Kaylie Hausknecht

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Education

- **Harvard College** — Cambridge, MA
  A.B. in Physics and Astrophysics; GPA: 4.00/4.00 — *Aug. 2019 - May 2024*
  Leave of Absence: *Took a gap year during the virtual 2020-21 academic year to conduct research at NASA*
- **Lynbrook Senior High School** — Lynbrook, NY
  Valedictorian; GPA: 105.2/100 — *Sep. 2015 - June 2019*

Awards and Fellowships

- **Bowdoin Prize in the Natural Sciences (2023)**: One of Harvard's oldest prizes that recognizes an essay of "originality and high literary merit" on the natural sciences; selected for my philosophy of physics essay entitled, "A Cautionary Tale on the Marriage of Mathematics and Physics," which challenges the standard view on the well-known "unreasonable effectiveness of mathematics" problem in the epistemology of physics
- **Phi Beta Kappa Junior 24**: Among the first 24 students in the 2024 class (1800 students) elected to PBK
- **Sosland Prize in Expository Writing (2020)**: Awarded to the best essay written in Expository Writing, a required class for all first-year students ($\sim$ 1600 in the 2023 class); selected for my essay on the ethics and philosophy of citizen science entitled, "Do-It-Yourself Biology: A Road to Innovation or a Threat to Safety?"
- **Sally Ride Internship Award**: Awarded yearly to 10 exceptional female interns (2,500 total NASA interns); provided funding for my internship and access to networking experiences with NASA leadership
- **John Harvard Scholar (2019-20 and 2021-22)**: Honors students in the top 5% of their class
- **Research Fellowships**: Selected for both the Herchel-Smith Fellowship and Program for Research in Science and Engineering in the summers of 2020 and 2021
- **Intel International Science and Engineering Fair Winner**: Won 1st place and Best in Category in Physics/Astronomy; selected to present my work in Bulgaria; awarded an asteroid named 16100 Hausknecht

Internship Experience

- **NASA Ames Research Center** — Remote
  Research Intern (Full-Time & Part-Time) — *Jan. 2021 - May 2022*
  Interned under Dr. Hamed Valizadegan in the Data Science Group, full-time in spring 2021 and part-time thereafter concurrently with school; worked on ExoMiner, a machine learning model for detecting exoplanets in space telescope data; specifically focused on model explainability; model found 301 new exoplanets in all
- **NASA Langley Research Center** — Remote
  Research Intern (Full-Time) — *Aug. 2020 - Dec. 2020*
  Interned under Dr. Meelan Choudhari in the Computational Fluid Dynamics Group; built convolutional neural networks to predict the location of laminar-turbulent transition on 2D swept airfoils; models will be incorporated into NASA's industry flow solvers and can help us conceptualize green aerospace vehicle designs

Academic Research Projects

- **Optimizing Mixing in Porous Media with Automatic Differentiation (Prof. Michael Brenner)**: Working on combining a differentiable computational fluid dynamics solver and Brownian dynamics solver to enable differentiation through Lagrangian simulations of fluid flows; provides a novel way to approach unsolved optimization problems and important inverse design problems in fluid mechanics
- **Junior Thesis in Astrophysics - Evidence for High Redshift Galaxy Mergers From the James Webb Space Telescope (Prof. Avi Loeb)**: Identified potentially merging galaxies by modeling galaxy halo properties from their photometry and finding pairs with overlapping virial radii that, thus, share a halo; results provide a mechanism for alleviating the tension found between high redshift JWST galaxies and standard cosmological models by showing that the number density of massive halos is being overcounted
- **Black Hole-Neutron Star Mergers as Sources of r-Process Enrichment in Ultra Faint Dwarf Galaxies (Prof. Edo Berger)**: Used population synthesis models determine if black hole-neutron star (BH-NS) mergers could be sources of r-process enrichment; used numerical relativity simulations to model the rate of r-process enrichment in ultra faint dwarf galaxies, which are anomalously rich in metals; found that, together, BH-NS and NS-NS mergers may explain the rate of r-process enrichment in these galaxies
- **Machine Learning Correlates the Charge Density Wave with the Local Gap in Cuprate Superconductors (Prof. Jennifer Hoffman)**: Developed a novel translationally invariant convolutional neural network architecture to study scanning tunneling microscope (STM) images of superconductors; trained models to identify the relationship between local doping and charge density waves on carefully simulated synthetic data; used the trained model to generalize and make predictions on real STM data

Publications

- **Normal Class Explainability: A Case Study on Applying Deep Neural Networks to Exoplanet Hunting;** Hamed Valizadegan, Miguel Martinho, **Kaylie Hausknecht** (2023). Submitted to *NeurIPS*.
- **ExoMiner: A Highly Accurate and Explainable Deep Learning Classifier that Validates 301 New Exoplanets;** Hamed Valizadegan, Miguel Martinho, Laurent S. Wilkens, Jon M. Jenkins, Jeffrey Smith, Douglas A. Caldwell, Joseph D. Twicken, Pedro C. Gerum, Nikash Walia, **Kaylie Hausknecht**, Noa Y. Lubin, Stephen T. Bryson, Nikunj C. Oza (2022). *The Astrophysical Journal*, 926(2), 120.

