# Yuqi Zhao

Yale University, USA
Homepage: yuqiweb.com
Email: yuqi.zhao@yale.edu

## Education

**Yale University** — New Haven, USA
*Ph.D Student at Applied Physics Department* — *Aug 2024 - Present*

**Chu Kochen Honors College, Zhejiang University** — Zhejiang, China
*B.E.(Eng.) in Opto-Electronics Information Science and Engineering* — *Sept 2020 - July 2024*

- **GPA**: 3.96/4.0, 90.7/100 **Ranking:** 1/101
- **Core Scores**: Optoelectronics (4.0), Physical Optics (4.0), Signals and Systems (4.0), Electromagnetic Fields & Waves (4.0), Silicon Photonics (4.0), Quantum Information Fundamentals (4.0), Applied Optics (4.0), Object Oriented Programming (4.0), Artificial Intelligence (4.0)

**Lab of Photonic Integrated Circuits and Quantum Measurements, EPFL** — Lausanne, Switzerland
*Full-time Visiting Researcher in Prof. **Tobias.J.Kippenberg**'s Group* — *July 2023 - December 2023*

## Research Interest

My research interest surrounds **photonic integrated circuit design**, **nonlinear optics**, and **quantum photonics**, with a focus on **inverse design methodologies**, **ultra-high-Q resonators**, and **electrical-optical-mechanical interactions**.

## Publication

- [1] **Y. Zhao**, J. Guo, G. Yang, L. Yu, S. Qian, H. Xiang, T. Cao, C. Zhou, & D. Dai, "High-performance and compact integrated photonic dichroic filters and triplexer realized by an efficient inverse design", *Opt. Lett.* 48, 4961-4964 (2023), doi: 10.1364/OL.501554.
- [2] **Y. Zhao**, J. Guo, L. Yu, G. Yang, C. Zhou, T. Cao, & D. Dai, "Compact and Low Loss silicon-integrated polarization beam splitter developed by efficient semi-inverse design approach", 2023 *Opto-Electronics and Communications Conference (OECC)* (pp. 1-3), IEEE, (2023), doi: 10.1109/OECC56963.2023.10209791.
- [3] J. Guo, L. Yu, H. Xiang, **Y. Zhao**, C. Liu, & D. Dai, "Realization of advanced passive silicon photonic devices with subwavelength grating structures developed by efficient inverse design", *Advanced Photonics Nexus*, 2(2), 026005-026005 (2023), doi: 10.1117/1.APN.2.2.026005.
- [4] L. Yu, J. Guo, H. Xiang, C. Liu, **Y. Zhao**, & D. Dai, "High-performance 2×2 bent directional couplers designed with an efficient semi-inverse design method", *Journal of Lightwave Technology*, (2023), doi: 10.1109/JLT.2023.3315214.
- [5] L. Yu, J. Guo, H. Xiang, G. Yang, **Y. Zhao**, Y. Li, & D. Dai, "Ultra-compact and high-performance four-channel coarse wavelength-division (de)multiplexing filters based on cascaded Mach-Zehnder interferometers with Bezier-shape directional couplers", *Optics Experss*, 32 (5), 7774-7782, doi: 10.1364/OE.509936

## Research Experience

**Yale University | Logan's Lab** — New Haven, USA
*Advisor: Prof. **Logan Wright**, Assistant Professor* — *May 2024 - Present*
**Project I: 2D Programmable Waveguide Design and Fabrication**

**EPFL | LPQM** — Lausanne, Switzerland
*Advisor: Prof. **Tobias J. Kippenberg**, Full Professor, LPQM* — *July 2023 - December 2023*
**Project I: Large Tolerance WDM devices design and tolerance analysis for EDWL**

- Simulated the directional couplers, tapered couplers and corresponding MZI (70 nm channel spacing) devices, while also analyzing the tolerance of width, thickness, coupler length and arm difference.
- Achieved the high-tolerance WDM designs that are suitable for wafer-scale production of various thicknesses (200/400/700/800 nm) and different channel spacings (980/1550 nm and 1480/1550 nm).
- Measured and calibrated the designed devices, analyzed the results, and proposed some possible solutions for the differences in performance between designed and fabricated devices.

