

# Saarah Hall

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## Education

### Northwestern University

*Ph.D. Candidate, Astronomy*

Certificate: [Integrated Data Science](#)

Advisor: Adam A. Miller

Evanston, IL  
September 2022 - present

### University of Pennsylvania

*B.A., Physics (with Departmental Honors)*

Concentration: Astrophysics

Advisor: Gary Bernstein

Philadelphia, PA  
August 2018 - May 2022

## Research Experience

### Analyzing JWST Observations of Rare Supernovae

*Northwestern University*

Advisors: Dr. Lindsey Kwok and Assistant Professor Adam A. Miller

June 2025 - present

- Analyzing spectra from the *James Webb Space Telescope (JWST)* taken of two Calcium-strong Transients (CaSTs), a rare subclass of supernovae with unknown origins and explosion physics
- Uncovering the structure and contents of these two CaSTs via modeling of spectral features with *emcee* and *dynesty* (Python libraries used for Bayesian inference)
- Developing modeling software for the spectral features attributed to Carbon Monoxide (CO) and cosmic dust, also utilized by collaborators (Sears+2026b and Macrie+2026 in prep.)

### Data Reduction Pipeline for SEDM-KP

*Northwestern University*

Advisor: Assistant Professor Adam A. Miller

November 2022 - present

- Developing the photometric data reduction pipeline (DRP) for the Spectral Energy Distribution Machine at Kitt Peak (SEDM-KP, formerly SEDMv2)
- Collaborating across institutions to develop an open-source Python package for DRP building; the [Modular Image Reduction and Analysis Resource \(MIRAR\)](#)
- Regularly monitoring and observing with SEDM-KP, virtually and in-person at Kitt Peak

### Scene Modeling Photometry on HPM Stars

*University of Pennsylvania - Senior Honors Thesis*

Advisor: Professor Gary Bernstein

August 2021 - August 2022

- Optimizing models of images for precise measurements of fluxes and motions of high-proper-motion (HPM) stars discovered in the DES

### Optical Counterparts to Gravitational Waves

*Northwestern University CIERA REU*

Advisors: Dr. Kerry Paterson and Professor Wen-Fai Fong

June 2021 - August 2021

- Upgrading image subtraction software to facilitate the counterpart candidate vetting process by writing and integrating Python code into the team's pipeline

### Animating Trans-Neptunian Objects

*University of Pennsylvania*

Advisor: Professor Gary Bernstein

May 2020 - May 2021

- Developing Python code to transform numerical data from the Dark Energy Survey (DES) into an [animation](#) (see video also at [vimeo.com/662683536](https://vimeo.com/662683536)) of 800+ Trans-Neptunian Object (TNO) orbital patterns over thousands of years

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| <b>Software</b>                    | Robert Stein, Viraj Karambelkar, Sulekha Kishore, <b>Saarah Hall</b> , Benjamin Roulston, & Jamie Soon (2024), <i>MIRAR</i> , DOI: <a href="https://doi.org/10.5281/zenodo.17592455">10.5281/zenodo.17592455</a><br><i>Photometric reduction code, used for WINTER, SEDM-KP, DREAMS, GMOS, WASP, and WIRC</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Publications</b>                | <p><b>Saarah Hall</b>, Lindsey A. Kwok, and 30 others (2026), <i>JWST Observations of Calcium-Strong Transients: I. Complex Nebular He Emission in SN 2024uj</i>, <a href="https://arxiv.org/abs/2607.00111">arXiv:2607.00111</a></p> <p>Colin W. Macrie, Conor Larison, Huei Sears, and 42 others, including <b>Saarah Hall</b> (2026), <i>JWST Nebular Spectroscopy of SN 2023qov: Circumstellar Dust Emission in a Normal Type Ia Supernova</i>, <a href="https://arxiv.org/abs/2604.09777">arXiv:2604.09777</a></p> <p>Adam A. Miller, Natasha S. Abrams, Greg Aldering, and 75 others, including <b>Saarah Hall</b> (2025), <i>The La Silla Schmidt Southern Survey</i>, PASP, 137, 9. <a href="https://doi.org/10.1088/1538-3873/ae02c5">10.1088/1538-3873/ae02c5</a></p> <p>Yashvi Sharma, Jesper Sollerman, Shrinivas Kulkarni, and 33 others, including <b>Saarah Hall</b> (2024), <i>Dramatic Rebrightening of the Type-changing Stripped-envelope Supernova SN 2023aew</i>, ApJ, 966, 199. <a href="https://doi.org/10.3847/1538-4357/ad3758">10.3847/1538-4357/ad3758</a></p> <p>Griffin Hosseinzadeh, Kerry Paterson, and 15 others, including <b>Saarah Hall</b> (2024), <i>SAGUARO: Time-domain Infrastructure for the Fourth Gravitational-wave Observing Run and Beyond</i>, ApJ, 964, 35. <a href="https://doi.org/10.3847/1538-4357/ad2170">10.3847/1538-4357/ad2170</a></p> <p>Chang Liu, Adam A. Miller, and 29 others, including <b>Saarah Hall</b> (2023), <i>SN 2022joj: A Peculiar Type Ia Supernova Possibly Driven by an Asymmetric Helium-shell Double Detonation</i>, ApJ, 958, 178. <a href="https://doi.org/10.3847/1538-4357/acffc9">10.3847/1538-4357/acffc9</a></p> <p>J. C. Rastinejad, K. Paterson, W. Fong, and 9 others, including <b>S. Hall</b> (2022), <i>A Systematic Exploration of Kilonova Candidates from Neutron Star Mergers During the Third Gravitational Wave Observing Run</i>, ApJ, 927, 50. <a href="https://doi.org/10.3847/1538-4357/ac4d34">10.3847/1538-4357/ac4d34</a></p> |
| <b>Posters &amp; Presentations</b> | <p><b>First JWST observations of Calcium-Strong Transients provide evidence for thermonuclear origin</b><br/><i>Contributed Talk; July 2026; European Astronomical Society Annual Meeting</i><br/><i>Contributed Talk; July 2026; Extragalactic Transient Universe</i></p> <p><b>SN 2024uj: molecule formation in a Ca-strong transient</b><br/><i>Poster Presentation; August 2025; 100 Years of Supernova Science</i></p> <p><b>Deriving Time-Dependent Supernova Luminosity Functions via Hierarchical Bayesian Modeling</b><br/><i>Contributed Talk; January 2025; 245th American Astronomical Society (AAS) Meeting</i></p> <p><b>Deriving Time-Dependent Supernova Luminosity Functions via Hierarchical Bayesian Modeling</b><br/><i>Poster Presentation; August 2024; Rise-Time Conference at Purdue</i></p> <p><b>Status Update on SEDMv2's Photometric Data Reduction Pipeline</b><br/><i>Contributed Talk; October 2023; ZTF 5th Science Meeting</i></p> <p><b>Data reduction pipeline for SEDMv2 built with MIRAR</b><br/><i>Contributed Talk; October 2023; CIERA Observational Group Meeting</i></p> <p><b>Photometric Data Reduction Pipeline for the Spectral Energy Distribution Machine</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

