

# Shi Zhao

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## Education

### Department of Electrical Engineering, California Institute of Technology

- Ph.D. in Electrical Engineering (Advised by Prof. [Changhuei Yang](#)) Sep 2023 – Expected June 2027
- M.S. in Electrical Engineering (Overall GPA: 4.20/4.30) Sep 2023 – June 2025

### School of Physics, Peking University

- Bachelor of Science in Physics (Major GPA: 3.80/4.00) Sep 2019 – June 2023

## Main Research Experience

### Digital Defocus Aberration Interference for Automated Microscopy

Feb 2025- August 2025

- Advisor: Professor Changhuei Yang, Caltech
- Developed a **novel physics-based autofocus** technique that detects defocus from fringes in the summed Fourier spectra of two-LED partially coherent illumination. [\[Link\]](#)
- The technique outperformed conventional approaches in **autofocusing range, speed, robustness, photon efficiency, simplicity, and generalizability**, and is compatible with complex-field imaging techniques for digital refocusing.

### Efficient, High-throughput, Aberration-free Computational Imaging

Sep 2023- Present

- Advisor: Professor Changhuei Yang, Caltech
- Built a **hybrid-illumination multiplexed Fourier ptychographic microscopy system** and developed optimization algorithms for efficient, aberration-corrected complex-field imaging, achieving robust reconstruction under up to 78  $\mu\text{m}$  defocus. [\[Link\]](#)
- Developed a gigapixel-scale, high-throughput **whole-slide complex-field imaging platform** using annular ptychographic imaging with AI-based sample localization, GPU-accelerated reconstruction, and automated stitching, achieving 70 % reduction in acquisition time and 50 $\times$  faster reconstruction speed. [\[Link\]](#)

### AI-based Variability Prediction of Stem Cell-derived Embryo Models

Dec 2023- Aug 2024

- Advisor: Professor Changhuei Yang, Caltech
- Designed a deep learning model to predict variability of stem-cell-derived embryo models, achieving 88 % accuracy.

### One-Pot Multi-Frame optical coherence tomography (OCT) Denoising

Apr 2021-Sep 2021

- Advisor: Professor Qiushi Ren, Peking University
- Developed a deep-learning denoising framework for OCT speckle noise reduction with a one-pot multi-frame strategy.

## Technical Skills

- **Optical Systems:** Microscopy, Physical Optics, Diffractive & Fourier Optics, Optical Alignment, Optical System Design
- **Computational & AI:** Optimization and Inverse Problems, Physics-based Modeling and Simulation, Image Denoising, AI for Science, Deep Learning, Machine Learning, Signal Processing
- **Programming:** Python (PyTorch), MATLAB

## Patents and Selected Publications

### Patents:

1. H. Zhou, S. Zhao, C. Yang, "Digital defocus aberration interference for automated optical microscopy." CIT-9339-P (2025)

### Selected Publications (Full publication list at [Google Scholar](#)):

1. **S. Zhao**, H. Zhou, C. Yang, "*Hybrid-illumination multiplexed Fourier ptychographic microscopy with robust aberration correction*," arXiv:2509.05549 (2025), under review at *JPhys Photonics*.
2. H. Zhou\*, **S. Zhao\***, Y. Fan, et al., "*Digital defocus aberration interference for automated optical microscopy*," arXiv:2507.10867 (2025), under review at *Nature Communications*.
3. P. Caldarelli, L. Deininger, **S. Zhao**, et al., "*AI-based approach to dissect the variability of mouse stem-cell-derived embryo models*," *Nature Communications* 16 (1): 1772 (2025).
4. **S. Zhao**, H. Zhou, S. Lin, R. Cao, C. Yang, "*Efficient, gigapixel-scale, aberration-free whole-slide scanner using angular ptychographic imaging with closed-form solution*," *Biomed. Opt. Express* 15 (10): 5739 (2024).
5. L. Jin, Q. Guo, **S. Zhao**, et al., "*One-pot multi-frame denoising*," *Int. J. Computer Vision* 132 (2): 515-536 (2024).