- Integrated the WDM devices into the next-generation Erbium-Doped Waveguide Amplifier (EDWA) and Erbium-Doped Waveguide Laser (EDWL) devices.

**Project II: Simulation and Measuring the Brillouin Scattering in the TFLN platform**

- Simulated fully anisotropic including the moving boundary, photo-elastic, and piezo-electric effects for the stimulated Brillouin scattering with *COMSOL Multiphysics*.
- Designed special lithium niobate waveguide structures for the experiments to validate the simulation results.
- Designed and built the setup with vector network analyzer (VNA) to measure the Brillouin gain.
- Estimated the impact of the piezoelectric effect on the Brillouin scattering effect in lithium niobate.

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**Zhejiang Univerisity | SING** Zhejiang, China

*Advisor: Prof. **Daoxin Dai**, Full Professor* *Sept 2021 - July 2024*

**Project I: Development and application of the inverse design to spectrally selective devices**

- Designed and compared high-performance dichroic filters of Y-Branch structure with and without sub-wavelength gratings (SWGs) structure using a high-efficiency semi-inverse design method.
- Designed flap-top (ELs $< 0.5$ dB, CTs $< 10$ dB, 1dB Bandwidth $> 25$ nm), small footprint ($2.5 \times 22$ um$^2$), and well-scalable dichroic-filters (60 nm channel space) with at least 2-fold footprint.
- Developed triplexers (1310/1490/1550 nm) with a compact footprint of $10.5 \times 117$ um$^2$ based on the dichroic filters, which had compactness with 15-fold footprint and better overall performance.
- Improved device geometry and loss function to accelerate the implementation processes, and achieved higher performance for the same structures.

**Project II: Advanced passive silicon photonic devices with subwavelength-grating structures**

- Proposed a high-efficiency semi-inverse design method for ultra-compact passive silicon photonic devices.
- Designed and simulated a 6-channel mode (de)multiplexer, a broadband 90°-hybrid, and a two-channel flat-top WDM (210 nm channel space) with ultra-compact footprints.
- Realized a compact ($1.6 \times 4.9$ um$^2$) and low loss (ELs $< 0.61$ dB, ERs $> 13.8$ dB) silicon-integrated polarization beam splitter.
- Designed and developed *Klayout*-based optical mask layout software by scripting in a *Python* API.

## Skills

- Engineering Applications:
  - Optical Simulation: *Lumerical* FDTD, COMSOL, Zemax
  - Mask Layout Design: *Klayout* & Scripting Python (build-in API & gdspy)
  - Engineering Drawing: SolidWorks & 3D Printing, Altium Designer
  - Data Analysis: Origin
- Programming Languages: C/C++, Python, MATLAB, Mathematica, MySQL, Website Design
- Programming Framework: PyTorch (Basic Neural Network Architecture & Reinforcement Learning Architecture)

## Selected Honors and Rewards

- **Chu Kochen Scholarship (ZJU Highest Grade Scholarship, 12 among 18000 students a year)** 2023.10
- **National Scholarship – highest honor for undergraduates in China (top 1%)** 2023.10 & 2022.10
- **College Star of Chu Kochen Honor College in 2023 (10/~2000)** 2023.11
- **College Star of Optical Science and Engineering in 2022 (10/~950)** 2022.10
- **Excellence Scholarship (sponsored by Chu Kochen Honors College, Top 1%)** 2022.10
- **Gold Medal in the 9-th International "Internet+" Innovation Entrepreneurship Competition** 2022.08
- **Second Prize of National University Students' Opt-Sci-Tech Competition** 2022.07
- **Second Prize in Zhejiang University Intelligent Robot Creativity Competition** 2022.03