Jiazheng Li

Web: jiazheng-li.github.io
E-mail: ljz@whu.edu.cn
ORCID: 0000-0001-7384-2506
Google Scholar: Jia-Zheng Li

EDUCATIONS

Wuhan University (WHU) 9.2021-6.2024(expected)
M.Sc. in Condensed Matter Physics, School of physics
Cumulative GPA: 3.87/4.00

Wuhan University (WHU) 9.2017-6.2021
B.S. in Physics (with highest honor), School of physics, TianJuan Program (an Honor Science Program)
Cumulative GPA: 3.95/4.00

Standardization Examination: TOEFL: 108 (R30+L29+S23+W26)

RESERACH INTEREST

Topological Band Theory and Its Applications, Driven Quantum systems, The Interplay between Nonlinearity and Topology, Non-Hermitian Physics, Emergent Phenomena in Condensed matter

PUBLICATIONS

[1]. **J.-Z. Li** et al., *'Braiding Topology of symmetry-protected degeneracy points in non-Hermitian systems'*, submitted to Phys. Rev. Lett. arxiv:2309.16152 (Sep. 2023)

[2]. C. Guo, **J. Li**, M. Xiao, S. Fan, *'Singular topology of scattering matrices',* Phys. Rev. B 108, 155418 (Oct. 2023) (**Editors' Suggestion**)

[3]. K. Bai, **J.-Z. Li** et al., *'Nonlinear Exceptional Points with a Complete Basis in Dynamics',* Phys. Rev. Lett. 130, 266901 (June 2023)

[4]. **J. Li** and M. Xiao, *'When the orbital degree of freedom meets higher-order topology',* Light: Sci. Appl. 12, 102 (April 2023)

[5]. T.-R. Liu, K. Bai, **J.-Z. Li** et al., *'Spin-dependent gain and loss in photonic quantum spin Hall systems',* Phys. Rev. B 108, L081101 (Aug. 2023)

[6]. K. Bai, T.-R. Liu, L. Fang, **J.-Z. Li** et al., *'Observation of nonlinear exceptional points with a complete basis in dynamics'*, under review at Phys. Rev. Lett. (July 2023)

RESEARCH EXPERIENCE

Graduate Student Researcher in Wuhan University
Advisor: Prof. Meng Xiao 9.2021-Present

Braid Topology of Symmetry-Protected Degeneracy Points in Non-Hermitian Systems [1]

- Delved into the braid topology of symmetry-protected degeneracy points in Non-Hermitian systems utilizing homotopy theory, which led to the development of a framework for classifying these singularities
- Overcame the challenge posed by the reduced codimension of degeneracy points
- Revealed counterintuitive topological phenomena through discovery of path-dependent annihilation of degeneracy points
- Completed the manuscript as first author, which was submitted to Phys. Rev. Lett.

The Interplay between Nonlinearity and Topology

- Characterized the topology of arbitrarily designed nonlinear modes by applying numerical K-theory, revealing the stability of nonlinear zero-modes protected by chiral symmetry
- Completed the manuscript as second author, which will be submitted to Nat. Phys.

The Classification of AIII Class Higher-Order Topological Insulator
Co-*Advisor: Prof. Fengcheng Wu of Wuhan University*

- Propose and realize a strategy to classify the higher order topological phase of general Hamiltonians with chiral symmetry
- Overcame the lack of correspondence between multipole chiral numbers, quadrupole moment and higher order phase

Nonlinear Exceptional Points in Non-Hermitian Systems [3,6]

- Established a theoretical framework of nonlinear Exceptional points with a complete eigenvector basis, fundamentally reducing noise, suggesting promising avenues for sensing applications
- Investigated chiral state transfer of a nonlinear exceptional point in presence of Langevin noise

Higher-order Topological Insulators in Photonic Systems [4]

- Formulated an effective Hamiltonian to describe a 3D photonic system and calculated winding numbers of quadrupole moments
- Explored and characterized the higher-order topology in photonic crystals with crystalline symmetries and its interplay with the orbital degree of freedom

Singular Topology of Scattering Matrices [2]

Co-*Advisor: Dr. Cheng Guo of Stanford University*

- Leveraged Takagi factorization to explore the singular topology of scattering matrices
- Proved that the continuous Takagi factorization proposed by mathematicians aligns with a parallel-transport gauge

Scattering Theory: A Lens to Understand Non-Hermitian Systems

- Studied the scattering theory and boundary Green function of topological insulators
- Proposed a theoretical model, integrating scattering theory and boundary Green functions, to unearth non-Hermitian physics—shedding light on the bulk-boundary correspondence in non-Hermitian contexts

Undergraduate Research Assistant in Wuhan University

Advisor: Prof. Meng Xiao 9.2020-6.2021

Topological Tensor Monopole Using a Synthetic Dimension

- Worked as a research assistant and designed an experimental proposal employing a synthetic dimension to actualize a topological tensor monopole in 4D

Undergraduate Research Assistant in APM of the Chinese Academy of Sciences (CAS)

Advisor: Prof. Mang Feng 3.2019-8.2019

Trapped Ion Systems as an Approach to Explore Quantum Physics

- Played a pivotal role in advancing a trapped ion system, utilizing Pound-Drever-Hall (PDH) techniques to achieve enhanced stabilization of laser light frequency

PROFESSIONAL ACTIVITIES

Refereeing:

Referee reports for *Physical Review Letters*, *eLight*, *Optica letters*, *Advanced Photonics*

Conferences:

- The Conference of Condensed Matter Physics (CCMP), Liyang, China (Aug. 2023)
- The 13th International Conference on Metamaterials, Photonic Crystals and Plasmonics (META2023), Paris, France (July 2023)

Discussions Involved:

M. Kang et al., *'Applications of Bound States in the Continuum in Photonics'*, Nat. Rev. Phys. 5, 11 (Oct. 2023)

Q. Zhou et al., *'Observation of Geometry-Dependent Skin Effect in Non-Hermitian Phononic Crystals with Exceptional Points'*, Nat. Commun. 14, 4569 (July 2023)

SELECTED HONORS

- Wang Lao Ji Scholarship in Wuhan University (1/900)
- Graduation with honor: College Graduate Excellence Award of Wuhan University (top 10%)
- The Scholarship of an honor Program (top 10%)
- The First Prize Scholarship of Wuhan University (top 5%)
- The First Prize Academic Scholarship of Wuhan University (top 10%)

OTHERS

- **I.T:** Mathematica, Python, Julia, Git, LaTeX