SHI FENG

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Education and Qualification

Technical University of Munich — **Garching b. München, Germany**
Postdoctoral Fellow in Condensed Matter and Quantum Information Theory — *2024 – present*
- Advisors: M. Knap, F. Pollmann, J. Knolle and S. Moudgalya

The Ohio State University — **Columbus, Ohio, USA**
Ph.D in Theoretical Condensed Matter Physics — *2018–2024*
- Advisor: N. Trivedi
- Dissertation: Fractionalization in Frustrated Quantum Matter

Xi'an Jiaotong University — **Xi'an, Shaanxi, China**
B.S. in Physics (Honors Program), Qian Xuesen College — *2014–2018*
- Visiting student in University of California, Riverside, 2016
- Visiting scholar in University of California, Los Angeles, 2017

Interest and Expertise

1. Theoretical study of quantum spin liquids and topologically ordered matter
2. Quantum magnetism and frustrated systems: phase transitions, dynamics, and response theory
3. Quantum information, non-equilibrium quantum dynamics and their application in condensed matter
4. Tensor network methods for many-body systems: MPS, DMRG, TEBD, etc
5. Statistical models and machine learning methods relevant for condensed matter theory

Publications and Preprints

1. *Obstruction to broken symmetries in topological flat bands*
   P. Zhu, **S. Feng**, Y.-M. Lu
   arXiv:2408.14533 (2024)
2. *Emergent Majorana metal in from a chiral spin liquid*
   P. Zhu*, **S. Feng***, K. Wang*, T. Xiang, N. Trivedi
   arXiv:2405.12278 (2024)
3. *Fractionalization signatures in the dynamics of quantum spin liquids*
   K. Wang*, **S. Feng***, P. Zhu, R. Chi, H. Liao, N. Trivedi, T. Xiang
   arXiv:2403.12141 (2024)
4. *Spin-orbit coupling controlled 2D magnetism in chromium trihalides*
   I. Lee, J. Chen, O. Molchanov, **S. Feng**, W. Huey, J. Tol, J. Goldberger, N. Trivedi, H.-Y. Kee, P. C. Hammel
   arXiv:2405.16709 (2024)
5. *Dimensional reduction of Kitaev spin liquid at quantum criticality*
   S. Feng, A. Agarwala, N. Trivedi
   Phys. Rev. Research 6, 013298 (2024)
6. *Hidden subsystem symmetry protected states in competing topological orders*
   S. Feng
   Phys. Rev. B 109, 075151 (2024)
7. *Machine learning reveals features of spinon Fermi surface*
   K. Zhang, **S. Feng**, Y. D. Lensky, N. Trivedi, E. A. Kim
   Commun. Phys. 7, 54 (2024)
8. *A statistical approach to topological entanglement: Boltzmann machine representation of high-order correlation*
   S. Feng, D. Kong, N. Trivedi
   arXiv:2302.03212 (2023)

9. *Anyon dynamics in field-driven phases of the anisotropic Kitaev model*
   S. Feng, A. Agarwala, S. Bhattacharjee, N. Trivedi
   Phys. Rev. B 108, 035149 (2023)
10. *Detection of long-range entanglement in gapped quantum spin liquids by local measurements*
    S. Feng, Y. He, N. Trivedi
    Phys. Rev. A 106, 042417 (2022)
11. *Gapless to gapless phase transitions in quantum spin chains*
    S. Feng, G. Alvarez, N. Trivedi
    Phys. Rev. B 105, 014435 (2022)
12. *Magnetic phase transitions in quantum spin-orbital liquids*
    S. Feng, N. D. Patel, P. Kim, J. H. Han, N. Trivedi
    Phys. Rev. B 101, 155112 (2020)
13. *Film-depth-dependent Crystallinity for Light Transmission and Charge Transport in Semitransparent Organic Solar Cells*
    T. Xiao, J. Wang, S. Yang, Y. Zhu, D. Li, Z. Wang, **S. Feng**, L. Bu, X. Zhan, G. Lu
    Journal of Materials Chemistry, A, 2020, 8, 401 (2020)
14. *Rapidly measuring charge carrier mobility of organic semiconductor films upon a point-contact four-probes Method*
    D. Li, S. Li, W. Lu, **S. Feng**, P. Wei, Y. Hu, X. Wang, G. Lu
    IEEE J-EDS 2018.2872714 (2018)
15. *Film-depth-dependent light absorption and charge transport for polymer electronics: A Case Study on Semiconductor/Insulator Blends by Plasma Etching*
    L. Bu, S. Gao, W. Wang, L. Zhou, **S. Feng**, X. Chen, D. Yu, S. Li, G. Lu
    Adv. Electron. Mater 2:1600359 (2016)

Research Experiences

The Ohio State University **Columbus, OH, USA**
Graduate Research Assistant and Fellow *2018–2024*
Advisor: Nandini Trivedi
- Theory of topological order: quantum spin liquid and Kitaev honeycomb model; detection of fractionalization; linear and non-linear response of fractionalized particles; projected symmetry group.
- Quantum information: (topological) quantum entanglement, stabilizer code, cluster state, lattice gauge theory.
- Magnetism: quantum phase transitions and fractionalization in one dimensional frustrated systems
- Numerical methods: Exact diagonalization, matrix product states, density matrix renormalization group, time-evolving block decimation
- Statistical methods and machine learning approach to quantum many-body physics: Restricted Boltzmann machine, convolution neural network

Xi'an Jiaotong University **Xi'an, Shaanxi, China**
Undergraduate Research Assistant *2017 - 2018*
Advisor: Guanghao Lu (Frontier Institute of Science and Technology)
- Transfer matrix method for light absorption in semiconductor
- In-situ reconstruction algorithm for semiconductor nano-tomography

