

Nathan Hart

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RESEARCH INTERESTS

Optical imaging, biomedical optics, signal processing, nonlinear dynamics, computational modeling.

EDUCATION

Vassar College

Bachelor of Arts in Mathematics and Physics (Double Major)

Poughkeepsie, NY

Expected May 2026

- GPA **3.99/4.00**
- Honors/Awards: Ethel Hickox Pollard Memorial Physics Award, 2024 University Physics Competition Silver Medalist.

University of Oxford; St. Catherine's College

Undergraduate Study in Mathematics and Physics

Oxford, UK

January 2025 - June 2025

- GPA **3.94/4.00**

SKILLS

MATLAB, Python, LaTeX, Numerical Modeling, Event-Based Sensing, Dual-Purkinje Imaging.

RESEARCH EXPERIENCE

Vassar College, Physics and Astronomy Department

Undergraduate Researcher

Poughkeepsie, NY

September 2025 – Present

- Research in the Vassar Applied Optics Lab (VAOL) under Professor Jenny Magnes, implementing Dynamic Optical Diffraction (DOD) to quantify the chaotic behavior of adult *C. elegans*.
- Lead an undergraduate team in developing a neural mathematical model of *C. elegans* to replicate its chaotic locomotion.
- Perform non-linear time series analysis to compute the Largest Lyapunov Exponent of our system.

University of Rochester, The Institute of Optics

2025 Photonics REU Undergraduate Researcher

Rochester, NY

May 2025 – August 2025

- Worked under Dr. Jannick Rolland in Dr. Michele Rucci's Active Perception Laboratory (AP Lab) as a part of University of Rochester's Photonics REU.
- Developed a high-precision event-based digital Dual Purkinje Image eye-tracker with sub-millisecond temporal resolution and investigated its angular resolution at various tracking ranges and illumination levels.
- Developed a Python-based tracking algorithm for sparse, event-based data.
- Presented research at the 2025 FiO/LS Symposium on Undergraduate Research in Denver, Colorado.

Vassar College, Mathematics and Statistics Department

URSI Researcher

Poughkeepsie, NY

May 2024 – August 2024

- Created a mathematical model for the spread of Respiratory Syncytial Virus (RSV) in children, as a part of Vassar's Undergraduate Research Summer Institute (URSI) with Professor Benjamin Morin and two peers.
- Modified a traditional SIRS compartmental model by dividing the population into two meta-populations - Safe and Unsafe - and allowed for preferential mixing between members of the two groups.
- Presented research to professors and peers at the 2024 URSI Symposium held at Vassar College.

Research Assistant

August 2023 – May 2024

- Conducted numerical simulations to predict the effects of contact between neighboring coils on the stability behavior of flexible springs.
- Applied numerical methods for solving differential equations and parameter continuation to compute equilibrium shapes of flexible springs and detect bifurcations.
- Generated bifurcation diagrams and visualization of spring shapes to provide qualitative insight into the behavior of highly flexible springs.
- Presented research at the 2024 Hudson River Undergraduate Mathematics Conference (HRUMC).

SELECTED COURSEWORK

University of Oxford; St. Catherine's College

Oxford, UK

Fourier Series & PDEs, Fluids, Flows, and Complexity, Calculus of Variations, Statistics and Data Analysis, Mathematical Modelling in Biology.

Vassar College

Poughkeepsie, NY

Quantum Mechanics I, Electromagnetism I & II, Control Theory, Nonlinear Differential Equations, Mathematical Modeling, Numerical Analysis, Complex Analysis, Real Analysis, Experimental Physics I & II.

WORK EXPERIENCE

Vassar College, Physics and Astronomy Department

Poughkeepsie, NY

Physics Departmental Intern

September 2024 – Present

- One of two physics students chosen to represent the department as a departmental intern.
- Provide tutoring hours 4-5 days a week for physics students in a wide range of physics classes.

Physics Grader

January 2023 – May 2023

- Graded lab notebooks for multiple sections of Electricity and Magnetism (Physics 112/114).

CAMPUS LEADERSHIP ACTIVITIES

Vassar College, Math Majors Committee

Poughkeepsie, NY

Co-president

September 2025 – Present

- Organize student research talks, game nights, and other social events for undergraduate mathematics and statistics students.

Vassar College, Vassar College Club Tennis

Poughkeepsie, NY

Co-founder, Co-captain, Secretary and Event Coordinator

November 2023 – Present

- Founded Vassar's first non-varsity tennis organization, leading practices three times a week.
- Communicate with 100+ members and organize intercollegiate competition through the USTA.