

Lily L. Zhao

NASA SAGAN FELLOW | UNIVERSITY OF CHICAGO

CONTACT	Email: lilylingzhao@uchicago.edu Website: https://lilylingzhao.github.io/ ORCID: 0000-0002-3852-3590	Mailing Address 5640 S Ellis Ave. Chicago, IL 60637
EDUCATION	Yale University M.S., M.Phil., Astronomy Ph.D., Astronomy Dissertation Title: <i>The Path to Extreme Precision Radial Velocity With EXPRES</i>	May 2018 Jun. 2021
	University of Chicago B.S. Mathematics B.A. Physics B.A. Biological Sciences	Jun. 2016
RESEARCH POSITIONS	University of Chicago <i>NASA Sagan Fellow</i>	Chicago, IL Oct. 2024 - Present
	Center for Computational Astrophysics, Flatiron Institute <i>Flatiron Research Fellow</i> <i>Pre-Doctoral Fellow</i>	New York, NY Sep. 2021 - Sep. 2024 Sep. 2019 - Jan. 2020
	Yale Exoplanet Group <i>NSF Graduate Research Fellow</i>	New Haven, CT Sep. 2016 - Jun. 2021
AWARDS	<i>Dirk Brouwer Memorial Prize for Outstanding PhD Thesis</i> , Yale University <i>Hubble Fellowship</i> , NASA <i>Third Place</i> , Three Minute Thesis Competition, Yale University <i>Sheldon Wise Pre-Doctoral Fellowship</i> , Yale University <i>Graduate Research Fellowship</i> , National Science Foundation	2024 2024 2020 2018 2016
PUBLICATIONS	First Author <ol style="list-style-type: none">10. Zhao, L.L., Al Moulla, K., Faria, J., et al. "The Extreme Stellar-Signals Project IV. State of the Field of Disentangling Solar Signals" in prep.9. Zhao, L.L., Fischer, D.A., Szymkowiak, A.E., et al. "Uncovering Hidden Systematics in Extreme-Precision Radial Velocity Measurements" submitted8. Zhao, L.L., Bedell, M., Hogg, D.W., Luger, R. "A Compact, Coherent Representation of Stellar Surface Variation in the Spectral Domain" 2024, ApJ, 977, 1407. Zhao, L.L., Dumusque, X., Ford, E., et al. "The Extreme Stellar-Signals Project III. Combining Solar Data from HARPS, HARPS-N, EXPRES, and NEID" 2023, AJ, 166, 1736. Zhao, L.L., Kunovac-Hodzic, V., Brewer, J.M., et al. "Measured Spin-Orbit Alignment of Ultra-Short Period Super-Earth 55 Cnc e" 2023, Nature Astronomy, 7, 1985. Zhao, L.L., Fischer, D.A., Henry, G.W., et al. "The EXPRES Stellar-Signals Project II. State of the Field of Disentangling Photospheric Velocities" 2022, AJ, 163, 1714. Zhao, L.L., Hogg, D.W., Bedell, M., Fischer, D.A. "Excalibur: A Non-Parametric, Hierarchical Wavelength-Calibration Method for a Precision Spectrograph" 2021, AJ, 161, 80	

3. **Zhao, L.L.**, Fischer, D.A., Ford, E., Henry, G.W., Rottenbacher, R.M., Brewer, J.M. “The EXPRES Stellar-Signals Project I. Description of Data” 2020, RNAAS, 4, 156
2. Petersburg, R.R., Ong, J.M.J., **Zhao, L.L.**, et al. “An Extreme-Precision Radial-Velocity Pipeline: First Radial Velocities from EXPRES” 2020, AJ, 159, 187
(Contributions were equally split among the first three authors)
1. **Zhao, L.L.**, Fischer, D., Brewer, J., Giguere, M., & Rojas-Ayala, B. “Planet Detectability in the Alpha Centauri System” 2018, AJ, 155, 24

Contributing Author (*: Student Paper)

