advection-diffusion and Fokker-Planck models", *SIAM Journal on Scientific Computing* **47:2** (2025), pp. A1145-A1169.

J. Chen, J. Nakao, J.-M. Qiu, and Y. Yang, "A high-order Eulerian-Lagrangian Runge-Kutta finite volume (EL-RK-FV) method for scalar nonlinear conservation laws", *Journal of Scientific Computing* **102:12** (2025).

J. Nakao, "Speeding up high-order algorithms in computational fluid and kinetic dynamics: based on characteristics tracing and low-rank structures", *University of Delaware* (2023).

J. Nakao, J. Chen, and J.-M. Qiu, "An Eulerian-Lagrangian Runge-Kutta finite volume (EL-RK-FV) method for solving convection and convection-diffusion equations", *Journal of Computational Physics*, **470** (2022), pp. 111589.

J. Nakao and Y.L. Han, "Preliminary simulated results modeling a dynamic heating cancer ablation probe", *ASME International Mechanical Engineering Congress and Exposition (IMECE) – Applications of Computational Heat Transfer*, Pittsburgh, PA, November 2018.

Articles

D. Crombecque, M. Hill, and J. Nakao, "A Word From...Spectra on the Recent Efforts Supporting LGBTQ+ Mathematicians", *Notices of the American Mathematical Society*, **71:6** (2024), pp. 705-707.

J. Nakao, "Recent Activities and Progress by Spectra and the LGBTQ+ Mathematics Community", *MAA FOCUS*, **43:6** (2023/2024), pp. 10-13.

R. Buckmire, A. Folsom, C. Goff, A. Hoover, J. Nakao, and K.A. Sather-Wagstaff, "On Best Practices for the Recruitment, Retention, and Flourishing of LGBTQ+ Mathematicians", *Notices of the American Mathematical Society*, **70:6** (2023), pp. 979-985.

J. Nakao, "The Pot of Gold at the End of the Rainbow – How Mathematics Departments Can Increase LGBTQ+ Inclusivity", *MAA Math Values Blog*, April 2021.

J. Nakao, "Adventures in Book Collecting", *The Atrium – University of Delaware's Quarterly Newsletter*, September 2019.

Open Access Handbooks and Reference Guides

J. Nakao, "The Handbook of MATH221".

J. Nakao and D. Hayes, "A MATLAB Reference Guide for Undergraduate STEM Majors".

J. Nakao, "A Mathematica Reference Guide (for calculus students)".

J. Nakao, "A Gentle Introduction to LaTeX".

HONORS AND AWARDS

- Graduate Student Excellence in Scholarly Community Engagement Award, University of Delaware   December 2022
  "This excellence award serves the following major purposes: 1. To highlight the University's commitment to engaged scholarship in teaching, engaged research/creative activities, and engaged service; 2. To reward Graduate Student excellence in mutually beneficial, scholarly engaged teaching, research/creative activities and service; and 3. To thereby promote excellence in community engagement among other Graduate Students." ($1000 award)
- Winter Research Symposium Best Poster Award, University of Delaware   February 2022
  Voted best poster at the annual Winter Research Symposium hosted by the University of Delaware Department of Mathematical Sciences. ($500 award)
- Baxter-Sloyer Graduate Teaching Award, University of Delaware   May 2021
  "Given to a graduate student teaching assistant, in mathematical sciences, who has demonstrated superior effectiveness in teaching, and in the performance of their responsibilities." ($300 award)
- Seth Trotter Book Collecting Contest, University of Delaware   June 2019
  Placed first in the book collecting contest put on by the Friends of the University of Delaware Library, and entered into the National Student Book Collecting Contest. Won with my reference library of (now) roughly 400 mathematical and engineering texts. ($1000 award)
- Wynne Alexander Guy Award, Seattle University   June 2018
  "Given in grateful acknowledgment of a graduating mathematics major whose extraordinary contribution to the department always went above and beyond what was expected. Named to honor beloved teacher Mrs. Guy, who performed extraordinary service to the Mathematics department and Seattle University for 30 years."

