

Taigao Ma

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EDUCATION

University of Michigan, Ann Arbor, MI, USA

Aug 2019 – April 2024 (*Expected*)

Ph.D. in Physics

GPA: 4.00/4.00

- **Data Science Certificate Program** (*ongoing*)
- **Advisor:** Prof. L. Jay Guo, ✉: guo@umich.edu
- **Skills:** Machine Learning and deep Learning, Optics and Photonics Simulation and Inverse Design, Neural Network Models Development and Improvement, Data Analysis, Data Mining and Data Visualization, Quantitative Analysis.
- **Simulation Tools:** FDTD, TMM, COMSOL, MEEP, MATLAB
- **Experiment Tools:** PVD, CVD, SEM, Ellipsometer, Lasers

University of Science and Technology of China (USTC), Hefei, China

Aug 2015 – Jun 2019

B.S. in Physics

- Outstanding Graduates.

RESEARCH EXPERIENCE

University of Michigan, Ann Arbor

Machine learning for sustainable optical multilayer thin film design

Jan.2022–Now

- Developed a deep learning algorithm to design optical multi-layer thin film with target spectrum in PyTorch.
- Build up a customized simulative environment integrated with physical simulations for thin film design.
- Designed multilayer thin film for many sustainable applications using machine learning, including environmentally friendly Cr color coatings, solar cells with pleasing colors for building-integration (with 30% energy efficiency improvement), etc.
- Deposited these thin films using PVD tools and demonstrated their performance.

Benchmark multiple deep learning models for nano-photonic inverse design

Sept.2020–Dec.2021

- Built up a benchmark platform to compare deep learning models for nanostructure inverse design, including periodic silicon nanorod metasurfaces and free-from silicon structures.
- Generated and prepared 10K training datasets for neural network training using MATLAB simulations.
- Designed three evaluation metrics, developed data analysis system and data visualization methods for evaluating the performance of three neural networks in two representative photonics inverse design problems.

Dual-comb spectroscopy and numerical calibration in quantum well laser diode

Jul.2018–Sept.2018

- Experimentally characterized the temperature and current tunability of frequency combs in quantum well laser diode in 1550nm wavelength, enabling direct comb generation with two AA batteries.
- Using Digital Difference Frequency Generation to computationally remove the noise in repetition rate and offset change and obtained pure dual-comb spectroscopy through MATLAB.

PUBLICATIONS

- **Taigao Ma**, Haozhu Wang, L. Jay Guo, "Elucidating the general design principle for multilayer metallic color by explaining the results from reinforcement learning". (*in preparation*)
- Anwesha Saha*, **Taigao Ma***, Haozhu Wang, L. Jay Guo, "Environmentally Friendly and Multi-functional Thin Film Coatings to mimic Chrome Designed by Reinforcement Learning". (*co-first author, submitted*)
- Youngbum Park, Sangeon Lee, Mustafa Tobah, **Taigao Ma**, and L. Jay Guo, "Optimize optical/electrical/mechanical properties of ultrathin metal films for flexible transparent conductor applications". (*Under publication, Optical Materials Express*)
- **Taigao Ma**, Mustafa Tobah, Haozhu Wang, and L. Jay Guo. "Benchmarking deep learning-based models on nanophotonic inverse design problems." [Opto-Electronic Science](#) **1**, no. **1** (2022): 210012.
- Day Matthew, Mark Dong, Bradley Smith, Rachel Owen, Grace Kerber, **Taigao Ma**, Herbert Winful, and Steven Cundiff. "Simple single-section diode frequency combs." *APL Photonics* **5**, no. **12** (2020): 121303.
- Niu Rui, Shuai Wan, Shuman Sun, **Taigao Ma**, Haojing Chen, Weiqiang Wang, Zhizhou Lu et al. "Repetition rate tuning of soliton in microrod resonators." *arXiv preprint arXiv:1809.06490* (2018).

TALKS

Physics Graduate Student Symposium

University of Michigan, Ann Arbor

- [Learn to design](#): From optimization to deep learning and reinforcement learning. Jul. 2022
- [Metasurface](#): Manipulating light at the nano scale. Jul. 2021

HONORS&AWARDS

- Rackham Graduate Research Grant (\$3000) 2022
- Cyrus Tang Scholarship (10%) 2015, 2016, 2017, 2018

ADDITIONAL INFORMATION

- **Reviewer:** AIP Advances
- **Graduate Student Instructor:** Physics Lab 241 (Winter 2020, Winter 2021), Physics Lab 141 (Fall 2020)
- **Programming Language:** Python, R, C/C++, MATLAB, Wolfram Mathematica