Yeyuan (Yinzi) Xin

Education

June 2025 **PhD in Physics**, *California Institute of Technology*, GPA: 4.0/4.0.
Thesis: Use of light coherence for exoplanet detection and characterization
Advisor: Dimitri Mawet

May 2020 **MS in Aeronautics and Astronautics**, *Massachusetts Institute of Technology*, GPA: 5.0/5.0.
Thesis: Coronagraphic data post-processing using projections on instrumental modes
Advisor: Kerri Cahoy

June 2018 **BS in Physics**, *California Institute of Technology*, GPA: 3.70/4.0.

Research Experience

10/2025- **Leiden University (Netherlands)**, *Postdoc*, Advisor: Sebastiaan Haffert.
- Investigating quantum optimal mode-sorting coronagraphy.
- Contributer to the coronagraphy and wavefront sensing and control work package for the Planetary Camera and Spectrograph instrument concept for the Extremely Large Telescope.

09/2020-06/2025 **Caltech (USA)**, *Graduate Researcher*, Advisor: Dimitri Mawet.
- Developed the photonic lantern nuller (PLN) instrument concept for the detection, imaging, and spectroscopy of close-in exoplanets.
- Characterized a PLN in the laboratory in monochromatic and broadband light. Demonstrated focal-plane wavefront control with the PLN. Tested and demonstrated PLN operations onsky at the Subaru Telescope.
- Implemented speckle nulling algorithm through a fiber to suppress unwanted starlight through the Keck Planet Imager and Characterizer (KPIC) instrument at the Keck II telescope. Tested and validated speckle nulling on-sky.
- Investigating coherent differential imaging methods for improving detection sensitivity with speckle nulling datasets.
- Part of KPIC instrument development and daytime calibration team.

02/2020-05/2020 **Space Telescope Science Institute (USA)**, *Visiting Graduate Researcher*, Advisor: Laurent Pueyo.
- Characterized coronagraphic robust observables for improving exoplanet detection sensitivity.
- Investigated behavior of constraints in apodized vortex coronagraph optimization.

07/2018-05/2020 **MIT (USA)**, *Masters Student Researcher*, Advisor: Kerri Cahoy.
- Aligned optical payload of Deformable Mirror (DeMi) demonstration cubesat. Wrote the wavefront control software (which was successfully used in orbit to close the loop).
- Simulated diffraction properties of laser guide star enabled segment cophasing wavefront control for large segmented space telescopes.
- Implemented circumstellar disk structure retrieval using Markov Chain Monte Carlo.
- Formulated post-processing with robust observables for a coronagraphic instrument.

06/2017-06/2018 **Caltech (USA)**, *Summer Undergraduate Research Fellow*, Advisor: Dimitri Mawet.
- Implemented speckle nulling algorithm and Kalman filter for starlight suppression through an optical fiber injection unit.
- Helped with the integration of the High Contrast Spectroscopy Testbed.

Awards and Fellowships

2024 **Judith G. Cohen Fellowship**, for work in diversity, equity, inclusion, and outreach in Caltech's Division of Physics, Math, and Astronomy. Funding awarded to design a survey to examine summer undergraduate student researcher recruitment methods at Caltech and identify ways to expand recruitment reach and increase diversity through the program.

2018-2023 **National Science Foundation Graduate Research Fellowship**.

First-authored peer-reviewed publications

2025 **Implicit electric field conjugation with a Photonic Lantern Nuller**, *Journal of Astronomical Telescopes, Instruments, and Systems.*

arXiv: https://doi.org/10.48550/arXiv.2503.24292

2024 **Laboratory demonstration of a Photonic Lantern Nuller in monochromatic and broadband light**, *Journal of Astronomical Telescopes, Instruments, and Systems.*

arXiv: https://doi.org/10.48550/arXiv.2404.01426

2024 **Coronagraphic data post-processing using projections on instrumental modes**, *The Astrophysical Journal.*

