

Chaoying Gu | <https://arianagu.github.io/>

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EDUCATION

UNIVERSITY OF CALIFORNIA, BERKELEY Berkeley, CA, US 08/2022-present

PhD student in Electrical Engineering, major in signal processing, GPA: **4.0/4.0**

Research focus: Signal processing, image reconstruction and inverse problems solving in computational imaging.

Related courses: Computational Imaging (A+), Optimization Models in Engineering (A+), Intro to Computer Vision and Computational Photography (A), Computational Color (A), Neural Computation (A+).

PEKING UNIVERSITY Beijing, China 09/2018-07/2022

BS in Electronic and Information Engineering, Overall GPA: **3.776/ 4.000** (1/50 in EIE Dept.)

Awards and Honors

AEON scholarship

01/2021

Merit Student, Peking University (top 10% students in each academic year)

2019&2020&/2021

TECHNICAL SKILLS

Modeling: Gradient-based optimization, Fourier optics, wave propagation, UNet/NeRF/diffusion model

Programming: Python (PyTorch, JAX), MATLAB (Simulink), C++, C#

Software development: HTML, Django, MySQL, Dart

Hardware development: LabView, FPGA, LTspice, Arduino

Visualization: LaTeX, Blender, Origin

PUBLICATIONS

Chaoying Gu, Talha Sultan, Khadijeh Masumnia-Bisheh, Laura Waller, Andreas Velten. "[Fast Non-line-of-sight Imaging with Non-planar Relay Surfaces.](#)" *IEEE International Conference on Computational Photography (ICCP)*. IEEE, 2023.

- Implemented a customized **ray-tracing simulator** and proposed a novel computational method that effectively performs **3D diffraction propagation** for arbitrary surfaces.
- Collected Non-line-of-sight imaging data using an active **laser scanning** system (2D galvos) and single-photon avalanche-diode (SPAD) camera.
- Achieved 2 orders of magnitude better computational complexity compared to state-of-the-art algorithms without quality degradation; open-sourced MATLAB implementation available on [GitHub](#).

[In Submission] Kevin C. Zhou, **Chaoying Gu**, Muneki Ikeda, Tina M. Hayward, Nicholas Antipa, Rajesh Menon, Roarke Horstmeyer, Saul Kato, Laura Waller. "[Large-scale compressive microscopy via diffractive multiplexing across a sensor array.](#)" arXiv:2507.14437v1

- Designed a snapshot gigapixel-scale imaging system using a sensor array, enabled by a customized **diffractive optical element** (DOE) to encode the information from the gaps between the individual sensors.
- Developed a deconvolution algorithm incorporating the DOE PSF across $> 5.2 \text{ cm}^2$ FOV with a **fully shift-variant model** and investigated GPU acceleration strategies.

CONFERENCE PROCEEDINGS

[**Oral Presentation**] Chaoying Gu, Antoine Islegen-Wojdyla, Markus Benk, Kenneth A. Goldberg, Laura Waller. "[Towards Full Field-of-View Fourier Ptychography for Extreme Ultraviolet Microscope.](#)" *IEEE Conference on Computational Imaging Using Synthetic Apertures (CISA)*. IEEE, 2024.

- Extensively evaluated the FPM algorithms and performed EUV microscope **aberration characterization**.
- Achieved a 36-fold increase in the usable field-of-view from the nominal $5 \times 5 \text{ }\mu\text{m}^2$ diffraction-limited area.

[**Oral Presentation**] Chaoying Gu, Antoine Islegen-Wojdyla, Markus Benk, Kenneth A. Goldberg, Laura Waller. "[Enhanced EUV mask imaging using Fourier ptychographic microscopy.](#)" *Advanced Lithography + Patterning*. SPIE, 2025.

- Developed an **automatic differentiation** framework for system **self-calibration** and wavefront error correction, enabling robust reconstruction of elliptical pupils and attenuated phase shift masks.
- Validated Fourier FPM as a promising technique for advanced EUV mask imaging, achieving quantitative phase recovery and enhanced resolution using experimental data from the SHARP EUV microscope at Lawrence Berkeley National Laboratory; open-sourced **Python/PyTorch** implementation available on [GitHub](#).