PRESENTATIONS AND POSTERS

Keynote Talks

- Towards improving diversity, queerness, and empathy: how to support LGBTQ+ mathematics students   July 2024
  Spectra Survey of Mathematics Conference (SSMC), The Ohio State University, Columbus, OH
- "Navigating Graduate School as a Queer Student"   November 2022
  LGBTQ+ Math Day (virtual), Fields Institute for Research in Mathematical Sciences, Toronto, CAN

Colloquium and Seminar Talks

- Title TBD   (Upcoming) September 2025
  PDEs & Data Control Seminar, Department of Mathematical Sciences, George Mason University, Fairfax, VA
- Implicit low-rank integrators for advection-diffusion and Fokker-Planck models with structure preservation   May 2025
  Plasma Seminar, Department of Aeronautics & Astronautics, University of Washington, Seattle, WA
- Low-rank implicit integrators based on reduced augmentation for solving advection-diffusion equations in higher dimensions   October 2024
  Numerical Analysis Seminar, University of Innsbruck, Innsbruck, AUT
- High-order implicit low-rank time integrators for advection-diffusion and Fokker-Planck models   March 2024
  Applied & Computational Mathematics Seminar, Department of Mathematical Sciences, George Mason University, Fairfax, VA
- "Balancing efficiency, physics, and robustness: what goes into designing a *good* algorithm?"   February 2024
  Mathematics Colloquium, Department of Mathematics & Statistics, Williams College, Williamstown, MA
- "Balancing efficiency, physics, and robustness: what goes into designing a *good* algorithm?"   February 2024
  Mathematics Colloquium, Department of Mathematics, Bryn Mawr College, Bryn Mawr, PA
- "Speeding up high-order algorithms in computational fluid and kinetic dynamics: based on characteristics tracing and low-rank structures"   May 2023
  Dissertation defense, University of Delaware, Newark, DE
- "A structure preserving, conservative, low-rank tensor scheme for solving the 1D2V Vlasov-Fokker-Planck equation"   August 2022
  AFRL/RQRS Technical Talks, Air Force Research Laboratory, Edwards, CA
- "A brief introduction to low-rank tensor decompositions"   August 2022
  AFRL/RQRS Technical Talks, Air Force Research Laboratory, Edwards, CA
- "Solving for Exact Stationary Solutions to Shallow-Water Waves"   November 2017
  Analysis Seminar, Department of Mathematics, Washington State University, Pullman, WA
- "Modifying an Optimal Payload Sensor Model to Detect Mobile Targets"   August 2017
  Summer Scholar Presentations, Air Force Research Laboratory, Albuquerque, NM

Conference Talks

- Title TBD   (Upcoming) November 2025
  SIAM NNP Section Conference, hosted by Penn State University, State College, PA
- Title TBD   (Upcoming) October 2025
  SIAM PNW Section Conference, hosted by University of Washington, Seattle, WA
- "Low-rank implicit time integrators based on reduced augmentation for solving advection-diffusion equations in three dimensions"   March 2025
  SIAM Conference on Computational Science and Engineering, Fort Worth, TX

- "Low-rank implicit time integrators based on reduced augmentation for solving advection-diffusion equations in three dimensions"   November 2024
  SIAM NNP Section Conference, hosted by Rochester Institute of Technology, Rochester, NY
- "Reduced Augmentation Implicit Low-rank (RAIL) integrators for advection-diffusion and Fokker-Planck models"   January 2024
  Joint Mathematics Meetings, San Francisco, CA
- "Navigating College and Beyond as a Queer Student"   November 2023
  Fourth Annual OURFA2M2 Conference (virtual)
- "Implicit low-rank integrators for solving time-dependent problems"   October 2023
  SIAM NNP Section Conference, hosted by New Jersey Institute of Technology, Newark, NJ
- "A structure preserving, conservative, low-rank tensor scheme for solving the 1D2V Vlasov-Fokker-Planck equation"   February 2023
  SIAM Conference on Computational Science and Engineering, Amsterdam, NLD
- "A structure preserving, conservative, low-rank tensor scheme for solving the 1D2V Vlasov-Fokker-Planck equation"   November 2022
  SIAM TX-LA Sectional Meeting, hosted by the University of Houston, Houston, TX
- "A structure preserving, conservative, low-rank tensor scheme for solving the 1D2V Vlasov-Fokker-Planck equation"   September 2022
  Sayas Numerics Day, hosted by the University of Maryland, Baltimore County, Baltimore, MD
- "A new Eulerian-Lagrangian Finite Volume (ELFV) Method for Solving Convection-Diffusion Equations and Hyperbolic Conservation Laws"   March 2022
  AMS Spring Central Sectional Meeting (virtual), originally hosted by Purdue University, West Lafayette, IN
- "An Eulerian-Lagrangian Finite Volume Method for Solving Nonlinear Transport Equations"   July 2021
  SIAM Annual Meeting (virtual), originally at Spokane, WA