24. Luhn, J., Rubenzahl, R.A., Halverson, S., **Zhao, L.L.** “An Exposure-averaged Gaussian Process Framework to Recover Stellar Variability in Combined Radial Velocity Data Sets” submitted
23. Ellsworth, M., Llama, J., **Zhao, L.L.**, et al. “The He I D3 Line as a Proxy for Magnetic Activity using EXPRES Solar Observations” arXiv, 2510.27059
22. Brady, M., Bean, J.L., Basant, R., et al. [incl. **Zhao, L.L.**] “An Earth-like Density for the Temperate Earth-sized Planet GJ 12b” accepted
- *21. Komori, C., Brewer, J.M., **Zhao, L.L.** “The Effects of Sunspots on Spectral Line Shapes in the Visible” 2025, AJ, 170, 209
20. Salzer, J., Cisewski-Kehe, J., Ford, E.B., **Zhao, L.L.** “Searching for Low-Mass Exoplanets Amid Stellar Variability with a Fixed Effects Linear Model of Line-by-Line Shape Changes” 2025, AJ, 170, 179
19. Freckleton, A.V., Mortier, A., Bedell, M., et al. [incl. **Zhao, L.L.**] “gr8stars – I. A homogeneous spectroscopic study of bright FGKM dwarfs and a public library of their high-resolution spectra” 2025, MNRAS, 540, 1786
18. Basant, r., Luque, R., Bean, J.L., et al. [incl. **Zhao, L.L.**] “Four sub-Earth planets orbiting Barnard’s Star from MAROON-X and ESPRESSO” 2025, ApJ, 982, 1
17. Vieytes, M., **Zhao, L.L.**, Bedell, M. “The Influence of Chromospheric Activity on Line Formation” 2025, ApJ, 981, 4
16. Savel, A.B., Bedell, M., Kempton, E.M-R., et al. [incl. **Zhao, L.L.**] “Peering into the black box: forward-modeling the uncertainty budget of high-resolution spectroscopy of exoplanet atmospheres” 2025, AJ, 169, 135
- *15. Lam, C., Bedell, M., **Zhao, L.L.**, Gupta, A. “Gaspery: Optimized Scheduling of Radial Velocity Follow-Up Observations for Active Host Stars” 2024, AJ, 168, 200
14. Llama, J., **Zhao, L.L.**, Brewer, J.M., et al. “The Lowell Observatory Solar Telescope: a fiber feed into the Extreme Precision Spectrometer ” 2024, SPIE, 13094, 20L
13. Siegel, J., Halverson, S., Luhn, J.K., **Zhao, L.L.**, et al. “Quiet Please: Detrending Radial Velocity Variations from Stellar Activity with a Physically Motivated Spot Model” 2024, AJ, 168, 158
12. Eisner, N.L., Grunblat, S.K., Barragán, O., et al. [incl. **Zhao, L.L.**] “Planet Hunters TESS. V. A Planetary System Around a Binary Star, Including a Mini-Neptune in the Habitable Zone” 2024, AJ, 167, 241
11. Korolik, M., Rottenbacher, R.M., Fischer, D.A., et al. [incl. **Zhao, L.L.**] “Refining the Stellar Parameters of τ Ceti: a Pole-on Solar Analog ” 2023, AJ, 166, 123
10. Brewer, J.M., **Zhao, L.L.**, Fischer, D.A., et al. “EXPRES IV. Two Additional Planets Orbiting ρ Corona Borealis Reveal Uncommon System Architecture” 2023, AJ, 166, 46
9. Rottenbacher, R.M., Cabot, S.H.C., Fischer, D.A., et al. [incl. **Zhao, L.L.**] “EXPRES. III. Revealing the Stellar Activity Radial Velocity Signature of ϵ Eridani with Photometry and Interferometry” 2021, AJ, 163, 19
8. Luger, R., Bedell, M., Foreman-Mackey, D., et al. [incl. **Zhao, L.L.**] “Mapping Stellar Surfaces III: An Efficient, Scalable, and Open-Source Doppler Imaging Model” 2021, arXiv:2110.06271
7. Holzer, P., Cisewski-Keke, J., Fischer, D.A., **Zhao, L.L.** “A Hermite-Gaussian Based Radial Velocity Estimation Method” 2021, AnApS, 15, 527

6. Holzer, P.H., Cisewski-Kehe, J., **Zhao, L.L.**, Fischer, D.A., Ford, E.B. "A Stellar Activity F-statistic for Exoplanet Surveys (SAFE)" 2021, AJ, 161, 272
5. Cabot, S.H.C., Roettenbacher, R.M., Henry, G.W., **Zhao, L.L.**, et al. "EXPRES. II. Searching for Planets Around Active Stars: A Case Study of HD 101501" 2020, AJ, 161, 26
4. Hoeijmakers, H.J., Cabot, S.H.C., **Zhao, L.L.**, et al. "High-Resolution Transmission Spectroscopy of MASCARA-2 b with EXPRES" 2020, A&A, 641, A120
3. Brewer, J.M., Fischer, D.A., Blackman, R.T., et al. [incl. **Zhao, L.L.
- 2. Blackman, R.T., Fischer, D.A., Jurgenson, C.A., et al. [incl. **Zhao, L.L.
- 1. Gaudi, S., Blackwood, G., Howard, A., et al. [incl. **Zhao, L.L.**] "Extreme Precision Radial Velocity Working Group" 2019, BAAS 51, 232****

