Xian-Zhang Chen

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Education

- **ICPCS, Lanzhou University** — Lanzhou, China
  Ph.D. in Condensed Matter Theory — *September 2016 - June 2023*
  Thesis title: Wavefunction-related Quantum Transport and Many-body effects in Graphene
  Advisor: Prof. Liang Huang and Prof. Rodolfo A. Jalabert

- **IPCMS, University of Strasbourg** — Strasbourg, France
  Joint training Ph.D. student — *December 2020 - November 2022*
  Project title: Theory of Scanning Gate Microscopy in Graphene
  Advisor: Prof. Rodolfo A. Jalabert

- **School of Physical Science and Technology, Lanzhou University** — Lanzhou, China
  Bachelor of Theoretical Physics — *September 2012 - July 2016*
  Thesis title: Quantum Transport in an Octagonal Graphene dot
  Advisor: Prof. Liang Huang

Empolyment

- **IDT, Eastern Institute of Technology, Ningbo** — Ningbo, China
  Research Assistant Professor — *December 2025 - Now*
  Research field: Topological Quantum Computing and Novel Magnetism
  Cooperative Advisor: Prof. Tong Zhou

- **EIAS, Eastern Institute of Technology, Ningbo** — Ningbo, China
  PostDoc in Condensed Matter Theory — *September 2023 - November 2025*
  Project title: Topological Quantum Computing in Magnetic textures
  Advisor: Prof. Tong Zhou

Honors and Awards

- Selected as a member of Programme Doctoral International (PDI) of Collège doctoral Européen (CDE), 2021
- China Scholarship Council award (EUR 32,400), China Scholarship Council, 2020
- Excellent Poster Award, The 5th National Statistical Physics Conference, 2019
- National Scholarship for Postgraduates (CNY 20,000), Ministry of Education of P. R. China, 2016

Personal Statement

My postdoctoral research centers on magnetic skyrmions for topological quantum devices. I develop skyrmion-engineered platforms to generate and control Majorana zero modes, and I design braiding and fusion protocols driven by skyrmion motion to realize non-Abelian statistics. To address readout, I propose scanning-gate-microscopy (SGM)–based detection approaches that interface naturally with transport. In a complementary line, I investigate altermagnetism, mapping its topological characteristics, analyzing proximity effects, and linking altermagnetic phases to topological superconductivity. My simulations combine KWANT (quantum transport/BdG), OOMMF (skyrmion micromagnetics), and DFT (altermagnet electronic structures).
Prior to this, my Ph.D. at ICPCS, Lanzhou University examined wavefunction properties in graphene—including SGM, magnetotransport, and many-body spectral statistics—with an emphasis on experimentally relevant theory and numerics for Dirac quasiparticles. This training established my habit of building end-to-end, experiment-proximate models, which I now apply to skyrmion-based topological devices and altermagnetic materials.

Research Interests:

