Qingjun Wang, PhD

Display Photonics Scientist, Meta
Redmond, WA | 5106930686 | qingjun.career@gmail.com

EDUCATION

University of California, Berkeley **08/2017-12/2022**
Ph.D. Photonics &optics Focus **Berkeley, CA**
Research Focus: Integrating the orbital angular momentum of light (OAM, also known as optical vortices) into nano-photonics systems and exploring the underlying principles of spin-orbit interaction within these systems.

Hunan University **09/2013-06/2017**
Bachelor of Engineering in **Electronic Science and Technology**, GPA**: rank #1 out of 112** **Hunan, China**
Awards: Baogang Scholarship (top 0.5%, 2016); National Scholarship (top 1%, 2016); National Scholarship (top 1%, 2015); National Students Innovation Project Funding (top 2%, 2015)

SKILLS AND INTERESTS

An educational background spanning nano-photonics and optics (8 years), electrical engineering (4 years), and material science (5 years), showcasing a strong commitment to cross-disciplinary collaboration and a fervent drive for innovation.

- **Nano-photonics and optics:**
  - Photonics simulation: Lumerical, COMSOL, Tidy3D
  - Ray tracing: Zemax
  - Experimen/metrology: Design and build photonics/optical test and metrology setup
- **Electrical Engineering:** Simulation: Verilog, SPICE
- **Nanofabrication:**
  - Cleanroom experience: EBL, photolithography, RIE, TCP-etching, PECVD, sputtering, E-beam evaporator, wire bonding, SEM, AFM
- **Programming:** Python, MATLAB, Mathematica, C
- **Mechanical Engineering:** AutoCAD, SolidWorks, 3D printing
- **Leadership and teamwork experience**: President of CGPSA (Chinese Graduate and Postdoctoral Scholars Association at UC Berkeley); Executive Board member in Hunan University Student Union

WORK EXPERIENCE

Meta **01/2024-**
Display Photonics Scientist (Contract through Magnit), supervised by Giuseppe Calafiore **Redmond, WA**
Focused on Photonics Integrated Circuit (PIC)-based LCOS displays for AR headsets

1. Speckle Reduction in Laser-Based Displays:
   - Conducted extensive research and authored a report on the design space for speckle problems including learnings from over 10 different design and for 20 degrees of freedom.
   - Successfully demonstrated a speckle-free display at the Spring 2024 Symposium.
2. Photonics and Optics Design and simulation:
   - Introduced innovative ideas and led the development of an optical cavity based de-speckle design, resulting in the filing of a patent.
   - Developed Lumerical-Python code pipeline for simulating photonics components (for example, CWM), enhancing design efficiency
   - Conducted Zemax simulations to assess and optimize the performance of optical imaging systems.
3. Display and AR Waveguide Metrology:
   - Authored Design of Experiments (DOE) and developed automated testing and image analysis pipelines (>3000 lines of code) using Python, improving process accuracy and speed.
4. Cross-Functional Collaboration:
   - Worked collaboratively with Mechanical Engineering, Electrical Engineering, and Optics teams to construct display demos, de-speckle prototypes, and perception study setups, facilitating interdisciplinary integration and prototype development.

PsiQuantum (a start-up building the first utility-scale photonic quantum computer) **01/2023-12/2023**
R&D Photonics Engineer (Full-time) **Palo Alto, CA**

1. Engaged in research dedicated to find a solution for precise phase control in densely fiber-connected quantum computing photonic chips. While conducting closed-loop analysis, I recognized a significant coupling between phase and polarization within fibers during active control. This leads to my design of a simultaneous phase and polarization control for a low-loss high-stability fiber connections module.
    - Delivered a closed loop control system for fiber polarization/phase compensation via interference/IQ measurement using fiber-based MZI
    - Built a digital twin of the fiber IQ phase measurement and analyze its reliable working condition
    - Performed a fundamental study on fiber phase instability w.r.t. environmental changes
    - Investigated different fiber phase compensation methods, such as piezo-fiber stretcher, thermal fiber stretcher, etc.
    - **Work results in two patents**
2. Photonic integrated circuits (PIC) design
    - Designed polarization splitter and rotator (PSR) for polarization recycling
    - Designed etch-trench between waveguides to mitigate crosstalk in long delay line
    - Designed wavelength demultiplexing (WDM)
    - Designed star crossing
    - Designed bendings
    - Design encoding/decoding subsystem
    - **Work results in one patent**
3. PIC encoding/decoding subsystem design and metrology
    - Design and tape-out a chip-to-chip encoding/decoding IO system using photonics interposer stack
    - Participate in bringing up the automatic test setup for the chip-to-chip encoding/decoding IO system

Apple | Exploratory design group **05/2022-08/2022**
Research Scientist (Intern), supervised by Yongming Tu **Cupertino, CA**

1. Thermal effect on PIN diode phase shifter array in photonic integrated circuits (PIC)
    - Worked on PIN diode phase shifter array, which functions as a laser de-speckling component to achieve uniform laser illumination for bio-sensing
    - During closed loop analysis, I identified the thermal phase noise as the root cause of phase errors in the phase shifter array and proposed a design principle to mitigate it
    - This new finding was included in the next design and tape-out

