

Benjamin A. Hyatt

NSF Graduate Research Fellow

PhD Candidate in Engineering Sciences and Applied Mathematics, Northwestern University

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EDUCATION

Northwestern University

Ph.D. in Engineering Sciences and Applied Mathematics

Expected Spring 2026

Member of Center for Interdisciplinary Exploration and Research in Astrophysics

Advised by Dr. Daniel Lecoanet

Northwestern University

M.S. in Engineering Sciences and Applied Mathematics, 3.96 GPA

2022

University of Maryland, Baltimore County (UMBC)

B.S. in Mathematics, Minor in Physics, Minor in Philosophy, 4.00 GPA

2021

Summa Cum Laude, with Departmental Honors

WORK EXPERIENCE

Lawrence Livermore National Laboratory, Livermore, CA

2024

Computing Graduate Student Intern in CASC

Mentored by Dr. Chris Vogl

Johns Hopkins University, Applied Physics Laboratory, Laurel, MD

2016 - 2019

Technical Staff (2018-2019)

NASA Intern (2017, 2018)

ASPIRE Intern (2016-2017)

Mentored by Dr. Carolyn Ernst

RESEARCH INTERESTS

Numerical methods: time-stepping (e.g., IMEX schemes, multi-rate methods) analysis and method development, spectral methods, scientific computing

Astrophysical and geophysical fluid dynamics: rotating turbulence and convection, planetary atmospheres, stellar interiors, modeling and simulating Earth's climate, space exploration

HONORS AND FELLOWSHIPS

NSF Graduate Research Fellowship

2023 - 2025

Outstanding Teaching Assistant Award, ESAM Department

2022 - 2023

Walter P. Murphy Fellowship, Northwestern University

2021 - 2022

Outstanding Graduating Senior in Mathematics, UMBC

2021

Freeman A. Hrabowski President's Advisory Council Scholarship, UMBC

2020

Undergraduate Research Award, UMBC

2019 - 2020

Undergraduate Merit Scholarship, UMBC

2017 - 2021

CURRENT PROJECTS

Polar vortex formation in differentially-rotating turbulence

Work with Daniel Lecoanet (Northwestern) and Anna Frishman (Technion) to understand the dynamics and stability of polar vortices on Jupiter. I am running simulations of forced-dissipative turbulence in 2D disk geometry with planetary rotation modeled by a γ -plane approximation. The simulations are evolved using pseudospectral methods (Dedalus) with IMEX time-stepping schemes. We aim to make comparisons with recent studies of Jupiter's polar regions (e.g., Siegelman et al. (2022, 2023)).

Analysis of operator splittings for time-stepping in geophysical systems

Work with Chris Vogl (LLNL) to test and analyze the performance of different operator splitting strategies in simplified atmospheric models with large separations of time scales. I am currently looking into the applications of recently-developed higher-order IMEX multi-rate schemes (e.g., Fish, Reynolds, and Roberts (2023)). I have shared preliminary results at AGU in 2024 and discussed potential applications (to the DOE E3SM project) with the PAESCAL-SciDAC5 working group.

PUBLICATIONS

6. **Hyatt B. A.**, Lecoanet D., Anders E. H., Burns K. J. “Multiple scales analysis of a nonlinear timestepping instability in simulations of solitons” (Journal of Computational Physics, 2025).
5. Ballouz R. L. Ernst C. M., Barnouin O. S., Daly R. T., DellaGiustina D. N., **Hyatt B. A.**, Martin A. C., “Seismic resurfacing of asteroid (433) Eros indicates a highly dissipative interior for large near-Earth asteroids” (Nat. Astron, 2024).
4. Anders E. H., Lecoanet D., Cantiello M., Burns K. J., **Hyatt B. A.**, Kaufman E., Townsend R. H. D., Brown B. P., Vasil G. M., Oishi J. S., Jermyn. A. S. “The photometric variability of massive stars due to gravity waves excited by core convection” (Nat. Astron, 2023).
3. Ernst C. M., Daly R. T., Gaskell R. W., Barnouin O. S., Nair H., **Hyatt B. A.**, Al Asad M. M., Wilcomb K. K. “High-resolution Shape Models of Phobos and Deimos from Stereophotoclinometry” (Earth Planets Space, 2023).
2. **Hyatt B.**, Shen. J., “Stability Analysis of Model Predictive Control-Based Car-Following Control Under Linear Vehicle Dynamics” (UMBC Review, 2020).
1. Sheth S., Barnard E., **Hyatt B.**, Rathinam M., Zustiak S. P., “Predicting Drug Release from Degradable Hydrogels Using Fluorescence Correlation Spectroscopy and Mathematical Modeling” (Front. Bioeng. Biotechnol., 2019).

PRESENTATIONS

Contributed Poster, AGU24	2024
“Error Analysis of Single and Multi-rate Temporal Coupling Approaches in a Simplified Aerosol System”	
Invited Talk, PAESCAL SciDAC group meeting	2024
“Process coupling strategies in a simplified aerosol model”	
Contributed Poster, LLNL Summer SLAM	2024
“Error Analysis of Single and Multi-rate Temporal Coupling Approaches in a Simplified Aerosol Model”	
Contributed Talk, 76th APS Division of Fluid Dynamics Annual Meeting	2023
“Timestepping stability in pseudospectral methods”	
Contributed Talk, 75th APS Division of Fluid Dynamics Annual Meeting	2022

“Relaxing timestep restrictions for numerical stability in DNS” Contributed Talk, UMBC SURF	2020
“Stability Analysis Of Car-Following Control Of Linear Vehicle Dynamics With General MPC Horizon” Contributed Poster, UMBC URCAD	2020
“A Reaction-Diffusion PDE Model for Predicting Solute Release” Contributed Talk, APL NASA Intern Presentation,	2018
“Examining the Geologies and Shapes of Small Bodies” Contributed Talk, APL NASA Intern Presentation,	2017
“Examining the Geologies and Shapes of Small Bodies”	

TEACHING EXPERIENCE

Graduate Teaching Assistantship Northwestern University	2022 – 2023
GEN_ENG 206-4 Honors Engineering Analysis 4 (Spring 2023)	
ES_APPM 252-1,2 Honors Multivariable Calculus (Fall 2022, Winter 2023)	
Teaching Assistant UMBC	2019 – 2021
MATH 225 Differential Equations (Fall 2020, Spring 2021)	
PHYS 224 Vibrations and Waves (Spring 2020)	
PHYS 324 Modern Physics (Fall 2019)	

SERVICE AND MENTORSHIP

Member of Climate Action Team	2022 – 2024
Worked with CIERA members to collaborate with a third-party organization Visceral Change to conduct a workplace DEI climate survey, analyze results, and incorporate community feedback in order to develop a set of recommended actions to improve DEI climate	
Causeway Program Mentor	2023 – 2024
Mentored a post-baccalaureate student at Northwestern University who went on to begin doctoral studies at Purdue University in applied mathematics	
REACH Program Mentor	2023
Co-mentored a local Evanston high school student at CIERA for three weeks during the summer on a project related to asteroseismology, sonification of astrophysical data, and programming in Python	
First-year Foundations Workshop Northwestern University	2022–2025
Introduced incoming first-year PhD students to the Department of Engineering Sciences and Applied Mathematics: gave presentations at beginning of academic year, ran preliminary examination review sessions	