

Address: 1 Cyclotron Rd, Berkeley, CA, 94720
Email: boyu.zhang@berkeley.edu
Mobile: 530-360-8332

Boyu Zhang

EDUCATIONAL BACKGROUND

University of California, Berkeley Degree: Ph.D. in Mechanical Engineering Major Field: Microelectromechanical Systems (MEMS) Minor Fields: Electrical Engineering, Energy Science and Technology GPA: 3.97/4.0 Relevant Coursework: Dynamics, Feedback Control Systems, Microelectromechanical Systems, Quantum and Optical Systems, Optical Engineering	Berkeley, CA, United States 01/2022 - 12/2026 (Expected)
University of Michigan-Shanghai Jiao Tong University Joint Institute Degree: B.S. in Mechanical Engineering GPA: 3.64/4.0 (Major GPA: 3.73/4.0) Relevant Coursework: Physics, Chemistry, Solid Mechanics, Thermodynamics, Dynamics and Vibration, Design and Manufacturing, Materials, Fluid Mechanics, Heat Transfer, Probabilistic Method	Shanghai, China 09/2017 - 08/2021

PROFESSIONAL EXPERIENCE

Lawrence Berkeley National Laboratory <i>Graduate Student Research Assistant, Energy Technologies & Systems</i> Designed, built, aligned, modeled, and validated advanced optical and laser systems across diverse applications and operating conditions to improve performance, stability, and efficiency.	Berkeley, CA, United States 01/2022 - Present
NIO Inc. <i>Intern, Product Design and Development</i> - Supported autonomous driving development in LiDAR-based optical perception and system architecture. - Collaborated with system engineers to analyze cross-module dependencies and risk factors.	Beijing, China 10/2021 - 12/2021

RESEARCH EXPERIENCE

Plasma Mirror Shaping and Characterization of Reflected Signals <i>Research in Lawrence Berkeley National Laboratory, Advisor: Prof. Vassilia Zorba</i> Background & Objectives: Investigated plasma mirror shaping as a strategy to enhance reflectivity and energy utilization efficiency in plasma-based reflective systems, with a focus on multi-voxel plasma arrays generated by diffractive optical elements (DOEs). Responsibilities: - Designed and conducted experiments using DOE-generated plasma arrays with varying inter-voxel separations and orientations. - Measured reflected CO₂ probe signals, analyzed energy-normalized reflectivity, and performed shadowgraph imaging to characterize plasma expansion dynamics and effective plasma density. Outcomes: Demonstrated that closely spaced plasma arrays enhance reflectivity by ~70% relative to single-plasma configurations, with strong orientation-dependent effects.	01/2025 - Present
Algorithmic Elimination of Undesired Diffractions in SLM Holographic Projection <i>Research in Lawrence Berkeley National Laboratory, Advisor: Prof. Vassilia Zorba</i> Background & Objectives: Developed a purely algorithmic solution to eliminate zeroth-order diffraction (ZOD) and higher-order diffractions (HODs) in pixelated SLM-based holography, aiming to simplify optical setups while improving projection fidelity and energy efficiency. Responsibilities: - Proposed and implemented a modified Gerchberg-Saxton framework incorporating grid-space-varying angular spectrum propagation.	10/2023 - 01/2025

Address: 1 Cyclotron Rd, Berkeley, CA, 94720
Email: boyu.zhang@berkeley.edu
Mobile: 530-360-8332

Boyu Zhang

- Developed full numerical modeling capacity and conducted experimental validation with both CW and high-power femtosecond laser systems.
- **Outcomes:** Achieved simultaneous elimination of ZOD and HODs without post-SLM optics, enabling flexible pattern positioning, reduced background noise, and improved energy utilization. Demonstrated robustness across complex patterns and high-power plasma voxel generation, offering a solution for next-generation holographic and wavefront-shaping systems.

Wavefront Manipulation and Turbulent Effect on Adaptive Optics

08/2022 - 10/2023

- **Background & Objectives:** Investigated how different wavefront shapes influence temporal coherence and adaptive optics (AO) performance in atmospheric turbulence, with the goal of understanding wavefront-dependent stability and coherence effects in dynamic optical systems.
- **Responsibilities:**
 - Performed Shack–Hartmann–based AO experiments under open- and closed-loop control.
 - Quantified turbulence mitigation performance by analyzing correlation coefficients between distorted and reference wavefronts and evaluated coherence time for different Zernike-mode wavefronts.
- **Outcomes:** Demonstrated that AO correction performance and coherence time depend strongly on the reference wavefront shape, revealing wavefront-dependent turbulence resilience. Provided experimental evidence that temporal coherence should be explicitly considered when applying structured or non-planar wavefronts in adaptive optics and free-space optical systems.

Long-distance Propagation of Vortex Laser Beams in Atmospheric Turbulence

01/2022 - 10/2023

- **Background & Objectives:** Investigated robust laser beam propagation under strong atmospheric turbulence, aiming to improve turbulence modeling accuracy and experimentally validate vortex beams (HyGG modes) as turbulence-resilient optical solutions for free-space applications.
- **Responsibilities:**
 - Designed and conducted 100 m turbulence-propagation experiments (>250,000 frames).
 - Developed wave-propagation simulations with multiple PSD models in MATLAB.
 - Performed quantitative analysis of multiple metrics assessing beam quality with CCD camera-based beam profiler.
- **Outcomes:** Demonstrated that refined PSD selection reduces turbulence prediction error by up to **79.8%** and experimentally proved that HyGG vortex beams withstand turbulence over **5× stronger** than Gaussian beams while maintaining stable intensity and beam structure.