Textbooks

<i>Astrobiology</i> (Pressbooks)	2024
Co-author	
<i>Handbook of Exoplanets</i> (Springer)	2023
55 Cancri (Copernicus): A Multi-planet System with a Hot Super-Earth and a Jupiter Analogue	
<i>Origins and the Search for Life in the Universe</i> (CK-12)	2017
Chapter 6: The Complexification of Chemistry	
Chapter 7: The Emergence of Life on Earth	

INVITED TALKS

Colloquia

- UC Berkeley (Feb. 2025)
- Rochester Institute of Technology (Dec. 2024)
- University of Toronto (Feb. 2024)
- University of Maryland (Apr. 2023)
- Jet Propulsion Laboratory (Nov. 2022)
- EPRV Research Coordination Network (May 2022)

Not listed: 12 seminars (9 invited)

Invited Conference Talks

- "Advancing Precision Radial Velocity Towards Detecting Earth Analogs" *Frank N. Bash Symposium* (Sep. 2025)
- "Advancing Precision Radial Velocity Towards Detecting Earth Analogs" *TDLI: Post-doctoral Frontier Symposium in Physics and Astronomy* (Sep. 2025)
- "Life Beyond Earth: The Missing Links *ISSI Breakthrough Workshop* (Jun. 2025)
- "Solar to Stellar Observations" *Cool Stars* (Jun. 2024)
- "Excalibur" *Spectral Fidelity* (Sep. 2023)
- "Comparing Solar Data across Four Precision Instruments" *PoET* (Feb. 2023)
- "Improving Exoplanet Detection with Discriminative Linear Regression" *Flatiron-wide Algorithms and Mathematics* (Oct. 2022)
- "Machine Learning for Extreme Precision Spectrographs" *AAS 238; Machine Learning in Astronomy (MiM)* (Jun. 2021)
- "EXPRES" *Extreme Precision Radial Velocity IV* (Mar. 2019)

Not listed: 21 contributed conference talks

PROFESSIONAL ACTIVITIES	<i>Referee:</i> AAS Journals, A&A, MNRAS, PASP, PASJ <i>Proposal Reviewer:</i> NASA APRA, NSF AAG, NSF ATI	
	Community Leadership & Collaborations	
	Exoplanet Exploration Program Analysis Group (ExoPAG) <i>Executive Committee Member</i>	2023 - 2026
	EPRV Research Coordination Network <i>Steering Committee Member</i>	2022 - Present
	The Terra-Hunting Experiment <i>Member</i>	2021 - Present
	Extreme Stellar Signals Project (ESSP) <i>Founder; Executive Committee Member</i>	2020 - Present
	Extreme Precision Spectrograph (EXPRES) Team <i>Project Scientist</i>	2016 - Present
	Scientific Organizing Committees	
	EPRV VI Splinter Session “Accessing and Working with EPRV Solar Datasets”	2025
	EPRV VI Splinter Session “Benchmarking Stellar Variability Mitigation Methods”	2025
MENTORING	EPRV V	2023
	EPRV V Splinter Session “From Solar to Stellar”	2023
	Sun-as-a-Star Workshop	2023
	Emerging Researchers in Exoplanet Science (ERES)	
	ERES III, Yale	2017
	ERES V, Cornell	2019
	ERES VI, Princeton	2021
	Diversity, Inclusion, & Equity	
	<i>Executive Board:</i> Yale Astronomy Climate and Diversity Committee	2020 - 2021
	<i>Fellow:</i> Yale Office of Graduate Student Diversity and Development	2018 - 2021
	<i>Founding Member:</i> Yale Astronomy Student Council	2018 - 2021
Invited Panels	<i>Interview Preparation Panel</i> , Guide to Applying for Astronomy Postdocs (GAAP) (Jul. 2025)	
	<i>Career Panel</i> , Emerging Researchers in Exoplanet Science IX (Jul. 2024)	
	<i>Co-Mentor:</i> Claire Komori Masters Student, State University of San Francisco First-author publication	2023-2025
	<i>Co-Mentor:</i> Chris Lam Graduate Student, University of Florida First-author publication, Poster presentation at EPRV V	Fall 2022
	<i>Mentor:</i> Nusrat Jahan Undergraduate Student, Hunter College Poster presentation at AAS 241 and CUWiP	Summer 2022
Mentoring	<i>Mentor:</i> Lianys Feliciano Undergraduate Student, New York City College of Technology Poster presentation at SACNAS and AAS 241	Summer 2022

