William (Chi Kin) Yau

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Purdue ECE PhD candidate focused on learning-driven OPC, accelerated lithography modeling, experienced in EM simulations (FDTD/RCWA) in C/C++/Python and physics-informed machine learning from UC Berkeley BAIR. Seeking computational lithography internship to advance simulation flow and learning-based optimization.

Education

Purdue University, Ph.D in Electrical and Computer Engineering: GPA: **4.00**/4.00 Aug 2025 - Now
Relevant courses: EUV & comp. lithography (Abbe/Hopkins, OPC/ILT, SMO, M3D), nanophotonics & metamaterials
University of California, Berkeley, BA in Physics and Computer Science: GPA: **3.93**/4.00 Aug 2021 - May 2025
Relevant courses: image processing & vision (C++), computational geometry, parallel computing (C, Linux), Laser & optoelectronics (Lumerical), Fourier optics (Zemax), physics-informed machine learning, data analytics

Research Experience

Graduate Researcher, Stanley Chan Lab @ Purdue ECE August 2025 - Now

- Developing **physics-aware, learning-based OPC framework** to optimize masks with interpretable procedures.
- Training GPU-accelerated **Fourier neural operator-based** surrogate models of Hopkins imaging for generating extensive simulated datasets of mask/aerial/resist images, ensuring model robustness and generalizability.
- Developing **variational autoencoder (VAE)-based** generative image encoding for aerial images with **PyTorch**, improving gradient-based optimization landscape, offering well-posed solutions and algorithmic interpretability.
- Deriving **theoretical guarantees** on optimization landscape properties (e.g., benign non-convexity), ensuring convergence speedups and mathematical implications on illumination design and SMO.
- **Benchmarking** my framework against conventional OPC metrics (MEEF, NILS, PV band) to provide **interpretable knobs** for imaging product engineers and customers.

Graduate Researcher, Qi Guo Lab @ Purdue ECE August 2025 - Now

- Developing an all-optical framework for **algorithm-metasurface co-design** based on **rigorous EM simulations of wafer stacks** to quantify sub-micron line/space surface defects with electron-microscopy-level precision.
- Achieved **5-10X** improvement in pinpointing defect location and **1.3-3X** higher defect-severity accuracy (<10 nm error) across large 3D patterned fields using end-to-end EM optimization.
- Developed **RCWA-based figure of merit** for **PyTorch-based co-optimization** on scatterometric illumination/ detection and metasurface design parameters, ensuring optimal imaging accuracy and noise-robustness.
- Deployed **GPU-accelerated, FDTD-based EM solver** to **model 3D volumetric fields** around multilayer stacks with diverse realistic defects (CD non-uniformity, sidewall roughness) for generalizable data-driven imaging.
- Implemented high-dimension parameter sweeps over defect configurations (CD, sidewall, height) across **multi-GPU clusters**, leveraging automated job scheduling, MPI parallelization, and **GPU-direct data pipelines** in Python/CUDA for **10X** faster EM simulation throughput on realistic wafer geometries.

Research Assistant, Laura Waller Lab @ Berkeley Artificial Intelligence Research (BAIR) Aug 2024 - Aug 2025

- Modeled **aberration wavefront profiles** with Zernike polynomials to study their impact on imaging contrast and resolution in microscopy/astronomy systems, connecting with a proprietary information-theoretic, **data-driven framework** for holistic, generalizable object-aware optical system characterization.
- Built scalable **Bayesian model** pipelines with GPU acceleration for image acquisition modeling & validation.
- Integrated **JAX-TensorFlow-PyTorch modules** for differentiable inverse design pipelines for diffractive optical elements (akin to lens/illumination design optimization), improving accuracy **25-30%**.

Research Fellow, Stanley Chan Lab @ Purdue ECE May - July 2024

- Developed **signal-denoising and depth-estimation algorithms** boosting single-photon LiDAR (SP-LiDAR) depth estimation accuracy **1000X** and noise robustness **17X**, enabling rapid, on-chip processing, addressing data storage limitations common for SP-LiDAR; Wrote **unit tests** and **regression tests** in **C++/Python** simulation modules to ensure numerical stability and performance.