- Topological Quantum Computing
- Skyrmions

- Altermagnet
- Scanning Gate Microscopy Technology
- Many-body Physics

Publications

- **Topological Quantum Computing**
  - **Xian-Zhang Chen**, Shuang Li, Zhengyu Zhang, Igor Zutic, Tong Zhou, to appear
    Contributions: Preliminary analytical derivation, calculation and analysis of numerical results, figure making, and paper writing.
  - **Xian-Zhang Chen**, Yongliang Hu, Tong Zhou, to appear
    Contributions: Preliminary analytical derivation, calculation and analysis of numerical results, figure making, and paper writing.
  - Richang Huang, Yongliang Hu, **Xian-Zhang Chen**, Peng Yu, Igor Zutic, Tong Zhou, *Towards Scalable Braiding: Topological Superconductivity Unlocked under Nearly Arbitrary Magnetic Field Directions in Planar Josephson Junctions*, arXiv:2504.20031
    Contributions: Helping in figure making, paper writing discussion and paper writing checking.
- **Magnetism (Altermagnet, QSH, QAH)**
  - **Xian-Zhang Chen**, Jiayong Zhang, Bowen Hao, Ziye Zhu, Zhengyu Zhang, Igor Zutic, Tong Zhou, to appear
    Contributions: Preliminary analytical derivation, calculation and analysis of numerical results, figure making, and paper writing.
  - Ziye Zhu, Richang Huang,**Xian-Zhang Chen**, Xunkai Duan, Jiayong Zhang, Igor Zutic, Tong Zhou, *Altermagnetic Proximity Effect*, arXiv:2509.06790
    Contributions: Model discussion and paper writing checking.
  - Ziye Zhu, **Xian-Zhang Chen**, Xunkai Duan, Zhou Cui, Jiayong Zhang, Igor Zutic, Tong Zhou, *Altermagnetic Proximity Effect*, arXiv:2512.02974
    Contributions: Transport calculation and partial paper writing.
  - Sihui Wu, Jiahui Qian, Xunkai Duan, **Xian-Zhang Chen**, Zhou Cui, Jiayong Zhang, Chunlan Ma, and Tong Zhou, *Electrically switchable quantum anomalous and spin Hall states in two-dimensional honeycomb lattices with non-Dirac bands*, Phys. Rev. B 111, 235414 (2025)
    Contributions: Model discussion and paper writing checking.
- **Quantum Transport (Graphene, SGM)**
  - **Xian-Zhang Chen**, Yongliang Hu, Kang Yang, Tong Zhou, to appear
    Contributions: Preliminary analytical derivation, calculation and analysis of numerical results, figure making, and paper writing.
  - **Xian-Zhang Chen**, Guillaume Weick, Dietmar Weinmann, Rodolfo A. Jalabert, *Scanning gate microscopy in graphene nanostructures*, Phys. Rev. B 107, 085420 (2023).
    Contributions: Preliminary analytical derivation, calculation and analysis of numerical results, figure making, and paper writing discussion.
  - Guan-Qun Zhang, **Xian-Zhang Chen**, Li Lin, Hai-Lin Peng, Zhong-Fan Liu, Liang Huang, Ning Kang, and Hong-Qi Xu, *Transport signatures of relativistic quantum scars in a graphene cavity*, Phys. Rev. B 101, 085404 (2020).
    Contributions: Numerical simulation and analysis of experimental results and supplementary materials writing.
- **Many-body Effects in Graphene**
  - **Xian-Zhang Chen**, Zhen-Qi Chen, Liang Huang, Celso Grebogi, and Ying-Cheng Lai , *Many-body spectral statistics of relativistic quantum billiard systems*, Phys. Rev. Research 5, 013050 (2023).
    Contributions: Preliminary paper writing, calculation and analysis of numerical results, and figure making.
- **Chaotic Scattering (spin transport, entanglement)**
  - Chen-Rong Liu, **Xian-Zhang Chen**, Hong-Ya Xu, Liang Huang, and Ying-Cheng Lai, *Effect of chaos on two-dimensional spin transport*, Phys. Rev. B 98, 115305 (2018).
    Contributions: Help in writing calculation programs and numerical results discussion.

- Chen-Rong Liu, Pei Yu, **Xian-Zhang Chen**, Hong-Ya Xu, Liang Huang, and Ying-Cheng Lai, *Enhancing von Neumann entropy by chaos in spin–orbit entanglement*, Chin. Phys. B 28, 10 (2019).
  Contributions: Numerical results discussion and paper writing checking.

- **Classical-quantum Correspondence**

  - Xiao-Liang Li, **Xian-Zhang Chen**, Chen-Rong Liu, and Liang Huang, *Quantization condition of scarring states in complex soft-wall quantum billiards*, Acta Phys. Sin., 69, 080506 (2020).
    Contributions: Help in writing calculation programs, numerical results analysis, and part of figures making.

Presentations

- **Talks**

  - Novel quantum spin and quantum anomalous Hall effects based on altermagnet
    CPS Meeting 2025, Harbin, China, 09/2025.
  - Many-body spectral statistics of relativistic quantum billiards systems
    DPG Meeting 2022, Regensburg, Germany, 09/2022.
  - Novel QSH and QAH based on Altermagnets
    CPS Meeting 2022, Harbin, China, 09/2025.

- **Posters**

  - Transport signatures of scars in graphene dots at low magnetic field
    GDR 2426, Aussois, France, 12/2021.
  - Many-body spectral statistics of relativistic quantum billiard systems
    The 5th National Statistical Physics Conference (SPCSC), Hefei, China, 07/2019.
  - Transport signatures of relativistic quantum scars in a graphene cavity
    International Workshop on Experimental and Theoretical Developments on Complex Quantum Systems, Lanzhou, China, 07/2018.

Participated Grants

- Spectral statistics of a class of pseudo-integrable quantum billiards, CNY 630,000, No. 12175090, NSFC, 2021.
- Study of spin anomalous effects in Dirac billiards, CNY 580,000, No. 11775101, NSFC, 2017.