Posters

- "Implicit low-rank integrators for solving time-dependent problems"   October 2023
  Workshop on Sparse Tensor Computations, hosted by the University of Illinois, Chicago, IL
- "An Eulerian-Lagrangian Runge-Kutta finite volume (ELRK-FV) method for solving convection-diffusion equations"   February 2022
  Winter Research Symposium, University of Delaware, Newark, DE
- "Modifying an Optimal Payload Sensor Model to Detect Mobile Targets"   August 2017
  Summer Scholar Poster Session, Air Force Research Laboratory, Albuquerque, NM
- "Reconstructing the water-wave profile from pressure measurements in a moving body of water"   April 2017
  AMS Sectional Meeting, Washington State University, Pullman, WA

SUMMER POSITIONS AND INTERNSHIPS

Air Force Research Laboratory   Edwards, CA
Aerospace Systems Directorate   *May 2022–August 2022*

    Mentors: William Taitano and Alexander Alekseenko

    Project: Building conservative, structure-preserving low rank tensor algorithms for solving the Vlasov-Fokker-Planck equation

Air Force Research Laboratory   Edwards, CA
Aerospace Systems Directorate   *May 2021–August 2021*

    Mentors: Robert Martin and Alexander Alekseenko

Project: Modelling the Fokker-Planck and Vlasov-Fokker-Planck equations

Air Force Research Laboratory   Albuquerque, NM
Space Vehicles Directorate   *June 2017–August 2017*

    Mentor: Reed Weber

    Project: Modifying and implementing an optimal payload sensor model

    Interim security clearance (secret)

TEACHING

Swarthmore College

- **Instructorships**

MATH 66 (stochastic and numerical methods)	Fall 2025
MATH 93 (mathematical contest in modeling training; directed reading)	Fall 2025
MATH 43 (basic differential equations)	Spring 2025
MATH 54 (partial differential equations)	Spring 2025
MATH 93 (introduction to low-rank tensors; directed reading)	Spring 2025
MATH 25 (single variable calculus 2 for natural sciences and engineering)	Fall 2024
MATH 93 (computational mathematics with MATLAB; directed reading)	Fall 2024
MATH 93 (computational mathematics with MATLAB; directed reading)	Spring 2024
MATH 43 (basic differential equations)	Spring 2024
MATH 25 (single variable calculus 2 for natural sciences and engineering)	Fall 2023

University of Delaware

- **Instructorships**

MATH 243 (calculus 3 for physical sciences and engineering with lab component) *Download evaluations here* Winter 2023

MATH 243 (calculus 3 for physical sciences and engineering with lab component) *Download evaluations here* Winter 2022

MATH 221 (calculus 1 for life sciences and business) *Download evaluations here* Winter 2021

MATH 221 (calculus 1 for life sciences and business) *Download evaluations here* Winter 2020

UNDERGRADUATE RESEARCH STUDENTS

- Dylan Jacobs '27   January 2024–Present
  Project: A structure-preserving reduced augmentation implicit low-rank (RAIL) scheme for the Vlasov-Dougherty-Fokker-Planck equation

