Lida XU

lidaxu66@umd.edu | +1 (240) 564-1841 | Website
ORCID: 0009-0005-3655-7868 | Google Scholar | LinkedIn | Github

Last updated: January 16, 2026

Research Profile

Broadband topological, nonlinear, and integrated photonics. I build **photonic integrated circuits** that harness **topological properties across octave-spanning bandwidths** to create **turnkey, robust nonlinear devices** with wafer-scale reproducibility. My work spans topological frequency combs, on-chip multi-timescale synchronization, broadband artificial gauge fields, and integrated harmonic generation—simultaneously advancing practical device engineering and probing fundamental **topological physics and quantum optics**.

Experience

2020-2021 **Research Assistant**, Sustech (China) – gap year due to COVID. Advisor: Xiuhao Deng.

Education

2021-2026 **Ph.D. Physics**, University of Maryland (USA) — Thesis: *Nonlinear topological photonics with coupled microresonators.*; Advisor: Mohammad Hafezi.

2016-2020 **B.Sc. Physics**, Nanjing University (China) — GPA 91/100 Thesis: *Single photon source characterization for rare-earth-ion doped quantum storage.* Advisor: Xiaosong Ma.

Selected Publications & Preprints (†Equal contribution)

Papers—Published / In press

1. ***Science*** 390 (6773), 612-616 (2025). *Multi-timescale Frequency-Phase Matching for High-Yield Nonlinear Photonics.*
   M. J. Mehrabad†, **L. Xu**†, G. Moille, C. J. Flower, S. Sarkar, A. Padhye, S. C. Ou, D. G. S. Forero, M. Ghafariasl, Y. K. Chembo, K. Srinivasan, M. Hafezi.
   Media: MIT Technology Review China, Phys.org, Optics.org
   Role: Led the experimental demonstration of the nested frequency-phase-matching concept.

2. ***Science Advances*** 11, eadw7696 (2025). *On-chip multi-timescale spatiotemporal optical synchronization.*
   L. Xu†, M. J. Mehrabad†, C. J. Flower†, G. Moille, A. Restelli, D. G. S. Forero, Y. Chembo, S. Mittal, K. Srinivasan, M. Hafezi.
   Role: Led experimental demonstration and theoretical analysis of multi-timescale mode-locking.

3. ***Science Advances*** 11, eadv2023 (2025). *Sub-wavelength optical lattice in 2D materials.*
   S. Sarkar†, M. J. Mehrabad†, D. G. S. Forero†, L. Gu†, C. J. Flower, **L. Xu**, K. Watanabe, T. Taniguchi, S. Park, H. Jang, Y. Zhou, M. Hafezi.
   Media: JQI news
   Role: Contributed to the design of grating couplers based on 3D FDTD simulations.

4. ***Science*** 384 (6702), 1356-1361 (2024). *Observation of topological frequency combs.*
   C. J. Flower†, M. J. Mehrabad†, **L. Xu**†, G. Moille, D. G. S. Forero, O. Örsel, G. Bahl, Y. Chembo, K. Srinivasan, S. Mittal, M. Hafezi.
   Media: Phys.org
   Role: Led tight-binding simulations as well as the massive device search (217 devices).

Papers—Submitted / Under Review

1. *Quantum metamorphosis: Emergence and the breakdown of bulk-edge dichotomy in multiscale systems.*
   M. J. Mehrabad†, A. Parhizkar†, **L. Xu**†, G. Moille, A. Dutt, D. Englund, K. Srinivasan, D. Leykam, M. Hafezi.
   Role: Built up the software framework for quantum metamorphosis as well as nonlinear simulations.

2. *Single-shot octave-spanning realization of 100 artificial gauge fields.*
   L. Xu†, A. Padhye†, S. Sarkar, A. Parhizkar, C. J. Flower, G. Moille, K. Srinivasan, M. Hafez, M. J. Mehrabad.
   Role: Created the theoretical model and led experimental demonstrations of the core concept.

Papers—In preparation

1. *Poling-free multi-timescale integrated nonlinear optics in Lithium Niobate.*
   A. Padhye†, M. J. Mehrabad†, **L. Xu**†, P. Barya†, S. Sarkar, A. Parhizkar, G. Moille, K. Srinivasan, E. Goldschmidth, M. Hafezi.
   Role: Major contribution to the device design and experimental realization.

2. *Theory of nested harmonic generations*
   L. Xu, A. Padhye, S. Sarkar, A. Parhizkar, G. Moille, K. Srinivasan, M. Hafez, M. J. Mehrabad.
   Role: Leading the theoretical modeling and simulations.

Patents (all equal share)

1. *Nested Frequency and Phase Matching.*
   M. J. Mehrabad, **L. Xu**, G. Moille, K. Srinivasan, M. Hafezi. Provisional US Patent (Filed Aug 2025).
2. *Quantum Optical Metamorphosis.*
   M. J. Mehrabad, A. Parhizkar, **L. Xu**, M. Hafezi. US Patent (Filed Aug 2025).
3. *TOPAI: Topological Photonics Architectures for Optical Computing and Artificial Intelligence.*
   M. J. Mehrabad, **L. Xu**, S. Sarkar, Z. Y. Wei, M. Hafezi. Provisional US Patent (Filed Aug 2025).
4. *Systems of ultrabroadband multimodal artificial gauge fields.*
   M. J. Mehrabad, **L. Xu**, S. Sarkar, A. Padhye, M. Hafezi. Provisional US Patent (Filed Dec 2025).

Conferences and Talks

1. The Winter Colloquium on the Physics of Quantum Electronics (PQE) 2026: invited talk
2. Conference on Lasers and Electro-Optics (CLEO) 2024: post-deadline contributed talk
3. Conference on Lasers and Electro-Optics (CLEO) 2025: poster session
4. Joint Quantum Institute (JQI) seminar 2025: invited talk

Teaching & Mentoring

1. JQI/UMD: Teaching Assistant for Experimental Physics I: Mechanics and Heat; prepared experimental equipment and instructed undergraduates on experiments.
2. JQI/UMD: Trained multiple junior graduate students on both theoretical and experimental projects across topological photonics and integrated nonlinear photonics.

Academic service

1. Referee: Nature Photonics, Science Advances, Nature Communications, Physical Review Letters

Research & Technical Skills

Simulation: Lumerical FDTD, Tidy3D
Design: KLayout, GDS factory, nanophotonics design
Lab: Integrated photonics
Programming: Python, MATLAB **Markup:** LaTeX **Graphics:** Inkscape
Languages: English, Chinese

Awards and Honors

Academic

1. Ralph Myers and Friends of Physics Award, Honorable Mention (2021,UMD)
2. School of Physics Elite Program Scholarship (2018 and 2019, Nanjing University)

Non-Academic

Ranked 2nd in the Wuxi city-wide high school football/soccer champions league (2016, China).

References

Prof. Mohammad Hafezi — PhD supervisor
hafezi@umd.edu

Prof. Kartik Srinivasan — PhD co-advisor
kartiks@umd.edu

Prof. Yanne K. Chembo — PhD co-advisor
ykchembo@umd.edu