Conference Presentations (Presenter Bolded)

- **"Optimizing Mixing in Porous Media via Automatic Differentiation," Kaylie Hausknecht**, Mohammed Alhashim, Michael Brenner. American Physical Society Division of Fluid Dynamics Annual Meeting, Washington DC, November 2023.
- **"Optimizing Chaotic Mixing with Automatic Differentiation," Kaylie Hausknecht**, Mohammed Alhashim, Michael Brenner. AI Institute in Dynamic Systems, Seattle, WA, July 2023.
- **"A Novel Explainability Framework for Transit Signal Machine Classifiers," Hamed Valizadegan**, Miguel Martinho, Kaylie Hausknecht. American Astronomical Society, June 2022
- **"Do Black Hole–Neutron Star Mergers Contribute to the (r-Process) Enrichment in our Universe?" Kaylie Hausknecht and Floor Broekgaarden**. European Astronomical Society Annual Meeting, Virtual, June 2021.
- **"Machine Learning Correlates Charge Density Wave with the Local Gap in Cuprate Superconductors," Kaylie Hausknecht**, Tatiana Webb, Michael Boyer, Yi Yin, Takeshi Kondo, Tsunehiro Takeuchi, Hiroshi Ikuta, Eric Hudson, Jenny Hoffman. American Physical Society March Meeting, Virtual, March 2021.
- **"Exploring Data-driven Modeling of Boundary Layer Transition," Meelan Choudhari**, Mujeeb Malik, Pedro Paredes, Muhammed Zafar, Heng Xiao, Jordan Berninger, Kaylie Hausknecht, Richard Qiu, and Jakub Perlin, SIAM Conference on Computational Science and Engineering, March 2021
- **"Machine Learning Correlates Charge Density Wave with the Local Gap in Cuprate Superconductors," Kaylie Hausknecht**, Tatiana Webb, Michael Boyer, Yi Yin, Takeshi Kondo, Tsunehiro Takeuchi, Hiroshi Ikuta, Eric Hudson, Jenny Hoffman. American Physical Society Conference for Undergraduate Women in Physics, Virtual, January 2021.
- **"Local correlations in disordered materials with neural networks,"** Kaylie Hausknecht, Tatiana Webb, **Jennifer Hoffman**, Machine Learning Quantum Matter Data Simons Foundation, January 2020
- **"Machine Learning Correlates CDW Properties with Local Gap in Cuprates," Kaylie Hausknecht**, Tatiana Webb, Michael Boyer, Yi Yin, Takeshi Kondo, Tsunehiro Takeuchi, Hiroshi Ikuta, Eric Hudson, Jenny Hoffman. American Physical Society March Meeting, Boston, MA, March 2019.
- **"Cuprate Quantum Phase Transition Probed by Nanoscale Density Wave Inhomogeneity," Tatiana Webb**, Kaylie Hausknecht, Michael Boyer, Yi Yin, Debanjan Chowdhury, Yang He, Takeshi Kondo, Tsunehiro Takeuchi, Hiroshi Ikuta, Eric Hudson, Mohammad Hamidian, Jennifer Hoffman, American Physical Society March Meeting, Boston, MA, March 2019
- **"Identifying Inhibitors of T-Cell Activation in Microgravity: Proposal for the International Space Station" Kaylie Hausknecht**, International Space Station R&D Conference, San Francisco, CA, July 2018.

Teaching Experience

- **Course Assistant at Harvard University**:
  - Physical Mathematics (Applied Math 201, graduate-level course) with Prof. Brenner — Fall 2023
  - Introductory Mechanics and Relativity (Physics 15a) with Dr. Morin — Fall 2021
  - Linear Algebra and Real Analysis I (Math 23a) with Dr. Bamberg — Summer & Fall 2020
  - Theory of Calculus (RA-23) with Dr. Bamberg: — Aug. 2020
    Led initiative to develop and teach a 2-week course to prepare incoming Harvard freshmen, whose high school math classes were cut short by the pandemic, for college-level math; had more than 100 enrollees
- **Inspirit AI** — Cambridge, MA
  Instructor & Curriculum Developer — *Nov. 2019 - April 2021*
  Developed and taught a course on AI for high schoolers; taught everything from coding 101 up to computer vision; designed a guided "AI for Astronomy" project that let students explore AI for exoplanet detection

Volunteer and Leadership Experience

- **Science Club for Girls** Cambridge, MA
  Harvard Chapter Co-President & Mentor *Aug. 2022 - Present*
  Mentor girls (grades K-8) from underserved schools in the Boston area; meet weekly to lead students in experiments and activities that generate excitement about STEM and teach important scientific topics; helped recruit over 30 volunteer mentors from Harvard as our chapter Co-President

- **Harvard Physics Department Equity and Inclusion Committee** Cambridge, MA
  Undergraduate Representative *Sep. 2020 - Sep. 2021*
  Selected by professors for this role; worked with 12 professors and graduate students to develop a new code of conduct, study the results of a departmental climate survey, and hold focus groups to develop more inclusive practices; focused specifically on barriers to entry for undergraduates in introductory classes

- **Girls' Angle** Cambridge, MA
  Meeting Facilitator *Aug. 2020 - Jan. 2021*
  Helped run this weekly enrichment program that aims to nurture girls' interests in mathematics (grades 5-12); provided technical support to transition clubs to Zoom; helped build a virtual math museum for the girls

- **Gender Inclusivity in Mathematics** Cambridge, MA
  Board Member & Math Night Coordinator *Aug. 2021 - May 2022*
  Helped facilitate Math Night, a weekly community event for math students to meet and collaborate on work

- **Other Involvement:** Harvard Global Education Movement Board Member, Harvard Women in Physics Board Member, Society of Physics Students, Student Astronomers at Harvard-Radcliffe

Personal Interests

- **Music**: Play piano, marimba, and sing at level 6/6 by the NY State School Music Association standards; performed with the Metropolitan Youth Orchestra at Carnegie Hall three times, LeFrak Hall, and a New York Mets game, among other venues
- **Space**: Active member of Student Astronomers at Harvard-Radcliffe (STAHR), which trained and certified me to operate the telescope in the Loomis-Michael Observatory on top of the Harvard Science Center