

# Emma Hart

Updated April 2025  
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## EDUCATION

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<b>Emory University</b> , Atlanta, GA	August 2022 - Present
PhD, Mathematics, Advised by Julianne Chung and Matthias Chung	
<b>Colgate University</b> , Hamilton, NY	August 2018 - May 2022
Bachelor of Arts; Major in Applied Mathematics, Minor in Educational Studies	GPA: 4.00/4.00

## RESEARCH INTERESTS

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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 key challenges in solving ill-posed, large scale inverse problems.

## PAPERS

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1. E. Hart, J. Chung, and M. Chung, *A paired autoencoder framework for inverse problems via Bayes risk minimization*, 2025 (Preprint)
2. S. H. Lim, Y. Wang, A. Yu, E. Hart, M. W. Mahoney, X. S. Li, and N. B. Erichson, *Elucidating the design choice of probability paths in flow matching for forecasting*, 2025 (Preprint)
3. M. Chung, E. Hart, J. Chung, B. Peters, and E. Haber, *Paired autoencoders for likelihood-free estimation in inverse problems*, *Machine Learning: Science and Technology*, 5 (2024), p. 045055
4. E. Buser, E. Hart, and B. Huenemann, *Comparison of atlas-based and neural-network-based semantic segmentation for dense mri images*, *SIAM Undergraduate Research Online*, 15 (2022)

## RESEARCH

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<b>DOE Computational Sciences Graduate Fellow</b>	Fall 2023 - Present
Advisors: Julianne and Matthias Chung	
Developing methods for large-scale, ill-posed inverse problems (surrogate modeling, prior-learning, uncertainty quantification) by leveraging representation learning techniques.	
<b>Lawrence Berkeley National Lab Affiliate</b>	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.	
<b>Colgate Undergraduate High Honors Senior Thesis</b>	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.	
<b>NSF REU at Emory University</b>	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

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- (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

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Python, MATLAB,  $\text{\LaTeX}$ , PowerPoint, Word

## TEACHING

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### Emory University

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

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Atlanta Science Festival Volunteer

Atlanta, GA, Spring 2025

Math Circle Middle School Section 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

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

## ADDITIONAL CONFERENCES

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- *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