2. Modular test setup for PIN diode phase shifter array in photonic integrated circuits (PIC)
    - Designed and brought up an automated free space test setup which can be easily assembled and dis-assembled, including:
        1. A SWIR interferometer to characterize the phase shifter array: phase vs. voltage
        2. An automated spatial filtering system for groups of facet output selection
        3. A SWIR optical microscope
    - The setup is fully automated, and each die can be measured and analyzed under 5 min

3. Stray light mitigation in photonic integrated circuits (PIC)
    - During closed loop analysis, we identified the root cause of spectral beating to be on-chip stray light (waveguide leakage and crosstalk)
    - Carried out experiments measuring the on-chip crosstalk to understand the stray light phenomenon
    - Simulated and ruled out the laser-to-chip coupler as the source of stray light generator
    - Down-select a mode-conversion component called strip-to-rib waveguide convertor as the stray light generator and simulated the power upper bound of high order mode from the laser-to-chip coupler
    - Redesigned the strip-to-rib waveguide convertor to mitigate stray light
    - Proposed a roadmap of the systematical investigation on stray light
    - The results helped the team understand the origins of stray light and provided guidance to mitigate stray light in the next tape-out

University of California, Berkeley **08/2017- 12/2022**
Graduate student researcher, supervised by Prof. Jie Yao **Berkeley, CA**

1. **Pseudospin and local Berry curvature mediated spin-orbital angular momentum conversion in a photonic crystal.**

- Proposed spin-orbital angular momentum conversion mechanism in hexagonal photonic crystal, **project leader**.
- Designed and optimized the photonic crystal using COMSOL eigenfrequency domain and frequency domain. Achieved the photonic crystal device working around 1.55-micrometer wavelength on a silicon-on-sapphire platform.
- Variability analysis: analyzed influence of fabrication errors on the performance.
- Nanofabricated the sample using EBL and TCP-etching to achieve a sample with +- 3% size error.
- Built optical setup to perform band structure measurement (OSA) and circular dichroism measurement. Designed the NSOM (near-field optical measurement) characterization optical setup to measure eigenmode field profile.
- Verified the spin-orbital angular momentum conversion mechanism. Achieved an optical chiral device with periodic orbital angular momentum generation.
- **Manuscript in preparation:** Qingjun Wang, Li Lei, Rui Chen, Kaichen Dong, Danqing Wang, Xiaosheng Zhang, Jiazhen Chen, Zhaoyu Nie, Tiancheng Zhang, Ming Wu, Junqiao Wu, Jie Yao. Berry curvature mediated spin-orbit interaction in honeycomb photonic crystal.

2. **Orbital angular momentum (OAM) from self-assembled concentric nanoparticle rings**
   - Proposed OAM generation from self-assembled concentric nanoparticle rings.
   - Modeled the system of self-assembled Au nanoparticle and PS-P4VP block-copolymer using effective medium theory. Verified the generation of OAM using COMSOL simulation.
   - Experimentally validated the generation of OAM.
   - **Co-first author,** Published by ***Advanced Materials*.**
   - **Patent:** Self-Assembled Concentric Nanoparticle Rings for Fabrication of Optical Nanodevices, Lithography 2022-079

3. **Surface acoustic wave mediated self-assembled nanoparticle-block-copolymer system**
   - Proposed the surface acoustic wave-driven self-assembled nanoparticle-block-copolymer system, **project leader**.
   - Simulated the interdigital transducer (IDT) device generating surface acoustic wave using COMSOL fluid domain solver.
   - Nanofabricated the IDT sample using PECVD, sputtering, and RIE. Designed and fabricated the microfluid system as the container for the nanoparticle-block-copolymer liquid.
   - Designed the 50 ohm RF electrical packaging and experimental setup at 300 MHz RF frequency.
   - Experimentally validated the localization and microstructure formation of nanoparticle-block-copolymer under the surface acoustic wave and characterized the experimental results using AFM.
   - **Manuscript in preparation:** Qingjun Wang, Le Ma, Emma Vargo, Alexander Brumberg, Li Lei, Rui Wu, Kaichen Dong, Rui Chen, Jian Zhu, Wenyu Zhao, Xiaoxi Huang, Qianyi Xie, David Collins, Ting Xu, Jie Yao. Optical grating from surface acoustic wave guided self-assembled polymer structure.
4. **Exploring spin-orbit interaction in a twisted nanowire**
   - Proposed twisted nanowire as a new OAM generation platform, **project leader**.
   - Optimized the nanowire parameters to analyze the mode coupling using Lumerical MODE.
   - In progress, project transferred to junior students.

5. **OAM interaction with the excitons in transition metal dichalcogenide monolayers (TMDC) and Cu2O system**
   - Proposed OAM interacting with TMDC material to change the valley selection rule, **project leader**.
   - Built and achieved the photoluminescence, Raman, valley selection rule optical setup and performed the measurements.
   - Calibrate the phase vs. voltage relation for the HOLOEYE spatial light modulator (SLM, liquid crystal phase modulator).
   - Designed an optical plasmonic device for further experiments.
   - In progress, project transferred to junior students.

