Elyssa Hofgard

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Massachusetts Institute of Technology, MA

EDUCATION

Massachusetts Institute of Technology Cambridge, MA
PhD Electrical Engineering and Computer Science (EECS)
Sept 2022-present GPA: 4.80/5.00

Stanford University Stanford, CA
M.S. Computational and Mathematical Engineering
Jan. 2021-June 2022 GPA: 3.97/4.00

Stanford University Stanford, CA
B.S. Physics with Honors, Minors: Mathematics and History
Sept. 2017-June 2021 GPA: 3.91/4.00

RESEARCH & EMPLOYMENT EXPERIENCE

Massachusetts Institute of Technology **Sept 2022 - present**
Graduate Research Assistant, Atomic Architects, Professor Tess Smidt

- Developing symmetry equivariant neural networks for applications in the natural sciences, funded by Department of Energy Computational Science Graduate Fellowship
- Recipient of the MIT Advanced Television and Signal Processing Fellowship for 2022-2023

Lawrence Berkeley National Laboratory **May 2024-present**
Graduate Intern, Dr. Sinéad Griffin & Dr. Dmitriy Morozov

- Applying topological data analysis (TDA) to characterize structure-property relationships of amorphous materials

Tompkins Laboratory **Sept 2021 - June 2022**
Research Assistant, IRIS-HEP

- Funded as a research assistant through Institute for Research and Innovation in Software for High Energy Physics (IRIS-HEP)
- Project focused on improving Kalman Filter algorithms used in particle track reconstruction

Lawrence Livermore National Laboratory **June 2021 - Sept 2021**
Intern, Data Science Summer Institute (DSSI)

- Project focused on improving seasonal predictions of precipitation and temperature over the western US using deep learning

ATLAS Experiment, CERN **June 2020 - June 2021**
Research Assistant, Professor Lauren Tompkins

- 1 of 11 students selected nationwide for the International Research Experience for Students (IRES) at CERN funded through the National Science Foundation
- Honors thesis explored the use of machine learning techniques to search for dark photons in ATLAS data, improved analysis sensitivity 10 times
- Thesis awarded Firestone Medal for Excellence in Undergraduate Research

Molecular Imaging Instrumentation Laboratory **Jan 2019 - Jan 2021**
Stanford, CA
Research Assistant, Professor Craig Levin

- Led an experiment to develop novel algorithms for analyzing dual-isotope positron emission tomography (PET) systems

Regeneron Genetics Center **Jun 2019 - Aug 2019**
Tarrytown, NY
Summer Intern, R&D Data Engineering Group

- Led the development of a novel statistical method to analyze gene burden association results
- Method enhanced ability to distinguish gene level effects across phenotypes

LIGO Group **Jun 2018 - Jan 2019**
Stanford, CA
Research Assistant, Dr. Brian Lantz

- Designed a wind fence for seismic isolation at the LIGO Hanford Site
- Modeled fluid dynamics/wind flow in Ansys Computational Fluid Dynamics (CFD) and Python

HONORS & AWARDS

QuARC, MIT QSEC Annual Conference **Jan 2024**
Best Poster in Quantum Algorithms and Machine Learning Session.

Department of Energy Computational Science Graduate Fellowship **2023**
Accepted, up to 4 years of funding

National Defense Science and Engineering Graduate Fellowship **2023**
Declined for DOE CSGF

MIT Advanced Television and Signal Processing Fellowship **Sept 2022**

NSF GRFP Honorable Mention **April 2022**

Firestone Medal for Excellence in Undergraduate Research **August 2021**

- Award given to the top ten percent of all honors theses in the social sciences, natural sciences, and engineering and applied sciences

American Physical Society Far West Section Meeting **Nov 2019**
Honorable Mention for Best Undergraduate Poster

PUBLICATIONS

Lawrence, Hannah*, Elyssa Hofgard*, Vasco Portilheiro, Yuxuan Chen, Tess Smidt, Robin Walters, *To Augment or Not to Augment? Diagnosing Distributional Symmetry Breaking*, 2025, `https://arxiv.org/abs/2510.01349`. Accepted to 2026 International Conference on Learning Representations.

Artificial intelligence for science in quantum, atomistic, and continuum systems, Foundations and Trends in Machine Learning, 2025, Vol. 18: No. 4, pp 385-912, `https://doi.org/10.1561/2200000115`.

Hofgard, Elyssa, R. Wang, R. Walters, and T. Smidt. "Relaxed Equivariant Graph Neural Networks." *Geometry-grounded Representation Learning and Generative Modeling Workshop (GRaM) at Forty-first International Conference on Machine Learning*, July 2024. `https://arxiv.org/abs/2407.20471`.

Wang, R., Elyssa Hofgard, H. Gao, R. Walters, and T. Smidt. "Discovering Symmetry Breaking in Physical Systems with Relaxed Group Convolution." *Forty-first International Conference on Machine Learning*, February 2024. `https://arxiv.org/abs/2310.02299`.

"Artificial Intelligence for Science in Quantum, Atomistic, and Continuum Systems." November 2023. `https://arxiv.org/abs/2307.08423`.

Cotter, D., Elyssa Hofgard, A. Szpiech, and N. Rosenberg. "A Rarefaction Approach for Measuring Population Differences in Rare and Common Variation." *Genetics*, April

2023.

