Emma Hart

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EDUCATION

Emory University, Atlanta, GA *August 2022 - Present*
PhD, Mathematics, Advised by Julianne Chung and Matthias Chung

Colgate University, Hamilton, NY *August 2018 - May 2022*
Bachelor of Arts; Major in Applied Mathematics, Minor in Educational Studies GPA: 4.00/4.00

RESEARCH INTERESTS

I am interested broadly in inverse problems and numerical linear algebra. I am currently working on projects that incorporate technologies from machine learning (in particular, autoencoder networks) to help address challenges in solving ill-posed, large-scale inverse problems.

PAPERS

1. Emma Hart, Bas Peters, et al. (2026). Latent Space Inference via Paired Autoencoders. *Preprint*
2. Emma Hart, Julianne Chung, and Matthias Chung (2025). A Paired Autoencoder Framework for Inverse Problems via Bayes Risk Minimization. *Preprint* (Accepted, SISC)
3. Soon Hoe Lim et al. (2025). Elucidating the Design Choice of Probability Paths in Flow Matching for Forecasting. *Transactions on Machine Learning Research*
4. Matthias Chung et al. (Dec. 2024). Paired autoencoders for likelihood-free estimation in inverse problems. *Machine Learning: Science and Technology* 5.4, p. 045055
5. Elle Buser, Emma Hart, and Ben Huenemann (2022). Comparison of Atlas-Based and Neural-Network-Based Semantic Segmentation for DENSE MRI Images. *SIAM Undergraduate Research Online* 15

RESEARCH

DOE Computational Sciences Graduate Fellow *Fall 2023 - Present*
Advisors: Julianne Chung and Matthias Chung
Developing methods for large-scale, ill-posed inverse problems (surrogate modeling, prior-learning, uncertainty quantification) by leveraging representation learning techniques.

Lawrence Berkeley National Lab Affiliate *Summer 2024*
Advisor: Xiaoye Sherry Li
Explored flow matching for generative modeling and probabilistic time series forecasting, in particular exploring the effects of different probability paths.

Colgate Undergraduate High Honors Senior Thesis *Fall 2021*
Advisor: Dan Schult
Developed a three step reaction model and simulated a system of partial differential equations to explore transitions between combustion states.

NSF REU at Emory University *Summer 2021*
Advisor: Lars Ruthotto
Compared how well different semantic segmentation approaches could identify regions of interest in a given MR image and produce a biomarker to be used in the diagnosis of Chiari Malformation.

POSTERS AND PRESENTATIONS

- (Co-Organized) *SIAM Annual Meeting 2025*, *Next-Gen Advancements in Inverse Problems: Ideas and Innovations from Early-Career Researchers*, Montreal, Canada. July, 2025
- (Invited) *Georgia Tech SIAM Student Seminar*, Georgia Institute of Technology, Atlanta, GA. "Autoencoders for Inverse Problems," October, 2024
- (Invited) *SIAM Conference on Mathematics of Data Science*, Atlanta, GA. "Paired Autoencoders for Inference and Regularization (PAIR)," October, 2024
- *UQIPI24: UQ for Inverse Problems and Imaging*, ICMS Bayes Center, Edinburgh, UK. "Paired Autoencoders for Inference and Regularization," September 2024
- *ACMR Research Affiliate Poster Session*, Lawrence Berkeley National Lab, Berkeley, CA, "Uncertainty Quantification for Forecasting Tasks Using Conditional Flow Matching," August, 2024
- (Invited) *SIAM Conference on Imaging Science*, Atlanta, GA, "Low-rank Approaches for Reduced Networks in Inverse Problems," May, 2024
- *DISC Graduate Seminar*, Emory University, Atlanta, GA. "Autoencoders for Inverse Problems" March, 2024
- *Georgia Scientific Computing Symposium*, Emory University, Atlanta, GA, "Paired Autoencoders for Inference and Regularization in Inverse Problems," February, 2024
- *DISC Graduate Seminar*, Emory University, Atlanta, GA. "Image Registration for Diagnosis of Chiari Malformation," October 2022
- *Georgia Scientific Computing Symposium*, Georgia Institute of Technology, Atlanta, GA, "Image-Based Diagnosis of Type I Chiari Malformation," February, 2022
- *Hudson River Undergraduate Mathematics Conference*, Keene State College, Keene, NH, "On Ash Trees in the Green Mountain Region," April, 2021

