

Haixuan Lin

B.S. STUDENT IN PHYSICS

Fudan University, Shanghai, China

+86 15108903132 | 23307110267@m.fudan.edu.cn | <https://haixuan-lin.github.io> | <https://github.com/HaiXuan-Lin>

Education

Fudan University

Shanghai, China

B.S. IN PHYSICS

Sept. 2023 – Expected Jun. 2027

- GPA: 3.78/4.00; Credits: 153
- Major GPA: 3.97/4.00; Credits: 79
- Undergraduate research advisor: Assoc. Prof. ZHANG Hao, Department of Information Science and Engineering
- Selected coursework: Group Theory, Differential Manifold, Solid Physics, Quantum Mechanics I/II, General Relativity

Research Interests

My research interests lie at the intersection of mathematics and physics. I particularly enjoy applying mathematical structures and computational methods to physical problems, drawing also on my experience in computing and information science. My current research focuses on symmetry and representation-theoretic methods in condensed matter physics.

Research Experience

NanoBTE — Accelerated Phonon Boltzmann Transport Solver

Shanghai, China

UNDERGRADUATE RESEARCHER & CO-FIRST AUTHOR; ADVISOR: PROF. HAO ZHANG

2026 – Present

- Co-developed NanoBTE, a deterministic finite-volume solver for steady-state, non-gray phonon transport in complex two- and three-dimensional nanostructures
- Designed and implemented a CuPy/MPI GPU backend with memory-efficient chunking, accelerating phase-space reductions and heat-flux calculations while retaining sparse linear solves on the CPU
- Achieved approximately 6–9× parallel speedup from 1 to 16 MPI ranks and up to 1.7× speedup over matched CPU calculations

spGroup — Electron-Phonon Selection Rules

Shanghai, China

INDEPENDENT RESEARCHER & DEVELOPER

2025 – Present

- Formulated electron-phonon selection rules at general momenta using projective irreducible representations of little cogroups in nonsymmorphic space groups
- Reduced the scattering multiplicity to a finite-group character calculation, yielding the number of independent symmetry-allowed coupling matrix elements
- Implemented an interactive web application that verifies crystal-momentum conservation and automatically identifies symmetry-allowed scattering channels and their multiplicities

spLandau — Symmetry Pathways of Continuous Phase Transitions

Shanghai, China

INDEPENDENT RESEARCHER & DEVELOPER

2025 – Present

- Developed a group-theoretic framework for continuous commensurate phase transitions driven by a single real irreducible representation of the parent space group
- Enumerated symmetry-distinct order-parameter directions and computed their isotropy subgroups to identify candidate symmetry-breaking pathways
- Implemented automated checks of the Landau and Lifshitz criteria and built an interactive web application for exploring the resulting transition pathways

Publications and Preprints

Chen, Hongjiang*, **Lin, Hai-Xuan***, Tian, Xiaole, Chen, Hongyu, Zhang, Juan, Yan, Shengyao, Shao, Hezhu, Wu, Yu, Liu, Junjie, Zhu, Heyuan, and Zhang, Hao. "NanoBTE: Fast Iterative Solution of the Phonon Boltzmann Transport Equation for Nanoscale Heat Transport." *arXiv preprint*, [arXiv:2607.03226](https://arxiv.org/abs/2607.03226) (2026). *Co-first authors

Manuscripts in Preparation

Feng, Yuan, Zhang, Yiming, **Lin, Hai-Xuan**, Zhang, Juan, Song, Yuna, Peng, Lei, Fu, Desheng, Shao, Hezhu, and Zhang, Hao. "Symmetry-Recovery Photoinduced Phase Transition in Inorganic Titanate Perovskites." *Manuscript in preparation*

Song, Yuna, Duan, Zhongtao, **Lin, Hai-Xuan**, Feng, Qi, Zhu, Xun, Chen, Hongyu, Shao, Hezhu, Zhang, Xiaolei, Jin, Qingyuan, Xie, Fengxian, and Zhang, Hao. "Thermally Induced Phase Transitions and Radiative Dynamics Driven by Electron-Phonon Coupling in Low-Dimensional Perovskites." *Manuscript in preparation*

Presentations

Lin, H.-X. 2026. [Exciton-Phonon Interaction from the Ground Up](#). Oral presentation: Research Group Meeting, Department of Physics, Fudan University, Shanghai, China

Lin, H.-X. 2026. [Topological Data Analysis and Its Applications in Computational Physics and Chemistry](#). Oral presentation: Research Group Meeting, Department of Physics, Fudan University, Shanghai, China

Lin, H.-X. 2025. [Group-Theoretical Analysis of Raman Spectra](#). Course project presentation, Department of Physics, Fudan University, Shanghai, China

Technical Skills

Programming	Python, MATLAB, Mathematica, C/C++, Rust, Julia, Jupyter, CUDA, Bash, Docker , Scientific programming, numerical implementation, and research-software development
Parallel Computing	MPI, CuPy, GPU acceleration , Distributed-memory parallelism, multi-GPU execution, and memory-efficient computational workflows
Numerical Methods	NumPy, SciPy, sparse linear algebra , Finite-volume discretization, iterative solvers, and large-scale numerical simulation
Materials Computing	First-principles workflows, Wannier interpolation , Electron-phonon interactions, phonon transport, and computational materials physics
Mathematical Skills	Group theory, representation theory, space-group symmetry, differential manifold , Projective representations, symmetry selection rules, and isotropy-subgroup analysis
Research Tools	Linux, Git, L^AT_EX , Version control, reproducible computational workflows, and scientific writing
Physics Skills	Quantum mechanics, statistical physics, solid-state physics, computational condensed matter, general relativity , Electron-phonon interactions, phonon Boltzmann transport, structural phase transitions, and first-principles calculations