TEACHING	<i>Guest Lecture: Another Earth</i> Columbia University	Fall 2022
	<i>Research Project Lead: Exoplanets</i> Warrior Scholars Project	Summer 2021
	<i>Certificate of College Teaching Preparation</i> Granted by the Yale Center for Teaching and Learning	Awarded 2018
	<i>Co-Instructor: Origins and the Search for Life in the Universe</i> Yale University	Fall 2017
	<i>Teaching Fellow: Frontiers and Controversies in Astrophysics</i> Yale University	Spring 2017
	<i>Teaching Fellow: Origins and the Search for Life in the Universe</i> Yale University	Fall 2016
SELECT OUTREACH	<i>Astronomy Conversations Presenter: Adler Planetarium</i> <i>Mentor: AMP-UP</i> <i>Reviewer: NHFP App Feedback Program</i> <i>Speaker: Skype a Scientist</i> <i>Docent: the Peabody Museum</i> <i>Demonstrations, Group Leader: Girls Science Investigation</i> <i>Guest Author: Scientific American, Observations</i> <i>Invited Speaker, Public Relations Committee: Open Labs Observatory Volunteer: Franklin Institute</i>	2025 - Present 2024 - 2025 2024 2019 - 2021 2018 - 2019 2017 - 2019 2017 2016 - 2020 2012 - 2016
PROPOSALS	<p>Observing Proposals</p> <p><i>Pi: NEID, 2022B</i> Awarded 5.8 hours of P2 time "Measuring the Shortest Timescale Stellar Signals for a Range of Spectral Types"</p> <p><i>Pi: Gemini, 2022B</i> Awarded 29.8 hours of Band 1 time "Unveiling the Signatures of Starspots in MAROON-X Spectra with Simultaneous Interferometric Stellar Surface Mapping"</p> <p>Grant Proposals</p> <p>While fully funded from 2021-2027, I contributed to the following successful proposals.</p> <p><i>Co-I: NASA Exoplanet Mass Measurement Program</i> 2024 Selectable "A Star-as-the-Sun: applying solar EPRV techniques to stellar spectra" (Pi: Drake Demming, University of Maryland)</p> <p><i>Co-I: NASA Exoplanet Mass Measurement Program</i> 2024 Selectable "Development of a community data reduction framework to advance EPRV towards the cm/s precision era" (Pi: Daniel Krokowski, University of Arizona)</p> <p><i>Co-I: NASA Extreme Precision Radial Velocity Foundation Science</i> 2022 Awarded \$450,000 "New Strategies for Combining EPRV Observations from Multiple Instruments" (Pi: Eric Ford, Pennsylvania State University)</p>	

<i>Co-I:</i> NASA Extreme Precision Radial Velocity Foundation Science Awarded \$480,000 "A community driven, modular data-pipeline architecture to push EPRV into the 1 cm/s era" (PI: Jennifer Burt, California Institute of Technology)	2022
<i>Collaborator:</i> NSF Astronomical Sciences Awarded \$510,000 "Unmasking Stellar Variability: Hierarchical Bayesian methods for characterization of low-mass planets with EPRV spectroscopy" (PI: Jessica Kehe, University of Wisconsin-Madison)	2023 - 2025
<i>Co-I:</i> NASA Exoplanets Research Program (XRP) Awarded \$575,000 "Turn down the noise! Disentangling planetary and stellar signals by observing the Sun with EXPRES" (PI: Joe Llama, Lowell Observatory)	2023 - 2025
<i>Co-I:</i> Heising-Simons Foundation Awarded \$950,000 "EXPRES 100 Earths Survey" (PI: Joe Llama, Lowell Observatory)	2022 - 2025

REFERENCES

Debra A. Fischer: debra.fischer@yale.edu
David W. Hogg: david.hogg@nyu.edu
Eric B. Ford: eford@psu.edu