

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, Origin, Blender

PUBLICATIONS [\[google scholar\]](#)

Leyla Kabuli, **Chaoying Gu**, Laura Waller. "Replica Artifacts in Phase Mask-Based Lensless Imaging Systems." *Computational Optical Sensing and Imaging*. Optica Publishing Group, 2023.

- Improved the diffuser-based lensless imaging by studying structured artifacts in **optimization-based deconvolution**.

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.
- Achieved orders of magnitude better computational complexity compared to state-of-the-art algorithms without quality degradation, validated on experimental data captured with different 3D non-planar structures.

CONFERENCE PROCEEDINGS

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.

- Utilized binary pseudo-random patterns (BPRP) and compared various FPM reconstruction algorithms using both simulated and experimental data from the SHARP EUV microscope at Lawrence Berkeley National Laboratory.
- Demonstrated robust performance in reconstructing elliptical pupils and attenuated phase shift masks, validating FPM as a candidate for advanced EUV mask imaging applications with **quantitative phase** and enhanced resolution.

Kevin C. Zhou, **Chaoying Gu**, Grace Jiang, Nicholas Antipa, Roarke W. Horstmeyer, Laura Waller.

"High-throughput computational microscopy with diffractive multiplexing across a gigapixel sensor array." *Computational Optical Imaging and Artificial Intelligence in Biomedical Sciences*. SPIE, 2024.

- Implemented a **patch-based deconvolution** method for fast and memory-efficient reconstruction for high-throughput multiplexed imaging that involves deconvolving a **customize designed diffraction optical element** pattern.
- Full paper manuscript in preparation for Optica.

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 $5 \times 5 \mu\text{m}^2$ diffraction-limited area.

ONGOING RESEARCH PROJECTS

Neural Network-Accelerated Reconstruction for High-Spatiotemporal-Throughput Video Microscopy of Freely Moving Organisms

Chaoying Gu, Kevin C. Zhou, Laura Waller.

- 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.

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

Chaoying Gu, 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.
- Investigating the optimization-inspired purification method to alleviate the trade-off between visual plausibility and measurement data fidelity.

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

Google APAC Software Product Sprint [\[project page\]](#)

06/2020

- Implemented a personalized social application based on Django, Django REST, MySQL and Dart.
- Recognized as the top contributing participant by group members.

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 500 out of over 7,631,000 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