

Lida XU

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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**.

Education

- 2021.8-2027.5 **Ph.D. Physics (expected)**, University of Maryland (USA) — Thesis: *Nonlinear topological photonics with coupled microresonators.*; Advisor: Mohammad Hafezi.
- 2020.6-2021.8 **Gap year due to COVID**
- 2016.9-2020.6 **B.Sc. Physics**, Nanjing University (China) — GPA 91/100 Thesis: *Single photon source characterization for rare-earth-ion doped quantum storage.* Advisor: Xiaosong Ma.

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: [Phys.org](#), [MIT Technology Review China](#), [Optics.org](#), [SciTechDaily](#)
Role: Led the experimental demonstration of the nested frequency-phase-matching.
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 theoretical simulations as well as the massive device search (217 devices).

Papers—Submitted / Under Review

1. *Single-Shot Realization of 10000-Mode Octave-Spanning Artificial Gauge Fields.*
L. Xu†*, A. Padhye†, S. Sarkar, A. Parhizkar, C. J. Flower, G. Moille, K. Srinivasan, M. Hafezi, M. J. Mehrabad.
(* corresponding author)
Role: Conceived the core idea and created the theoretical model and led experimental demonstrations.
2. *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.

Papers—In preparation

1. *Theory of nested frequency phase matching and harmonic generations.*
L. Xu, A. Padhye, S. Sarkar, A. Parhizkar, G. Moille, K. Srinivasan, M. Hafezi, M. J. Mehrabad.
2. *Poling-free multi-timescale integrated nonlinear optics in Lithium Niobate.*
A. Padhye†, M. J. Mehrabad†, **L. Xu**†, P. Barya†, S. Sarkar,
3. *Reservoir computing with topological photonic arrays.*
P. Dolgirev, **L. Xu**, S. Sarkar, M. J. Mehrabad, M. Hafezi.

Patents

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).
Finalist for UMD's Invention of the Year awards for 2025 (winner to be announced in May 2026).
4. *Systems of ultrabroadband multimodal artificial gauge fields*.
L. Xu, M. J. Mehrabad, S. Sarkar, A. Padhye, M. Hafezi. Provisional US Patent (Filed Dec 2025).

Conferences and Talks

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

Awards and Honors

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| 1. NSF I-Corps™ Teams Award, Entrepreneurial Lead | 2026 |
| 2. UMD Invention of the Year, Finalist | 2026 |
| 3. Ralph Myers and Friends of Physics Award, Honorable Mention | 2021 |
| 4. School of Physics Elite Program Scholarship, Nanjing University | 2018–2019 |
| 5. Wuxi City-Wide High School Soccer League, Silver Medalist | 2016 |

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:** L^AT_EX **Graphics:** Inkscape

Languages: English, Chinese

References

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

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

Prof. Kartik Srinivasan — PhD co-advisor
kartik.srinivasan@nist.gov