The ATLAS collaboration., Aad, G., Abbott, B. et al. Search for dark photons from Higgs boson decays via ZH production with a photon plus missing transverse momentum signature from pp collisions at = 13 TeV with the ATLAS detector. *J. High Energ. Phys.* 2023, 133 (2023). https://doi.org/10.1007/JHEP07(2023)133.

Garg, R.B., Elyssa Hofgard, L. Tompkins, and H. Gray. "Exploration of Different Parameter Optimization Algorithms within the Context of ACTS Software Framework." 2022. https://doi.org/10.48550/arXiv.2211.00764.

Hofgard, Elyssa. "Cuts Optimization and Machine Learning Models for Dark Photon Signal-Background Discrimination with the ATLAS Detector." *Stanford Digital Repository*, Undergraduate Theses, 2021. https://purl.stanford.edu/pb798fj0435.

Hofgard, Elyssa, G. Chinn, and C. Levin. "Simultaneous Multi-Isotope PET: A Computational Framework for Line of Response (LOR) Identification." 2020 IEEE Nuclear Science Symposium and Medical Imaging Conference (NSS/MIC), 2020. https://doi.org/10.1109/NSS/MIC42677.2020.9507891.

LIGO Scientific and Virgo Collaborations. "Open Data from the First and Second Observing Runs of Advanced LIGO and Advanced Virgo." 2019. https://arxiv.org/abs/1912.11716.

CONFERENCES & TALKS

Hofgard, Elyssa, Dmitriy Morozov, Musa A Hussien, Temuujin Bayaraa, Sinead M Griffin, Tess E Smidt. *Applications of Topological Data Analysis (TDA) for Studying Structural Motifs in Amorphous Bi_2Se_3.* Oral Presentation at APS Global Physics Summit 2025.

Using E(3)-Equivariant Neural Networks (ENNs) to Uncover Symmetry-Implied Missing Information. Computational Research in Boston and Beyond (CRIBB) Seminar, March 2025.

Applications of Euclidean Neural Networks for the Design and Understanding of Physical Systems. Plenary talk at The 5th International Conference on Data-Driven Plasma Science, Berkeley, CA. Given on behalf of Tess Smidt.

Hofgard, Elyssa, A.M. Tehrani, and T. Smidt. *Learning Crystal Structure from Powder X-Ray Diffraction Data Using Invariants.* Oral Presentation at 2024 American Physical Society March Meeting.

Hofgard, Elyssa, R. Wang, and T. Smidt. *Using Symmetry-Equivariant Neural Networks (ENNs) to Uncover Symmetry-Implied Missing Information.* Oral Presentation at 2023 Materials Research Society Fall Meeting.

Hofgard, Elyssa et al. *Exploration of Machine Learning (ML) Methods for Determining Unit Cell Parameters from Powder XRD Patterns.* Oral Presentation at 2023 Materials Research Society Fall Meeting.

Hofgard, Elyssa, R. Garg, and L. Tompkins. *Exploration of Different Parameter Optimization Algorithms within the Context of ACTS Software Framework.* Oral presentation given by R. Garg at Connecting the Dots 2022.

Hofgard, Elyssa, and L. Tompkins. *Cuts Optimization and Machine Learning Models for Dark Photon Signal-Background Discrimination with the ATLAS Detector.* Oral presentation at 2021 APS April Meeting.

Hofgard, Elyssa. *An Algorithmic Approach to Identify Non-Pure Positron Emitters for*

Positron Emission Tomography (PET) Imaging Applications. Poster presented at 2019 Annual Meeting of the APS Far West Section.

Hofgard, Elyssa, E. Bonilla, and B. Lantz. *Wind-Proofing LIGO.* Poster presented at 2018 oSTEM Houston Conference and 2019 Conference for Undergraduate Women in Physics at UC Davis. Presented by collaborators at 2018 LIGO/Virgo Collaboration Meeting.

TEACHING & OUTREACH

- Co-President of Graduate Women in Course 6 (GW6), 2023-2024
  - Elected as co-president of GW6, an organization to support graduate women in EECS at MIT

- MIT EECS Graduate Student Council (GSC) Representative, 2022-2023
  - Elected as a GSC representative to advocate for EECS students and the general graduate student body

- Tutor, Schwab Learning Center, Stanford University, 2020-2021
  - Provided individual tutoring for students with learning differences, tutor math courses including linear algebra, multivariable calculus, and differential equations

- Undergraduate Representative, 2020-2021 Physics Undergraduate Studies Committee
  - Selected as one of two undergraduate representatives to offer ideas on course design and department culture

- Teaching Assistant Physics 21: Mechanics, Fluids, and Heat Fall 2020
- Co-President of Physics Undergraduate Women and Minorities at Stanford (PUWMAS) 2019-2020, Director of Community Development 2018-2019
  - Organized faculty lunches, a mentorship program, community outreach events

- Learning Assistant (LA) for Physics 41E: Mechanics, Winter 2020
  - Mentored 12 students, led and planned a weekly recitation section

- Residential Assistant (RA) in Florence Moore Hall for the 2019-2020 academic year
  - Planned events for 270 residents, worked with a team of 12 other staff members