

Binbin LIU

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Educations

- 2020–2023 **M. S. in Physics**, *Beihang University*, Beijing, China.
Major GPA: 3.96/4, ranking **1/20**.
- 2016–2020 **B. S. in Applied Physics**, *Beihang University*, Beijing, China.
Major GPA: 3.91/4, ranking **top 3%**.

Honors and Awards

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|-----------|---|--------|
| 05.2023 | Presidential PhD Scholarship Award. Imperial College London. | 30/600 |
| 05.2023 | First Prize in the academic poster competition. Beihang U. | 3% |
| 09.2022 | National Scholarship. Ministry of Education, China. | 1% |
| 05.2019 | “Yuanhang” Global Study Summer Research Scholarship Award. Beihang U. | 1.5% |
| 2018–2022 | First Prize in the Learning Excellence Scholarship×4. Beihang U. | 3% |

Publications

- [1] **Binbin Liu** et al., *Second-order and real Chern topological insulator in twisted bilayer α -graphyne*, [Phys. Rev. B 106, 035153 \(2022\)](#). [PDF]
 - [2] Wang Yang*, **Binbin Liu***, et al., *Large bilinear magnetoresistance from Rashba spin-splitting on the surface of a topological insulator*, [Phys. Rev. B 106, L241401 \(2022\)](#), (Letter). [PDF]
 - [3] Xu-Tao Zeng, **Binbin Liu**, et al., *Three-dimensional real Chern insulator in bulk γ -graphyne*, [Phys. Rev. B 108, 075159 \(2023\)](#). [PDF]
 - [4] **Binbin Liu**[†], Zeying Zhang, Xian-Lei Sheng[†], Yuxin Zhao and Shengyuan A. Yang, *Projective Symmetry Enriched Berry Curvature Effects in Space and Time Invariant Crystals*. (To be submitted to PRL.)
 - [5] Xu-Tao Zeng, Ziyu Chen, Cong Chen, **Binbin Liu**, et al., *Topological hinge modes in Dirac semimetals*, [Front. Phys. 18, 13308 \(2023\)](#). [PDF]
 - [6] *Threefold relativistic particles in moiré heterostructure Bi/FeCl₂*. (In preparation. Theory first author.)
 - [7] **Binbin Liu** et al., *First and second-order topological insulator in 2D elementary materials*. (Invited review, in preparation.)
 - [8] **Binbin Liu** and Chueng Ji, *Anatomy of nucleon self-energy from equal-time to light-front*. (To be submitted to PRD.)
- (* equal contributions, [†] correspondence)

Skills

- Coding Matlab, Mathematica, Python, Linux, Latex, Markdown, C, Fortran.
- Software VASP, Wannier90, VESTA (material); Irvsp (Irreps), Magnetic TB/k-p (model), MindQuantum (quantum computation), Hspice (circuit simulation), Github, Blender, AI, PS...

- Vasplib A powerful Matlab package for condensed matter and materials research: build effective models from first-principals, identify topology, interface with VASP, QE, etc...(Developed by our group.)
- Miscellaneous **Problem-solving**, project leadership, team collaboration, rapid learning, and a strong motivation to pursue an academic career.

Research

- 2023– **Moiré-induced threefold relativistic particles in 2D FeCl₂/Bi(111)**, Online
- Advisors Dr. Frank Schindler, Imperial College London, Prof. Titus Neupert, U. of Zurich, and Prof. Niels Schroeter, MPI
- Description Relativistic crossings at the K point of the mini Brillouin zone in a moiré structures formed by several layers of Bismuth on top of a FeCl₂ substrate. Developed a theoretical effective model combined with first-principle calculations to elucidate the origin of the moiré-induced threefold relativistic particles, which is due to the band warping effect for the surface bands at Fermi level. [6].
- 2022–2023 **Projective Symmetry Enriched Berry Curvature Effects in Space and Time Invariant Crystals.**, Nanjing U, Nanjing, China
- Advisors Prof. Shengyuan A. Yang, Singapore U. of Technology and Design, Prof. Yuxin Zhao, HKU., and Prof. Xian-Lei Sheng, Beihang U.
- Description Proposed a projectively enriched space and time inversion symmetry and investigated its nontrivial implications: the existence of Weyl points even in the presence of projective space and time symmetry [4].
- 2021–2022 **Higher-order Topology in Graphyne Families**, Beihang U, Beijing, China
- Advisors Prof. Xian-Lei Sheng, Beihang U. and Prof. Shengyuan A. Yang, Singapore U. of Technology and Design.
- Description Identified twisted bilayer α -graphyne as a second-order topological insulator in 2D and γ -graphyne as a real Chern insulator with higher-order hinge states in 3D using first-principles calculations [1,3]. Demonstrated that higher-order topological states in these materials are induced by effective moiré magnetism or Zeeman fields [1,3,5,7].
- 2021–2022 **Large Bilinear Magnetoresistance (BMR) from Rashba Spin-Splitting on the Surface of a Topological Insulator**, Online
- Advisors Prof. John Q. Xiao, U. of Delaware, Prof. Xian-Lei Sheng, Beihang U. and Prof. Shengyuan A. Yang, Singapore U. of Technology and Design.
- Description Discovered Rashba spin-splitting quantum well states developed near the surface of Bi₂Se₃ decorated with transition-metal atoms Cu or Au, explaining the observed unusual large BMR in experiments [2].
- 2019–2022 **Anatomy of Nucleon Self-energy from Equal-time to Light-front**, NC, USA
- Advisors Prof. Chueng Ji, APS fellow, North Carolina State U.
- Description First to derive the leading non-analytic behavior of a light-front instantaneous Feynman diagram, providing new insights into understanding the backward moving part of a nucleon-pion loop in light-front dynamics [8].

Presentation

- 12.2021 Light-Cone 2021 (Korea). [Anatomy of nucleon self-energy from equal-time to light-front.](#)

Advanced Courses

- M. S.** Group Theory (98), Quantum Many-Body Theory (95), Quantum Optics (96). Advanced Statistical Physics (92).
- B. S.** Advanced Quantum Mechanics (94), Solid State Physics II (95).

Extracurricular Activities

- 2021/2022 Teaching Assistant, Solid State Physics (delivering lectures and revising homework).
- 2020–2021 Student President of Academic Associations, Department of Physics, Beihang University.
- 2012– Classical Pianist (Bach, Beethoven, Chopin, Mozart).
- 2017– Membership in the [Opera House](#), World Genius Directory.

References

Name	Affiliation	Email
○ Prof. Shengyuan Yang	○ U. of Macau,	○ yangshengyuan@um.edu.mo,
○ Prof. Xian-Lei Sheng	○ Beihang U.	○ xlsheng@buaa.edu.cn
○ Dr. Frank Schindler	○ Imperial College	○ f.schindler@imperial.ac.uk
○ Prof. Chueng Ji	○ NC State	○ crji@ncsu.edu
(Available upon request)		