

## Education

### Chu Kochen Honors College, Zhejiang University

*B.E.(Eng.) in Opto-Electronics Information Science and Engineering*

Zhejiang, China

*Sept 2020 - Present*

- **GPA:** 3.96/4.00, 90.6/100    **Ranking:** 1/101
- **Core Scores:** Photonics (4.0), Physical Optics (4.0), Signals and Systems (4.0), Integrated Photonics Devices and Design (4.0), Quantum Information Fundamentals (4.0), Applied Optics (4.0), Object Oriented Programming (4.0)

### Laboratory of Photonic Integrated Circuits and Quantum Measurements, EPFL

*Full-time Exchange Researcher in Prof. Tobis.J.Kippenberg's Group*

Lausanne, Switzerland

*July 2023 - December 2023*

## Research Interest

My research interest surrounds **photonics device design** and **optical mechanics**, with a focus on **inverse design methodologies**, **optical frequency combs**, and **electrical-optical-mechanical interactions**.

## Publication

- [1] **Y. Zhao**, J. Guo, G. Yang, ..., & 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](https://doi.org/10.1364/OL.501554). (**1<sup>st</sup> Author**)
- [2] **Y. Zhao**, J. Guo, L. Yu, ..., & D. Dai (2023, July). "Compact and Low Loss silicon-integrated polarization beam splitter developed by efficient semi-inverse design approach", In *2023 Opto-Electronics and Communications Conference (OECC)* (pp. 1-3), IEEE, (2023), doi: [10.1109/OECC56963.2023.10209791](https://doi.org/10.1109/OECC56963.2023.10209791). (**1<sup>st</sup> Author**)
- [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](https://doi.org/10.1117/1.APN.2.2.026005). (4<sup>th</sup> Author)
- [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", in *Journal of Lightwave Technology*, (2023), doi: [10.1109/JLT.2023.3315214](https://doi.org/10.1109/JLT.2023.3315214). (5<sup>th</sup> Author)
- [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", submitted to *Optics Express*, Oct. 2023. (5<sup>th</sup> Author)

## Research Experience

### Integrated Photonic Device Design | Zhejiang University

*Advisor: Prof. Daoxin Dai, Vice Dean of the College of Optical Science and Engineering*

Zhejiang, China

*Sept 2021 - Present*

#### Project I: Development and application of the inverse design to spectrally selective waveguides

- Designed and compared two high-performance dichroic filters of Y-Branch structure with and without sub-wavelength gratings (SWGs) using a high-efficiency semi-inverse design method.
- Improved performance by using flap-top (ELs < 0.5 dB, CTs < 10 dB, 1dB Bandwidth > 25 nm), small footprint ( $2.5 \times 22 \text{ } \mu\text{m}^2$ ), and well-scalable dichroic-filters (60nm channel space) with at least 2-fold footprint.
- Developed a triplexer (1310/1490/1550 nm) with a compact footprint of  $10.5 \times 117 \text{ } \mu\text{m}^2$  based on the dichroic filters, which had both a decent overall performance and compactness with at least 15-fold footprint and better overall performance.
- Proposed some methods such as adjusting device geometry definition and loss function definition to accelerate the implementation processes and achieve 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 which performed well.
- Realized a compact ( $1.6 \times 4.9 \text{ } \mu\text{m}^2$ ) and low loss (ELs < 0.61dB, ERs > 13.8 dB) silicon-integrated polarization beam splitter.
- Designed and developed *Klayout*-based optical mask layout software by scripting in a *Python* API.

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## Photonic Integrated Circuits Design | EPFL

Advisor: Prof. **Tobis J. Kippenberg**, Full Professor, LPQM

Lausanne, Switzerland

July 2023 - December 2023

### Project I: Large Tolerance WDM devices design and tolerance analysis

- Simulated the directional couplers, tapered couplers and corresponding WDM (70nm 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 photo-lithographic processes of various thicknesses (200/400/700/800 nm) and different channel spacings (980/1550 nm and 1480/1550 nm).
- Integrated the WDM devices into the first Erbium-Doped Waveguide Amplifier (EDFA) and Erbium-Doped Waveguide Laser (EDWL) device.
- Working on designing the first Erbium-Doped Waveguide Laser (EDWL) device.

### Project II: Simulation and Measuring the Brillouin Scattering in LNOI platform

- Simulated fully anisotropic including the moving boundary, photo-elastic, and piezo-electric effects for the Brillouin interaction with *COMSOL*.
- Designed and fabricated special lithium niobate waveguide structures for the experiments to validate the simulation results.
- Designed and built the “double modulators” setup to measure the Brillouin gain.

## Skills

- Engineering Applications:
  - Optical Simulation: *Lumerical* FDTD, *COMSOL*, *ZEMAX*
  - Mask Layout Design: *Klayout* & Scripting API Python (build-in & *gdsapy*)
  - Engineering Drawing: *Altium Designer*, *SolidWorks*
- Programming Languages: C/C++, Python, MATLAB, Mathematica, MYSQL, LaTeX
- Programming Frame: PyTorch, Neural Network & Reinforcement Learning Architecture
- Operating System: Linux (Ubuntu), Windows Server, MacOS
- Language Skills: Mandarin (native), English

## Selected Honors and Rewards

- Chu Kochen Scholarship (Zhejiang University Highest Grade Scholarship, 12 among all students) 2023.10
- National Scholarship – highest honor for undergraduates in China, awarded to top 1% 2023.10 & 2022.10
- College Star of Optical Science and Engineering in 2022 (10/950) 2022.10
- Pilot 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 in the Eastern Region of National University Students’ Opt-Sci-Tech Competition 2022.07
- Second Prize in Zhejiang University Intelligent Robot Creativity Competition 2022.03

## Standardized Tests

TOEFL iBT 106/120 Reading: 29 Listening: 26 Speaking: 24 Writing: 27