Beicheng **Lou**

PhD · Applied Physics, Statistics

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Education

Stanford University

PhD in Applied Physics, minor in Statistics — *Sept 2018 - Dec 2024*

National University of Singapore

Bachelor in engineering science, and physics, minor in computer science — *Sept 2015 - Jun 2018*

University of Toronto

Exchange in engineering science program — *Jan 2017 - May 2017*

Professional Experience

Jump Operations, Researcher — *Sept 2024 - Present*

Next-generation pipeline for training, evaluation and data (RL, LLM, agents, self-improvement)

Nvidia Research, Research Scientist — *Jun 2024 - Sept 2024*

Inverse design for tackling bandwidth bottleneck in next-generation platforms

Jump Operations, Quantitative Researcher — *Jun 2023 - Aug 2023*

Scalable alpha research in high-frequency and mid-frequency problems

Citadel, Quantitative Researcher — *Jun 2022 - Aug 2022*

Exotic modeling in mid-frequency problems

Research Experience

Stanford University - Dept of Applied Physics — *Stanford, CA*

Advisor: Prof. Shanhui Fan — *Jan 2019 - Jun 2024*

- Software-hardware co-design for numerical simulation and information processing
- Develop theory and computational method for exotic structures

Stanford University - Dept of Material Sciences — *Stanford, CA*

Advisor: Prof. Thomas Devereaux — *Sept 2018 - Dec 2018*

- Simulate quantum systems in large scale with advanced computational techniques

National University of Singapore - Center for Quantum Technology — *Singapore*

Advisor: Prof. Dzmitry Matsukevich, Prof. Benoît Grémaud — *May 2017 - Aug 2018*

- Build an ion-trap-based quantum computer and automate scalable experiment platform with system-on-chip

National University of Singapore - Dept of Mathematics — *Singapore*

Advisor: Prof. Tan Ser Peow — *Jan 2016 - Jan 2017*

- Answered the open problem of whether there are infinitely many pseudomodular groups (in short, **"Yes!"**), with main results published on *Geometry Topology* and a sequel on *International Mathematics Research Notices*

Publications

Journal

Haoning Tang*, **Beicheng Lou***, Fan Du, Guangqi Gao, Mingjie Zhang, Xueqi Ni, Evelyn Hu, Amir Yacoby, Yuan Cao, Shanhui Fan, and Eric Mazur. An adaptive moiré sensor for spectro-polarimetric hyperimaging. *Nature Photonics*, 19(5):463–470, May 2025

Beicheng Lou and Shanhui Fan. Rcwa4d: Electromagnetic solver for layered structures with incommensurate periodicities. *Computer Physics Communications*, 306:109356, 2025

Beicheng Lou, Haoning Tang, Fan Du, Guangqi Gao, Eric Mazur, and Shanhui Fan. Free-space beam steering with twisted bilayer photonic crystal slabs. *ACS Photonics*, 11(9):3636–3643, 2024

Xueqi Ni, Yuan Liu, Beicheng Lou, Mingjie Zhang, Evelyn L. Hu, Shanhui Fan, Eric Mazur, and Haoning Tang. Three-Dimensional Reconfigurable Optical Singularities in Bilayer Photonic Crystals. *Phys. Rev. Lett.*, 132: 073804, Feb 2024

Haoning Tang*, **Beicheng Lou***, Fan Du, Guangqi Gao, Mingjie Zhang, Xueqi Ni, Evelyn Hu, Amir Yacoby, Yuan Cao ans Shanhui Fan, and Eric Mazur. On-Chip Multidimensional Dynamic Control of Twisted Moiré Photonic Crystal for Smart Sensing and Imaging. *arXiv:2312.09089*, 2023a

Haoning Tang*, **Beicheng Lou***, Fan Du, Mingjie Zhang, Xueqi Ni, Weijie Xu, Rebekah Jin, Shanhui Fan, and Eric Mazur. Experimental probe of twist angle–dependent band structure of on-chip optical bilayer photonic crystal. *Science Advances*, 9(28):eadh8498, 2023b

Beicheng Lou, Jesse Alexander Rodriguez, Benjamin Wang, Mark Cappelli, and Shanhui Fan. Inverse design of optical switch based on bilevel optimization inspired by meta-learning. *ACS Photonics*, 10(6):1806–1812, 2023