- Zoe Tang '27   September 2024–Present
  Expected Project: Low-rank structure-preserving Chang-Cooper (SPCC) discretizations for Fokker-Planck equations

- Paolo Bosques-Paulet '27   September 2024–Present
  Expected Project: High-order implicit low-rank integrators for high-dimensional advection-diffusion models in the hierarchical Tucker tensor format

- Joost Almekinders '27   Starting 2025
  Expected Project: Writing a MATLAB toolbox for the Reduced Augmentation Low-rank Implicit (RAIL) integrator

PROFESSIONAL SERVICE

The Broader Mathematics Community

- *Northeast Applied Mathematics at Small Colleges*   January 2025–Present
  Participant and volunteer for a newly formed group intended to connect applied mathematicians at small colleges and universities in the northeast region of the United States. The group was formed by Becca Thomases of Smith College.
- *SIAM New York-New Jersey-Pennsylvania (NNP) Section*   August 2024–Present
  District Liaison for Eastern Pennsylvania
  Duties include attending the regular Zoom meetings of the officers, and helping with communications between the section and the institutions of Eastern Pennsylvania.
- *MAA FOCUS*   August 2023–Present
  Editorial Board
  The newsmagazine of the Mathematical Association of America (MAA) (website link here), contains information about MAA activities, news from the mathematical community, and thought-provoking articles about mathematics, mathematics education, and related areas.
- Spectra   July 2021–August 2024
  Board of Directors – Membership Committee Chair
  Spectra (website link here) is the association for LGBTQ+ mathematicians.
  Contributions: creation of Spectra student chapters, Spectra LGBTQ+ Twitter visibility campaign, AMS-sponsored Spectra LGBTQ+ mathematicians posters.

Conferences and Workshops

- SIAM NNP 2025 Section Conference, hosted by Penn State University   (Upcoming) November 2025
  Organizing committee.
- SIAM NNP 2024 Section Conference, hosted by Rochester Institute of Technology   November 2024
  Organizing committee.

Journal Reviewer

- Numerical Analysis and Scientific Computing Journals
  Journal of Scientific Computing

MINISYMPOSIA, WORKSHOPS, AND PANELS

Minisymposia and Workshop Sessions Organized

- SIAM NNP Section Conference   (Upcoming) November 2025
  TBD
- SIAM NNP Section Conference   November 2024
  Advances in efficient and accurate kinetic and fluid solvers
- ICERM Workshop: Empowering a Diverse Computational Mathematics Research Community   July 2025
  Co-led a research team at this two-week ICERM workshop. Team leaders: Jingmei Qiu (University of Delaware), Joseph Nakao (Swarthmore College), William Taitano (Los Alamos National Laboratory). Team project: low rank tensor methods for high dimensional multi-scale multi-physics PDE models.
- SIAM Conference on Applied Linear Algebra   May 2024
  Low-rank tensor methods for high-dimensional problems
- Joint Mathematics Meetings   January 2024
  Spectra Special Session

- SIAM NNP Section Conference   October 2023
  Low-rank methods and their applications in large data and high-dimensional problems
- SIAM Annual Meeting   July 2022
  LGBT Minisymposia

Panels

- Panelist at the Virtual Joint Mathematics Meetings   April 2022
  Spectra Workshop: Identifying Best Practices Fostering Inclusion and Retention of LGBTQ Mathematicians. Topics of discussion: supporting transgender mathematicians in the work place (Keri Sather-Wagstaff), LGBTQ+ mathematicians balancing work choices with family (Ron Buckmire), best practices for recruitment of LGBTQ+ faculty (Amanda Folsom), and supporting LGBTQ+ graduate students (Joseph Nakao).
- Panelist at Society for Industrial and Applied Mathematics (SIAM) Annual Meeting   July 2021
  Minisymposium: Presentations by LGBTQ Mathematicians. Responsible for leading discussion about LGBTQ inclusivity in the applied mathematics community, as well as Spectra's current projects.

COMPUTER SKILLS

Proficient: MATLAB, Mathematica, LaTeX, Word, Excel, Powerpoint
Some experience: Fortran 90, Python, Julia