University of California, Los Angeles **Los Angeles, CA, USA**
Cross-disciplinary Scholars in Science and Technology *Summer 2017*
Advisor: Hongwen Jiang (Department of Physics & Astronomy)
- Monte Carlo simulation of electron beam induced defects in SiO_2
- Nano-imprint lithography of MOS quantum dots

University of California, Riverside **Riverside, CA, USA**
Undergraduate Research Assistant *Fall 2016*
Advisor: Marc Bockrath (Department of Physics & Astronomy)
- Nano fabrication and the analysis of electronic transport in twisted bilayer graphene

Conferences

Jun, 2024: **Gordon Research Conference: Correlated Electron Systems**, Mt. Holyoke College, MA, USA

- Poster: Majorana metal from a chiral spin liquid

Mar, 2024: **APS March Meeting**, American Physical Society

- Contributed Talk: Mobility constraint of anyons in a quantum spin liquid

Oct, 2023: **Q-PHORIA**, Pittsburgh Quantum Institute, Pittsburgh, PA, USA

- Poster: Dimensional reduction of quantum spin liquids

Jul, 2023: **Boulder Summer School – Non-Equilibrium Quantum Dynamics**, CU Boulder, CO, USA

- Poster: Anyon response in field-induced quantum spin liquids

May, 2023: **TopoMag23 – Topology and Fractionalization in Magnetic Materials**, Columbus, Ohio, USA

- Poster: Anyon response in field-induced quantum spin liquids

Apr, 2023: **Topology, Symmetry and Interactions in Crystals**, KITP-UCSB, California, USA

- Poster: Dynamics of Abelian anyons in the Kitaev model

Mar, 2023: **APS March Meeting**, American Physical Society

- Contributed Talk: Transition from Kitaev quantum spin liquid to weakly coupled critical spin chains

Feb, 2023: **Edward F. Hayes Advanced Research Forum**, OSU, Ohio, USA

- Contributed Talk: Anyon, fractionalization, and their detection

Jun, 2022: **Gordon Research Conference: Correlated Electron Systems**, Mt. Holyoke College, MA, USA

- Poster: Discovery of novel topological phase in Kitaev spin liquid in a field

Mar, 2022: **APS March Meeting**, American Physical Society

- Contributed Talk: Spin response and magnetic absorption of Kitaev liquids under an external field.

Mar, 2021: **APS March Meeting**, American Physical Society

- Contributed Talk: Field-induced gapless-to-gapless phase transitions in integer spin chains.

Aug, 2020: **Ultra Quantum Matter**, Perimeter Institute for Theoretical Physics, Waterloo, Canada

Jun, 2020: **Condensed Matter Physics in all Cities**, University of Kent Canterbury, Kent, UK

- Contributed Talk: Magnetic phase transition in quantum spin orbital liquid.

Honors and Awards

2024: **The Chinese Government Award for Outstanding Students Abroad**, Chinese Consulate in NY, USA

- The highest award granted by the Chinese government to Chinese students overseas

2023: **Presidential Fellowship**, *OSU*, Columbus, OH, USA

- The Presidential Fellowship is the most prestigious award given by the Graduate School of OSU, embodying the highest standards of scholarship in the full range of Ohio State's graduate programs

2023: **2nd place, Edward F. Hayes Advanced Research Forum**, *OSU*, Columbus, OH, USA

2018: **Siyuan Scholarship**, *XJTU*, Xi'an, Shaanxi, China

- Awarded to undergraduate students for their academic excellence

2017: **CSST Scholarship**, *UCLA*, Los Angeles, CA, USA

- Awarded in the UCLA-CSST program for cross-disciplinary scholars in science and technology

2016: **Meritorious Winner** of Interdisciplinary Contest in Modelling, Bedford, MA, USA

2016: **1st Place Award** of China Mathematical Contest in Modelling, Xi'an, Shaanxi, China

Other Academic Experience

Reviewer for: Physical Review B, Physical Review Applied, Quantum Information & Computation

Invited Talks/Lectures:

- Invited lecture for TopoMag23 conference: Frustrated magnetism and quantum spin liquid, Columbus, Ohio, USA, 2023

- Invited seminar: Dynamical features of quantum spin liquids, Institute of Physics, Chinese Academy of Sciences, Beijing, China, 2024

Teaching Experiences

Department of Physics, OSU **Columbus, OH, USA**
Graduate Teaching Assistant *2018-2021*

- Statistical Mechanics (Fall 2021, OSU)
- Introductory Physics – Electromagnetism, Optics, Modern Physics (Spring 2020, OSU)
- Introductory Physics – Mechanics, Thermal Physics, Waves (Fall 2019, OSU)
- Introductory Physics – Mechanics, Kinematics, Fluids, Waves (Spring 2019, OSU)
- Statistical Mechanics (Fall 2018, OSU)

Technical Skills

Projects: Developer and maintainer of
- ExactDiagPy: Exact diagonalization with implementation of various quantum entanglement measures

Programming Languages: Python, Julia, C++, Perl, Matlab, Mathematica, Java, Bash

Libraries and Softwares:
- Eigen, TenPy, DMRG++, ITensor, HDF5, OpenGL, Blas, Lapack; Blender, Inkscape

OS and Clusters:
- OS: Linux (Ubuntu), Windows, macOS, High Performance Computing (HPC) environments
- Clusters: OSU Unity and Ohio Supercomputer Center (OSC)

References

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Professor, Physics
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