[Oral Presentation] Chaoying Gu, Kevin C. Zhou, Laura Waller. "Neural Network-Accelerated Reconstruction for High-Spatiotemporal-Throughput Video Microscopy of Freely Moving Organisms." *Computational Optical Sensing and Imaging*. Optica Publishing Group, 2025.

- Developed an **end-to-end neural network** to accelerate optimization-based video reconstruction, employing a patch-based strategy involving Fourier convolution kernel to adapt for gigapixel image reconstruction with diffractive multiplexing across a sensor array.

ONGOING RESEARCH PROJECTS

Fourier Ptychographic Microscopy for Through-Focus Lithography Emulation of High-NA Anamorphic Imaging
Chaoying Gu, Markus Benk, Antoine Islegen-Wojdyla, Kenneth A. Goldberg, Laura Waller.

- Applied Fourier ptychographic **phase-retrieval** to emulate wave propagation and simulate photomask through-focus behavior under various illumination patterns and validated with experimental data.
- Predicted lithographic process windows and optimized illumination for high-NA anamorphic imaging.
- Manuscript in preparation.

Pre-trained Diffusion Model for Optimization-Guided Deconvolution with Large Kernels

Chaoying Gu, Alex Mehta, Ajil Jalal, Amit Kohli, Laura Waller.

- Applied current **diffusion posterior sampling methods** (e.g., DPS, Red-Diff, DDNM, EDM) to customized deconvolution problems with diffuser PSFs, identifying significant hallucination issues in existing methods.
- Investigated the optimization-inspired purification method to alleviate the trade-off between visual plausibility and measurement data fidelity.

INTERNSHIP EXPERIENCES

Source Mask Optimization Intern

ASML, San Jose, CA

05/2025-08/2025

- Explored and compared different regularizations in source mask co-optimization for lithography.
- Developed a customized regularization method that improves adherence to specific design rules.

SELECTED COURSE PROJECTS

Enhanced Deconvolution Using Langevin Sampling Beyond maximum a posteriori (MAP) estimation

- Replicated results from the **Langevin sparse sampling** method, leveraging Langevin dynamics to reconstruct sparse dictionaries for customized datasets and natural images while analyzing its "automatic pruning" behavior.
- Extended the approach to sample solution spaces for noised image deblurring and deconvolution problems, demonstrating its potential in **uncertainty quantification**.

Stereo Alignment for Multispectral RGB-UV Imaging in Animal Vision Studies

- Built a **synchronized RGB-UV stereo camera** based on Raspberry Pi
- Developed a pipeline for feature-based projection matrix estimation for robust pixel-to-pixel matching of RGB and UV image pairs, applied disparity map generation for **depth estimation**.

EXTRACURRICULAR EXPERIENCE

Volunteer, REACH Academy (Oakland)

03/2024

- Taught science to TK-2 students, fostering curiosity and early STEM engagement through hands-on activities.

Co-President, UC Berkeley Optics Chapter [\[website\]](#)

06/2024-present

- Organized technical seminars featuring speakers from diverse departments, universities, and industry leaders, hosting **14 events** in 2024 with an average attendance of **25 participants**.
- Coordinated professional development events, including resume workshops and mock preliminary exams for first-year graduate students.

Amateur Minesweeper Player [\[profile\]](#)

06/2023-present

- Ranked in the **top 800 out of over 9,800,000 players** on a worldwide Minesweeper platform.
- Achieved a personal best of 72 seconds on the Expert level.

TEACHING

• Teaching assistant, *Analysis and Design of Analog Circuits*, Peking University

09/2021-06/2022

• Teaching assistant, *EE120 Signals and Systems*, UC Berkeley

01/2025-05/2025

• Head Teaching assistant, *EE120 Signals and Systems*, UC Berkeley

08/2025-01/2026