PUBLICATIONS

-
- **Zhang, B.**, Kim, C., Li, W., Chirinos, J., Mao, X., Harrison, R. and Zorba, V., 2026. Towards robust laser beam propagation in atmospheric turbulence. *Photonics Research*, 14(7), pp.3245-3267. **(Research Highlight)**
 - **Zhang, B.**, Wang, Y., Fang, Y., Wang, Y. and Feng, M., 2026. Toward noninvasive tumor removal through optical clearing and real-time guided femtosecond laser ablation. *Cell Reports Physical Science*, 7(4). **(Cover Article)**
 - **Zhang, B.**, Meehan, K., Kim, C., Chirinos, J., Mao, X. and Zorba, V., 2026, March. Simultaneous elimination of zeroth-order and higher-order diffractions in holographic projection with improved energy efficiency and flexibility. In *Laser Resonators, Microresonators, and Beam Control XXVIII* (p. PC138790H). SPIE.
 - Meehan, K.C., **Zhang, B.**, Chirinos, J., Mao, X. and Zorba, V., 2026, March. Free space laser plasmas as

Address: 1 Cyclotron Rd, Berkeley, CA, 94720
Email: boyu.zhang@berkeley.edu
Mobile: 530-360-8332

Boyu Zhang

scattering and reflection elements for standoff IR spectroscopy. In *Frontiers in Ultrafast Optics: Biomedical, Scientific, and Industrial Applications XXVI* (p. PC138830D). SPIE.

- Kim, C., **Zhang, B.**, Mao, X., Chirinos, J. and Zorba, V., 2026, March. Spatiotemporal control in femtosecond filament assisted remote sensing under atmospheric turbulence. In *Frontiers in Ultrafast Optics: Biomedical, Scientific, and Industrial Applications XXVI* (p. PC138830L). SPIE.
- **Zhang, B.**, Kim, C., Chirinos, J., Mao, X. and Zorba, V., 2025, March. Temporal coherence affected by wavefront manipulation with Zernike polynomials in adaptive optics. In *Free-Space Laser Communications XXXVII* (Vol. 13355, p. 1335520). SPIE.
- Meehan, K.C., **Zhang, B.**, Chirinos, J., Mao, X. and Zorba, V., 2025, March. Reflection and backscattering of IR light from free space laser plasmas in air. In *Real-time Measurements, Rogue Phenomena, and Single-Shot Applications X* (p. PC133480E). SPIE.
- Kim, C., **Zhang, B.**, Chirinos, J., Mao, X. and Zorba, V., 2025, March. Investigating the application of adaptive optics in femtosecond filament-assisted remote sensing under atmospheric turbulence. In *Frontiers in Ultrafast Optics: Biomedical, Scientific, and Industrial Applications XXV* (p. PC1335307). SPIE.
- **Zhang, B.**, Li, W., Chirinos, J., Mao, X., Kim, C., Alvidrez, Z. and Zorba, V., 2024, March. Long range propagation of optical vortex beams in atmospheric turbulence. In *Free-Space Laser Communications XXXVI* (Vol. 12877, pp. 477-485). SPIE.
- Kim, C., Chirinos, J., Mao, X., **Zhang, B.** and Zorba, V., 2024, March. Femtosecond filament-matter interactions under atmospheric turbulence. In *Frontiers in Ultrafast Optics: Biomedical, Scientific, and Industrial Applications XXIV* (p. PC1287508). SPIE.

HONORS & AWARDS

- | | |
|---|-------------|
| ▪ 2020 Outstanding TA Award (top award for teaching assistants) | 06/2021 |
| ▪ Excellent Graduate of Shanghai (top graduate honor) | 05/2021 |
| ▪ John Wu & Jane Sun Excellence Scholarship (for top 2% of students) | 2017 - 2021 |
| ▪ SJTU Outstanding Scholarship (for top 10% of students) | 2018 - 2021 |
| ▪ SJTU Progress Scholarship | 2019 |
| ▪ Bronze medal in the University Physics Competition | 11/2018 |
| ▪ Third prize in the Chinese Mathematics Competition | 10/2018 |
| ▪ Third place in the SJTU Mechanical Innovation Competition | 05/2018 |

TECHNICAL SKILLS

- **Optical Systems & Testing:** Optical system design and assembly, optical alignment, diffractive and Fourier optics, wavefront shaping and control, non-linear optics, laser-matter interaction, optical testing and characterization
- **Optical Hardware:** CW & pulsed lasers, SLMs, DOEs, AO systems, CCD/CMOS cameras, photodiodes, power meters, wavefront sensors, beam-delivery optics, optoelectronic & optomechanical components
- **Modeling & Data Analysis:** FDTD methods, atmospheric and nonlinear optical propagation modeling, adaptive-grid numerical simulation, automated image & signal processing
- **Programming & Engineering Software:** MATLAB, Python, SolidWorks, AutoCAD, LabVIEW, Zemax