**Version 2 (SEDMv2)***Poster Presentation; June 2023; [Transient and Variable Universe Conference at UIUC](#)***Searches After Gravitational-waves Using ARizona Observatories (SAGUARO): Updating Optical Counterpart Search Methods***[iPoster Presentation](#); June 2022; 240th American Astronomical Society (AAS) Meeting***Gravitational Waves: Streamlining the Optical Counterpart Search***Virtual Poster; August 2021; CIERA REU Poster Session***The DES Year 6 catalog of trans-Neptunian objects***Bernardinelli, P. and Hall, S.**Virtual Presentation; May 2021; Dark Energy Survey (DES) Videocon***Animating TNOs***Virtual Presentation; July 2020; UPenn [P&A Undergraduate Summer Research Academy](#)***Awards & Honors****LSST Discovery Alliance Data Science Fellow**

2025 - 2027

**Illinois Space Grant Graduate Fellow, Northwestern**

2024 - 2025

**GEM Associate Fellow, Northwestern**

2022 - 2024

**Dean's List, UPenn**

2021 - 2022

**Hispanic Scholarship Fund**

2021

**NSF REU Stipend**

2021

**Allied Family Scholarship Fund**

2018 - 2021, 2023-2025

**Vagelos Endowed Scholarship in Molecular Life Sciences, UPenn**

2018 - 2021

**AAPT Outstanding Physics Student of the Year**

2018

**Outreach & Leadership****REACH Further Mentor Lead, [CIERA REACH Further](#)**

2026

**Astronomer Conversations Volunteer, Adler Planetarium**

2024 - present

**Coding Tutor, [CIERA REACH](#)**

2023-present

**Research Mentor, [CIERA REACH Further](#)**

2023

**STEAM Mentor (Volunteer), Operation Airlift by Adler Planetarium**

2023

**Astronomy on Tap (Volunteer)**

2022 - present

**Science Olympiad at UPenn (SOUP) Grader (Volunteer)**

2022

**Women in Physics Board Member, UPenn**

2020 - 2022

**Video Editor, Singh Center for Nanotechnology**

2019 - 2022

**Teaching Experience****Teaching Assistant, Northwestern Department of Physics & Astronomy**

• Physics 126-3 - Physics for ISP Lab - Waves and Optics

Spring 2024

• Physics 126-2 - Physics for ISP Lab - Electricity and Magnetism

Winter 2024

• Data Science 421 - Integrated Data Analytics I

Fall 2023

**Tutor & Grader, UPenn Physics Department**

• Astronomy 001 - A Survey of the Universe

2021

• Astronomy 007 - The Big Bang and Beyond

2021

**Workshops & Summer Schools****[LS4 Team Meeting](#), Northwestern University**

March 2025

**[Astro Imaging Workshop](#), Northwestern University**

July 2023

**[ZTF Summer School](#), Virtual**

July 2023

**[Time Domain Astronomy in the Rubin Era](#), Northwestern University**

October 2022