Binbin LIU

+86 133 8950 7501
bbliu@buaa.edu.cn
liu-binbin.github.io

Educations

2020– **M. S. in Physics**, *Beihang University,* Beijing, China. GPA: 3.87/4.
Major GPA: 3.96/4, ranking **1/20**.

2016–2020 **B. S. in Applied Physics**, *Beihang University,* Beijing, China. GPA: 3.78/4.
Major GPA: 3.91/4, ranking **top 3**%.

Honors and Awards

09.2022 National Scholarship. ***1***%

05.2019 Beihang "Yuanhang" Global Study Summer Research Scholarship Award. ***1.5***%

2018–2022 First Prize in the Learning Excellence Scholarship of Beihang University. ***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).

[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).

[3] Xu-Tao Zeng, Ziyu Chen, Cong Chen, **Binbin Liu**, et al., *Topological hinge modes in Dirac semimetals*, Front. Phys. 18, 13308 (2023).

[4] **Binbin Liu**†, Xian-Lei Sheng†, Yuxin Zhao† and Shengyuan A. Yang, *Non-centered inversion symmetry in momentum space*. (To be submitted to PRL.)

[5] Xu-Tao Zeng, **Binbin Liu**, et al., *Three-dimensional real Chern insulator in bulk γ-graphyne*. (Submitted to PRB.)

[6] **Binbin Liu** et al., *First and second-order topological insulator in 2D elementary materials*. (Invited review, in preparation.)

[7] **Binbin Liu**, *Spinless eightfold fermions from projective symmetries*. (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)

Research

2022– **Topological Insulators with Momentum-non-centered Inversion Symmetries**, Beijing, China

Advisors Prof. Yuxin Zhao, Nanjing U., Prof. Shengyuan A. Yang, Singapore U. of Technology and Design, and Prof. Xian-Lei Sheng, Beihang U.

Description Discovered non-centered inversion symmetries in the momentum space from projective symmetry algebras, identified and characterized novel twisted inverse topological edge states with off-centered crossing points in the momentum space, distinct from edge states protected by the normal inversion symmetry. Designed topological circuits to simulate the nontrivial states [4].

2021–2022 **Higher-order Topology in Moiré Superlattice**, 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 new second-order topological insulator from first-principles [1] and demonstrated that the second-order topological states are generally induced by effective moiré magnetism or Zeeman fields [1,5-6].

2021–2022 **Large Bilinear Magnetoresistance (BMR) from Rashba Spin-Splitting on the Surface of a Topological Insulator**, international

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 Bi_2Se_3 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

Advisor Prof. Chueng Ji, APS fellow, Department of Physics, North Carolina State University.

Description Identified a light-front instantaneous Feynman diagram from the backward moving part of a nucleon-pion loop diagram and found its leading non-analytic behavior. Traced a zero mode contribution (bubble diagram) between the instant and light-front form dynamics [8].

Presentation

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

Skills

Models Tight-binding (TB) and k · p.

Materials VASP, Wannier90, Slator-Koster TB.

Circuits Construct topological circuits based on TB models and simulate them with "hspice".

Computer Matlab, Mathematica, Python, Linux, Latex, Cinema 4D, Adobe Illustrator and Photoshop.

Others Topological characterization from K-theory and topological quantum chemistry; Feynman diagram calculations.

Advanced Courses

M. S. Group Theory (98), Quantum Many-Body Theory (95), Quantum Optics (96).

B. S. Solid State Physics II (95), Advanced Quantum Mechanics (94).

Extracurricular Activities

2021/2022 Teaching assistant for Solid State Physics for two semesters.

2020–2021 Student president of department academic associations, with leadership in departmental academic activities, mainly for graduate students.

2012– Playing Bach, Beethoven, Chopin, and Mozart.