Open Access: https://doi.org/10.3847/1538-4357/ad1879

2023 **On-sky speckle nulling through a single-mode fiber with the Keck Planet Imager and Characterizer**, *Journal of Astronomical Telescopes, Instruments, and Systems.*

arXiv: https://doi.org/10.48550/arXiv.2307.11893

2022 **Efficient detection and characterization of exoplanets within the diffraction limit: nulling with a mode-selective photonic lantern**, *The Astrophysical Journal.*

Open Access: https://doi.org/10.3847/1538-4357/ac9284

Select First-author Conference Presentations and Proceedings

2024 **Wavefront sensing and control for a Photonic Lantern Nuller for exoplanet characterization**, *SPIE Astronomical Telescopes and Instrumentation (Yokohama, Japan)*, Proceedings of SPIE.

2024 **Single telescope nulling interferometry with photonic mode-sorters for exoplanet characterization**, *Charting Quantum Horizons (Tucson, USA).*

2023 **Laboratory characterization of a mode-selective photonic lantern for exoplanet characterization**, *SPIE Optics and Photonics (San Diego, USA)*, Proceedings of SPIE: https://doi.org/10.1117/12.2676421.

2023 **Reconstructing the coherent starlight spectrum from KPIC speckle nulling data**, *Coherent Differential Imaging Workshop (Paris, France).*

2023 **On-sky speckle nulling through a single-mode fiber with the Keck Planet Imager and Characterizer**, *Adaptive Optics for Extremely Large Telescopes 7 (Avignon, France)*, Proceedings of AO4ELT7: https://10.13009/AO4ELT7-2023-008.

Select Co-authored Papers

2024 **Rotation and Abundances of the Benchmark Brown Dwarf HD 33632 Ab from Keck/KPIC High-resolution Spectroscopy**, *The Astrophysical Journal*, 971, 9, C.-C. Hsu, J. J. Wang, J. W. Xuan, J.-B. Ruffio, E. Morris, D. Echeverri, **Y. Xin**, et al.

2024 **Coherent Imaging with Photonic Lanterns**, *The Astrophysical Journal*, 964, 113, Y. J. Kim, M. P. Fitzgerald, J. Lin, S. Sallum, **Y. Xin**, N. Jovanovic, and S. Leon-Saval.

2024 **Atmospheric Metallicity and C/O of HD 189733 b from High-resolution Spectroscopy**, *The Astronomical Journal*, 167, 43, L. Finnerty, J. W. Xuan, **Y. Xin**, et al.

2023 **Real-time Experimental Demonstrations of a Photonic Lantern Wave-front Sensor**, *The Astrophysical Journal Letters*, 959, 2, J. Lin, M. P. Fitzgerald, **Y. Xin**, et al.

2022 **On-sky Reconstruction of Keck Primary Mirror Piston Offsets Using a Zernike Wavefront Sensor**, *The Astrophysical Journal*, 932, 2, M. A. M van Wooten, S. Ragland, R. Jensen-Clem, **Y. Xin**, et al.

2021 **Kernel Phase and Coronagraphy with Automatic Differentiation**, *The Astrophysical Journal*, 907, 1, B. J. S. Pope, L. Pueyo, **Y. Xin**, and P. G. Tuthill.

Teaching and Mentoring

2024 **Research Mentor**, *Caltech*, Summer Undergraduate Research Program.

Suvinay Goyal (University of Illinois Urbana-Champaign): Analysis of angular differential post-processing algorithms for exoplanet direct detection with the Photonic Lantern Nuller.

2021 **Teaching Assistant**, *Caltech*, First-year Classical Mechanics and Electromagnetism.

2020-2021 **Volunteer Tutor**, *Caltech*, Rise Program.

2018 **Teaching Assistant**, *Caltech*, Sophomore Physics Lab.

Skills

Languages: Python, Matlab, C/C++, Mathematica

Modeling and Simulation: optical propagation, dynamical and control systems

Laboratory: optical alignment, basic electronics (circuits and soldering)

Miscellaneous

- Website : https://yinzi-xin.github.io
- Github : https://github.com/yinzi-xin