# Kaylie Hausknecht

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## Education

- **Harvard College** — Cambridge, MA
  *A.B. in Astrophysics and Physics; 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, . . . , **Kaylie Hausknecht**, . . . (2022). *The Astrophysical Journal*.

## Research Conference Presentations (7 Total)

- **"Optimizing Mixing in Porous Media via Automatic Differentiation,"** American Physical Society (APS) Division of Fluid Dynamics Annual Meeting, Washington D.C., November 2023; AI Institute in Dynamic Systems, Seattle, WA, July 2023.
- **"Do Black Hole–Neutron Star Mergers Contribute to the (r-Process) Enrichment in our Universe?"** European Astronomical Society Annual Meeting, Virtual, June 2021.
- **"Machine Learning Correlates Charge Density Wave with the Local Gap in Cuprate Superconductors,"** APS March Meeting, Virtual, March 2021; APS Conference for Undergraduate Women in Physics, Virtual, January 2021; APS March Meeting, Boston, March 2019.
- **"Identifying Inhibitors of T-Cell Activation in Microgravity: Proposal for the International Space Station"** 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