Research Assistant, Ivan Vasko Group @ UC Berkeley Space Sciences Lab (SSL) Aug 2022 - Aug 2023

- Developed **scalable Python/Pandas-based data pipeline & dashboard** processing 1M+ plasma dynamics datapoints from NASA THEMIS, enabling high-throughput analytics and performance monitoring.

Technical Skills

Python, **C++**, **C**, **MATLAB**, Java, Git; Image processing/ recognition/ comp. geometry: **OpenCV**, **TorchVision**, **GEOS**, Dlib, Simd; Data/optimization: **PyTorch, JAX, TensorFlow**, Pandas, NumPy, SciPy; **HPC**: GPU cluster optimization (**CUDA**), **MPI** (**Linux**), parallel/distributed programming (**Dask**); **FDTD** (Meep, Tidy3D), **RCWA, FEM(FEA)** (JCMsuite), PWEM, eigenmode expansion, angular spectrum, method of moments; **Comp. litho. sim.** (TorchLitho), **OPC** (OpenILT), M3D, SMO, etch; Overlay metrology sim.; **Ansys EDA**: **Lumerical, Zemax, Code V**, APDL multiphysics; Math: **PDE**, **lin. alg.**, convex optim.; Optics lab: LabVIEW, laser alignment, spectroscopy, etc.

Awards & Presentations

Hong Kong Scholarship For Excellence Scheme (HKSES) Awardee 2021-2025
Awarded full-tuition scholarship covering all four years at UC Berkeley.
Physics-inspired Neural Networks Seminar Apr 2025
Physics-inspired Neural Mapping for High-flux Single-photon LiDAR Simulation
IEEE Multimedia Signal Processing (MMSP) Conference Oct 2024
Analysis and Improvement of Rank-Ordered Mean Algorithm in Single-Photon LiDAR

Projects

RCWA-based Simulation of Overlay Metrology using OCD (Scatterometry) Dec 2025
- RCWA solver in Python/CUDA to rigorously model a **scatterometry-based overlay metrology** setup akin to **ASML YieldStar** tools. Models coherent light from illumination, to scattering off nano-scale grating-over-grating structures, eventually to detection and infers misalignment.
- Scatterometric configuration (e.g. illumination angle, detection) optimization via **distributed parameter sweeps** on multi-GPU Linux clusters; post-measurement scripts analyzing accuracy and noise-robustness.

RCWA-based Surface Defect Field Simulation Dec 2025
- GPU-accelerated RCWA solver in Python/CUDA to rigorously generate image libraries of resultant fields due to local defects (e.g., sidewall roughness & angle, CD non-uniformity) in line/space patterning
- Compared **speed-accuracy tradeoffs** vs. FDTD; GPU-accelerated **distributed parameter sweeps** on multi-GPU Linux clusters; analysis scripts computing robustness, calibration, and **image quality metrics**

Plane Wave Expansion Method (PWEM)-based Isolated Nanopillar Field Sim. Dec 2025
- A GPU-accelerated PWEM eigen-solver in Python/CUDA to simulate resultant fields due to (arbitrarily shaped) isolated nanopillars
- **Automation scripts** for parameter sweeps; results analysis; **data preparation pipeline** for ML-based surrogate modeling and data visualization

Volunteering/ Community Work

Editorial Photographer, Fashion and Student Trends @ Cal Aug 2024 - May 2025
Shot and directed creative campaigns, including clients like Valentino Garavani
Senior Photographer, The Daily Californian Dec 2022 - May 2025
Work frequently featured on *the Daily Cal*'s website and printed copies' front page.
Tech & Operations Associate, UC Berkeley ASUC Aug 2021 - May 2022
Built AWS infrastructure and learning-based algorithms for *Connect@Cal*, a student-led service that distributes community and academic resources.