COMPUTER PROFICIENCIES

Python, MATLAB, LaTeX, PowerPoint, Word

TEACHING

Emory University

MATH 112: Calculus II, Instructor of Record	*Fall 2025*
MATH 111: Calculus I, Instructor of Record	*Fall 2024*, *Spring 2025*
MATH 116: Life Sciences Calculus II, TA	*Primary Instructor Malena Sabaté Landman*, *Spring 2024*
MATH 212: Differential Equations, Grader	*Primary Instructor Manuela Manetta*, *Spring 2023*
MATH 112: Calculus II, Grader	*Primary Instructor Jim Nagy*, *Fall 2022*

Colgate University

Writing Peer Consultant	*Writing and Speaking Center*, *Fall 2019 - Spring 2022*
MATH260: Computational Mathematics, TA	*Primary Instructor Silvia Jiménez Bolaños*, *Spring 2022*
Mathematics Peer Tutor	*Center for Learning, Teaching, and Research*, *Fall 2021*
MATH260: Computational Mathematics, TA	*Primary Instructor Silvia Jiménez Bolaños*, *Spring 2021*

OUTREACH

SIAM Student Chapter Website Manager	*Emory University, Atlanta, GA, Fall 2025 - Present*
Atlanta Science Festival Volunteer	*Atlanta, GA, Spring 2025*
Math Circle Middle School Section Volunteer Instructor	*Emory University, Atlanta, GA, Fall 2024*

Julia Robinson Mathematics Festival Volunteer — *Emory University, Atlanta, GA, Fall 2024*
Volunteer Middle School Math Tutor — *Rochester, NY, Summer 2021*
Volunteer SAT Tutor — *Hamilton High School, Hamilton, NY, Spring 2019*
Volunteer High School Math Tutor — *Webster-Schroeder High School, Rochester NY, Summers 2016-2018*

HONORS AND AWARDS

SIAM Student Travel Award — *National Science Foundation, 2026*
Computational Sciences Graduate Fellowship — *Department of Energy, 2023 - Present*
Women in Natural Sciences Fellowship — *Emory University, 2022 - Present*
SIAM Student Travel Award — *National Science Foundation, 2025*
Graduate School Access Funding — *Colgate University, 2022*
Dean's Award for Academic Excellence with Distinction — *Colgate University, all semesters*
Osborne Mathematics Prize, for achievement in mathematics — *Colgate University, Spring 2021*
Sisson Mathematics Prize, for achievement in mathematics — *Colgate University, Spring 2020*
Charles A. Dana Scholar, for academic achievement and leadership — *Colgate University, Spring 2020*
Liberal Arts Core Curriculum Prize, voted best CORE research paper — *Colgate University, Spring 2020*
Liberal Arts Core Curriculum Prize, voted best CORE analytical paper — *Colgate University, Spring 2019*

ADDITIONAL CONFERENCES, WORKSHOPS, AND ACTIVITY GROUPS

- *DOE Annual Program Review*, July 2025, Washington D.C.
- *SIAM Activity Group on Data Science: Teaching the Mathematics of Data Science*, May 2024, Webinar
- *DOE Annual Program Review*, July 2024, Washington D.C.
- *Copper Mountain 18th Conference on Iterative Methods*, April 2024, Copper Mountain, CO
- *Supercomputing*, November 2023, Denver, CO (virtually)
- *DOE Annual Program Review*, July 2023, Washington D.C.
- *AMS Southeastern Sectional Meeting*, March 2023, Georgia Institute of Technology, Atlanta, GA.
- *SIAM Conference on Mathematics of Data Science*, September 2022, San Francisco, CA (virtually)
- *Nebraska Conference for Undergraduate Women in Mathematics*, January 2021, Lincoln, NE (virtually)
- *First Annual Project Fibonacci STEAM Conference*, July 2015, Rome, NY