# Taigao Ma

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## EDUCATION

**University of Michigan, Ann Arbor, MI, USA** 08/2019–04/2024 (*Expected*)

**Ph.D. in Physics** GPA: 4.00/4.00

- **Data Science Certificate Program** *(ongoing)*
- **Advisor**: Prof. L. Jay Guo, :guo@umich.edu
- **Interest:** Generative AI, Foundation Models, Reinforcement learning, AI for Science, Optics and Photonics Simulation and Inverse Design, Data Analysis, Data Mining and Data Visualization, Quantitative Analysis.

**University of Science and Technology of China (USTC), Hefei, China** 08/2015–06/2019

**B.S. in Physics**

- Outstanding Graduates. GPA: 3.81/4.30

## WORK EXPERIENCE

*PhD Intern at Visa Research, Austin*

**Foundation Models for transaction modelling in payment industry** 05/2023-*Now*

- Built up the working pipeline from table-to-text generator and data preprocessing, to model architecture and training.
- Demonstrated a proof of concept foundation model for understanding the transaction data and predicting future transaction states.

## RESEARCH EXPERIENCE

*Graduate Student Research Assistant at University of Michigan, Ann Arbor*

**Foundation Models for simulation and design of photonic structures** 05/2022–*Now*

- Proposed and developed OL-Transformer as a fast surrogate model for photonic simulation with 3800x time improvement.
- Proposed and developed OptoGPT as a foundation model for fast, efficient, flexible inverse design in multilayer thin film structures.
- 2 papers submitted, 1 paper in preparation, 1 patent submitted.

**Reinforcement learning for sequential design of sustainable photonic structures** 06/2021–*Now*

- Developed a deep reinforcement learning algorithm to design optical multilayer thin film in PyTorch.
- Build up a customized environment integrated with physical simulations for thin film design.
- Designed and fabricated multilayer thin film for sustainable applications, including environmentally friendly Cr color coatings, solar cells with pleasing colors for building-integration (with 30% energy efficiency improvement), etc.
- 2 paper published, 2 patent submitted.

**Benchmark multiple deep learning models for nano-photonic inverse design** 01/2020–06/2021

- Built up a benchmark platform to compare deep learning models (tandem networks, GANs, VAEs) for nanostructure inverse design.
- Designed evaluation metrics, developed data analysis system and data visualization methods for evaluating their performance.

## PUBLICATIONS

- **Taigao Ma**, Haozhu Wang, L. Jay Guo, "Elucidating the General Design Principle for Multilayer Thin Film Structures through Explainable Sequential Learning". *(in preparation)*
- **Taigao Ma**, Haozhu Wang, and L. Jay Guo. "OptoGPT: A Foundation Model for Inverse Design in Optical Multilayer Thin Film Structures." arXiv:2304.10294 (2023).
- **Taigao Ma**, Haozhu Wang, and L. Jay Guo. "OL-Transformer: A Fast and Universal Surrogate Simulator for Optical Multilayer Thin Film Structures." arXiv:2305.11984 (2023). *(Accepted by ICML 2023 SynS & ML Workshop)*
- Anwesha Saha*, **Taigao Ma***, Haozhu Wang, L. Jay Guo, " Environmentally Sustainable and Multifunctional Chrome-like Coatings Having No Chromium Designed with Reinforcement Learning". ACS Applied Materials & Interfaces (2023). *(*co-first)*
- 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". Optical Materials Express 13, no. 2 (2023): 304-347.
- **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. 2022
- Metasurface: Manipulating light at the nano scale. 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)