Hunan University **06/2015 - 06/2017**
Undergraduate student researcher, supervised by Chujun Zhao **Hunan, China**

Vectorial fiber laser's characteristics based on micro-structured optical elements

- Designed a vectorial fiber laser with metasurface as P-B phase optical elements.
- Used Polarizer rotating method to test polarization purity of the output radially and azimuthally polarized beams

- Generated fiber laser with metasurface (P-B phase optical elements) in the cavity to produce switchable radially and azimuthally polarized beams; attained the highest efficiency reported to date among switchable vectorial fiber lasers at 1 μm wavelength. **(**Published by ***Optics Express*****)**

PUBLICATION&PATENT

- Vargo, Emma*, Katherine M. Evans*, **Qingjun Wang***, Andrew Sattler, Yiwen Qian, Jie Yao, and Ting Xu. "Orbital Angular Momentum from Self-Assembled Concentric Nanoparticle Rings." ***Advanced Materials*** 33, no. 40 (2021): 2103563. **(* Co-First Author)**
- **Qingjun Wang**, Li Lei, Rui Chen, Kaichen Dong, Danqing Wang, Xiaosheng Zhang, Jiazhen Chen, Zhaoyu Nie, Tiancheng Zhang, Ming Wu, Junqiao Wu, Jie Yao. "Berry curvature mediated spin-orbit interaction in honeycomb photonic crystal". A manuscript is currently in preparation, and my PhD thesis is available upon request for additional information.
- **Qingjun Wang**, Le Ma, Emma Vargo, Alexander Brumberg, Li Lei, Rui Wu, Kaichen Dong, Rui Chen, Jian Zhu, Wenyu Zhao, Xiaoxi Huang, Qianyi Xie, David Collins, Ting Xu, Jie Yao. "Optical grating from surface acoustic wave guided self-assembled polymer structure"**.** A manuscript is currently in preparation, and my PhD thesis is available upon request for additional information.
- Dong, Kaichen, Tiancheng Zhang, Jiachen Li, **Qingjun Wang**, Fuyi Yang, Yoonsoo Rho, Danqing Wang, Costas P. Grigoropoulos, Junqiao Wu, and Jie Yao. "Flat Bands in Magic-Angle Bilayer Photonic Crystals at Small Twists." ***Physical Review Letters*** 126, no. 22 (2021): 223601.
- Tang, Kechao, Kaichen Dong, Jiachen Li, Madeleine P. Gordon, Finnegan G. Reichertz, Hyungjin Kim, Yoonsoo Rho, **Qingjun Wang** et al. "Temperature-adaptive radiative coating for all-season household thermal regulation." ***Science*** 374, no. 6574 (2021): 1504-1509.
- Peiyao Zhang, Ting-Fung Chung, Quanwei Li, Siqi Wang, **Qingjun Wang**, Warren L. B. Huey, Sui Yang, Joshua E. Goldberger, Jie Yao, Xiang Zhang. "All-optical switching of magnetization in atomically thin CrI3", ***Nature Materials***, in press (2022)
- Huang, Bin, **Qingjun Wang**, Guobao Jiang, Jun Yi, Pinghua Tang, Jun Liu, Chujun Zhao, Hailu Luo, and Shuangchun Wen. "Wavelength-locked vectorial fiber laser manipulated by Pancharatnam-Berry phase." ***Optics Express*** 25, no. 1 (2017): 30-38
- Manuscript in preparation: **Qingjun Wang**, Li Lei, Rui Chen, Kaichen Dong, Danqing Wang, Xiaosheng Zhang, Jiazhen Chen, Zhaoyu Nie, Tiancheng Zhang, Ming Wu, Junqiao Wu, Jie Yao. Berry curvature mediated spin-orbit interaction in honeycomb photonic crystal.
- Manuscript in preparation: **Qingjun Wang**, Le Ma, Emma Vargo, Alexander Brumberg, Li Lei, Rui Wu, Kaichen Dong, Rui Chen, Jian Zhu, Wenyu Zhao, Xiaoxi Huang, Qianyi Xie, David Collins, Ting Xu, Jie Yao. Optical grating from surface acoustic wave guided self-assembled polymer structure.
- US Patent App. 18/234,246 Ting Xu, Jie Yao, Katherine Evans, **Qingjun Wang**, Emma Vargo. "Self-assembled concentric nanoparticle rings to generate orbital angular momentum"
- Patent pending (lead): Simultaneous Phase and Polarization Control for a Low-Loss High-Stability Fiber Connections Module (PsiQuantum)
- Patent pending: Large-Scale Precise Temperature Control System for Fiber Optical Stability. (PsiQuantum)
- Patent pending: Micromachined MEMS isolation for quantum computer facility power reduction (PsiQuantum)
- Patent pending(lead): Optical Cavity Design for Laser-Based Display Despeckling (Meta)