

# Qixiao Yuan

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## Research Interests

Experimental studies of magnetism and superconductivity in two-dimensional materials; electronic correlations, topology, and quantum transport

## Education

### University of Science and Technology of China

Sep. 2023–Jul. 2027 (expected)

*B.Sc. in Physics; School of the Gifted Young and Jici Yan Talent Program*

*Hefei, China*

- GPA: 4.00/4.30 (average score: 92.57/100); rank: 8/164 in Applied Physics.
- Selected advanced coursework: Topological Phase Transition and Topological Field Theory I (100), Quantum Field Theory (96), Frontiers of Condensed Matter Physics (94), Supersymmetry (100), and Selected Topics in String Theory and Field Theory (90).

## Publications, Preprints & Manuscripts

- Yunmei Zhang, Jun Zhan, Ping Wu, Yun-Peng Huang, **Qixiao Yuan**, *et al.*, “Visualizing the interplay of dual electronic nematicities in kagome superconductors,” arXiv:2604.05506 (2026). Submitted to *Physical Review Letters*. **Contribution:** STM/QPI data processing and interpretation of doping-dependent electronic anisotropy.

## Research Experience

### Synthesis of Flat-Band Kagome Films

Sep. 2024–Mar. 2025

*Advisor(s): Prof. Zhenyu Wang*, Department of Physics, USTC

- Synthesized high-quality kagome flat-band  $\text{Ni}_3\text{In}$  films using molecular beam epitaxy (MBE) and characterized the films using reflection high-energy electron diffraction (RHEED), X-ray diffraction (XRD), atomic force microscopy (AFM), and Physical Property Measurement System (PPMS) prior to STM measurements.
- Contributed to the daily maintenance of the MBE system.

### Visualization of Dual Electronic Nematicities in Kagome Systems

Mar. 2025–Jan. 2026

*Advisor(s): Prof. Zhenyu Wang*, Department of Physics, USTC

- Processed and analyzed scanning tunneling microscopy (STM) spectroscopic datasets from doped  $\text{CsV}_3\text{Sb}_5$  using quasiparticle-interference (QPI) analysis; observed suppression of the charge-density-wave (CDW) signal near a doping level of 0.12 while a twofold electronic anisotropy persisted along a distinct direction.
- Interpreted the doping-dependent anisotropy as a crossover from CDW-induced nematicity to a distinct, non-CDW-driven nematic order associated with competing band-dependent mechanisms.

### Visualization of Moiré Superlattices Using AFM Techniques

June. 2026–Present

*Advisor(s): Prof. Tiancheng Song*, Department of Physics, University of Wisconsin–Madison

- Set up high-resolution torsional force microscopy (TFM) and piezoresponse force microscopy (PFM), and imaged spatially uniform moiré patterns and lattice relaxation in twisted BN and twisted  $\text{WSe}_2$ .
- Demonstrated imaging of moiré superlattices through BN encapsulation, enabling AFM-based visualization of moiré structures in air-sensitive materials.
- Fabricated nanodevices and identified regions with suitable moiré superlattices on the stamp, enabling subsequent STM measurements.

### Nanofabrication and Transport of 2D Quantum Materials

Jan. 2026–Present

*Advisor(s): Prof. Tiancheng Song*, Department of Physics, University of Wisconsin–Madison

- Developed a contact-gating strategy and achieved measurable electrical conduction in twisted  $\text{WSe}_2$  devices for transport measurements.
- Obtained ultrathin  $\text{Mn}_3\text{Si}_2\text{Te}_6$  and  $\text{UOTe}$  flakes with thicknesses below 10 nm.

- Developed a strategy to suppress the degradation of  $\text{Mn}_3\text{Si}_2\text{Te}_6$ , enabling prolonged exposure to ambient conditions.
- Exfoliated  $\text{WSe}_2$ ,  $\text{WTe}_2$ ,  $\text{UOTe}$ ,  $\text{Mn}_3\text{Si}_2\text{Te}_6$ ,  $\text{MoSe}_2$ , and  $\text{CrSBr}$  into thin flakes and monolayers; fabricated van der Waals heterostructures and performed electronic transport measurements in a Bluefors LD250 dilution refrigerator at a base temperature of 10 mK.
- Set up an annealing furnace and developed annealing protocols for different electrode materials, reducing fabrication residues and improving contact quality.

### Screening-Tunable Wigner Crystals

Sep. 2026–Present

*Advisor(s):* **Prof. Tiancheng Song**, Department of Physics, University of Wisconsin–Madison

- Fabricated monolayer  $\text{WSe}_2$  devices for optical measurements and set up optical components for photoluminescence and absorption measurements using the attoDRY2100XL cryostat.
- Reproduced characteristic photoluminescence and absorption spectra and observed the umklapp peak associated with the Wigner crystal.

### Quantum Oscillations in the Topological Semimetal $\text{ZrGeSe}$

Sep. 2025–Jan. 2026

*Advisor(s):* **Dr. Jie Li**, Physics Experiment Teaching Center, USTC

- Grew  $\text{ZrGeSe}$  single crystals by chemical vapor transport (CVT) and characterized the crystals using transmission electron microscopy (TEM).
- Measured Shubnikov–de Haas oscillations through low-temperature magnetotransport, identified two dominant oscillation frequencies corresponding to distinct extremal Fermi-surface areas, and fitted the temperature dependence of the oscillation amplitudes using the Lifshitz–Kosevich formalism.

### Topological Properties of Nonlinear SSH Models

Jun. 2025–Jan. 2026

*Advisor(s):* **Dr. Xianhao Wei** and **Prof. Ming Gong**, Department of Physics, USTC

- Proposed circuit- and photonics-based realizations of a nonlinear Su–Schrieffer–Heeger (SSH) model and a method for characterizing its topological properties. Reproduced the previously reported absence of conventional bulk–edge correspondence in the nonlinear regime and analyzed bifurcations in the system.

### Honors & Awards

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|---------------------------------------------------------------------------|------------|
| National Scholarship (highest academic honor for undergraduates in China) | 2024       |
| Outstanding Student Research Program                                      | 2026       |
| Jici Yan Scholarship                                                      | 2024, 2025 |
| Rose Scholarship                                                          | 2024       |
| Outstanding Volunteer, USTC                                               | 2026       |
| Excellent Freshman Scholarship—Silver                                     | 2023       |

### Teaching Experience

#### Teaching Assistant, Mathematical Analysis B1

Sep. 2025–Jan. 2026

*Instructor:* **Prof. Yi Cheng**, Department of Mathematics, University of Science and Technology of China

### Academic Programs & Activities

- Participated in the 2026 APS March Meeting, the SUSTech Summer School on Kagome Lattices, an HKU short course on fractional Chern insulators, and an international workshop on kagome physics at UCAS.
- Administrator of the USTC student physics club; organized dozens of seminars on theoretical physics, mathematics, condensed matter physics, and literature.

### Skills & Languages

**Nanofabrication:** Mechanical exfoliation, dry transfer, electron-beam lithography (EBL).

**AFM techniques:** PFM, TFM, contact mode, tapping mode, and PeakForce microscopy.

**Measurements:** Electric transport measurements, optics setup and measurements

**Programming:** C, Python, LabVIEW.

**Languages:** Mandarin (native); English (TOEFL: Reading 30, Listening 28, Speaking 23, Writing 24).