Beicheng Lou, Benjamin Wang, Jesse A Rodríguez, Mark Cappelli, and Shanhui Fan. Tunable guided resonance in twisted bilayer photonic crystal. *Science Advances*, 8(48):eadd4339, 2022

Beicheng Lou and Shanhui Fan. Tunable frequency filter based on twisted bilayer photonic crystal slabs. *ACS Photonics*, 9(3):800–805, 2022

Jesse A Rodríguez, Ahmed I Abdalla, Benjamin Wang, **Beicheng Lou**, Shanhui Fan, and Mark A Cappelli. Inverse design of plasma metamaterial devices for optical computing. *Physical Review Applied*, 16(1):014023, 2021

Cheng Guo, Yu Guo, **Beicheng Lou**, and Shanhui Fan. Wide wavelength-tunable narrow-band thermal radiation from moiré patterns. *Applied Physics Letters*, 118(13):131111, 2021

Beicheng Lou, Nathan Zhao, Momchil Minkov, Cheng Guo, Meir Orenstein, and Shanhui Fan. Theory for twisted bilayer photonic crystal slabs. *Phys. Rev. Lett.*, 126:136101, 2021b

Beicheng Lou, Ser Peow Tan, and Anh Duc Vo. Hyperbolic Jigsaws and Families of Pseudomodular Groups II. *International Mathematics Research Notices*, 2022(21):16524–16568, 2021a

Momchil Minkov, Ian A. D. Williamson, Lucio C. Andreani, Dario Gerace, **Beicheng Lou**, Alex Y. Song, Tyler W. Hughes, and Shanhui Fan. Inverse design of photonic crystals through automatic differentiation. *ACS Photonics*, 7(7):1729–1741, 2020

Beicheng Lou, Ser Tan, and Anh Duc Vo. Hyperbolic jigsaws and families of pseudomodular groups, i. *Geometry & Topology*, 22(4):2339–2366, 2018

Conference paper & Others

Chih-Jung Tracy Chang, Yuan Gao, and **Beicheng Lou**. Wormhole maml: Meta-learning in glued parameter space. *arXiv preprint arXiv:2212.14094*, 2022

Oliver Johnson, **Beicheng Lou**, Janet Zhong, and Andrey Kurenkov. Saved you a click: Automatically answering clickbait titles. *arXiv preprint arXiv:2212.08196*, 2022

Beicheng Lou, Nathan Zhao, and Jiahui Wang. Meta-learning from sparse recovery. In *Fifth Workshop on Meta-Learning at the Conference on Neural Information Processing Systems*, 2021c

Weiquan Mao, **Beicheng Lou**, and Jiyao Yuan. Tunagan: interpretable gan for smart editing. *arXiv preprint arXiv:1908.06163*, 2019

Presentations

May 2023. *Inverse design of optical switch with meta-learning*. CLEO.

Mar 2023. *Architecture Optimization with GNN*. Medium.

May 2022. *Tunable frequency filter based on twisted bilayer photonic crystal slabs*. CLEO.

Dec 2021. *Meta-learing from sparse recovery*. NeurIPS 2021 Workshop Meta-Learning.

Nov 2021. *Theory for twisted bilayer photonic crystal slabs*. FiO LS.

Awards & Grants

2018 **Lee Kuan Yew Gold Medal**, Presidential Office, Singapore
IES Gold Medal, NUS
NUSS Medal for Outstanding Achievement, NUS
ST Engineering Prize for Global Engineering Program, NUS
Best Final Year Research Project Award, NUS

2015-2018 **Dean's List Every Semester**, NUS
Science & Technology Undergraduate Scholarship, NUS
Tuition Grant, Ministry of Education, Singapore

Courses

Computer Science: Large Language Models from Scratch, Reinforcement Learning, System Programming, Probablistic Graphical Models, Natural Language Processing, All The Machine Learning Courses

Statistics: Statistical Inference, Modern Markov Chains, Non-parametric Statistics, Information Theory, Experiment Design, Optimization, Statistical Methods for Neural Network

Teaching Experience

2023 **EE 236B Guided Waves**, Teaching Assistant *Stanford*