Ruiheng Su

I am excited about exploring quantum materials with strongly correlated phases using novel transport or spectroscopic probes.

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EDUCATION

2024 **Bachelor of Applied Science in Engineering Physics,** *University of British Columbia (UBC)*

GPA: 87.7/100.0 (Letter Grade: A)

Relevant coursework:
Graduate Condensed Matter I (PHYS 502, Grade: A+)
Quantum Mechanics, Statistical Mechanics, Optics

PUBLICATIONS

1. **Su, R.,** Kuiri, M., Watanabe, K., Taniguchi, T., and Folk, J. Superconductivity in twisted double bilayer graphene stabilized by WSe_2. ***Nat. Mater.*** (2023). https://doi.org/10.1038/s41563-023-01653-7
   Featured in: *News & Views - Nature Materials*

CONTRIBUTED TALKS

2024 (Submitted) **"Current-bias spectroscopy of in-plane magnetoresistance on the microtesla scale in twisted monolayer-trilayer graphene."** *APS March Meeting, Minneapolis, MN, March 3-8th* (Speaker)

"Moiré-localized flat bands in a family of twisted Bernal-stacked graphene multilayers." *APS March Meeting, Minneapolis, MN, March 3-8th* (Co-author, in collaboration with Prof. M. Yankowitz, University of Washington)

2023 **"Superconductivity in twisted double bilayer graphene stabilized by WSe_2."** *APS March Meeting, Las Vegas, NV, March 6-10th* (Speaker)

POSTER PRESENTATIONS

2023 **First place award: "Superconductivity and Isospin Order in Twisted Double Bilayer Graphene on WSe_2."** *Stewart Blusson Quantum Matter Institute (SBQMI) International Scientific Advisory Board Meeting, September 19-20th*

"Electronic phases of twisted double bilayer graphene on WSe_2." *Canadian Institute for Advanced Research (CIFAR) Quantum Materials Program Spring School, Montreal, May 8-12th*

AWARDS AND HONOURS

2023 **Edward G. Auld Prize in Engineering Physics**, *UBC*

Undergraduate Student Research Award, *Natural Sciences and Engineering Research Council of Canada (NSERC)*

First Place Poster Award, *International Scientific Advisory Board Meeting, SBQMI, UBC*

2022 **Trek Excellence Scholarship**, *UBC*

2018 **Academic Bronze Medal**, *The Governor General of Canada*

British Columbia Government Scholarship

Community Service Award, *Knights of Columbus Council*

RESEARCH EXPERIENCE

2021 – Present

Electronic Phases of Multilayer Graphene — Prof. Joshua Folk, *UBC*
Undergraduate Researcher

Transport experiments: I have led several experiments through the efforts of nanofabrication (electron beam lithography), electronic instrumentation (in Bluefors LD/XLD dilution refrigerators and ICEoxford VTI), data analysis, figure preparation, and manuscript writing. This includes a **first-author publication on superconductivity in twisted double bilayer graphene** (TDBG) in Nature Materials (2023).

Other experimental observations I have led include:
- **Unconventional sequence of finite-magnetic field Chern insulators in TDBG** at integer and half-integer filling factors, inconsistent with a picture of sequential populations of |C| = 2 Chern bands

Collaborating with the group of Prof. Matthew Yankowitz, *University of Washington, Seattle*, I found:
- **Quantum anomalous hall effect at $\nu = 1/4$ in twisted bilayer-trilayer graphene** (T2+3), and independent control of the orbital magnetic order by the perpendicular electric field, and in-plane and out-of-plane magnetic field
- **Anomalous hall effect at $\nu = 3$ in twisted mono-trilayer graphene** (T1+3), and an associated **extraordinary resistivity response** to < **1 μV of bias** and < **1 mT of in-plane magnetic field**

These results are subjects of manuscripts in preparation.

I often use low-field quantum oscillations to tell the material's Fermi surface degeneracy. I performed band structure calculations of AB-stacked tetralayer graphene and compared the theory to my measurements in an ultraclean sample.

Thermodynamic measurements: I also led instrumentation efforts to probe 2D materials using aluminum single-electron transistors in both DC and phase-sensitive (AC) modes. I assembled the experiment set up, involving:
- eliminating ground loops, optimizing passive circuits and feedback controllers to work in conjunction with DC voltage sources and lock-in amplifiers

to yield robust, direct measurements of the inverse electronic compressibility

May 2021 – January 2022

Charge noise in GaAs/AlGaAs Quantum Wells — Prof. Joshua Folk, *UBC*
Undergraduate Researcher

Utilized the edge of a Coulomb blockade peak in a GaAs/AlGaAs quantum dot to obtain sensitive measurements of the noise power spectral density
- Optimized ohmic contacts to the quantum well and fabricated quantum dots

January – May 2020

X-ray Detection and Radiotherapy Response Modelling — Prof. Geordi Pang, *University of Toronto*
Research Assistant

- Wrote C^{++} programs to perform Monte-Carlo simulations of a MeV X-ray detector
- Implemented a mathematical model to simulate the external beam radiotherapy treatment response of non-small cell lung cancer patients, reproducing the results of a reference publication, involving developing heuristics to improve fitting to a model with 16 parameters, using parallelism to speed up calculations

May – August 2019

Measurement Interface for Silicon Photonics — Prof. Jeff Young, *UBC*
Research Assistant

Designed a Python-based web interface to measure photonic devices, implementing features such as:
- Global sample alignment, mapping design file coordinates to physical coordinates
- Closed-loop fine alignment using a modified gradient descent algorithm between an optical fiber array and grating couplers

TECHNICAL PROJECT EXPERIENCE

September – January 2020

Virtual Parking Attendant
Course Project, ENPH 353, *UBC*

- Combined classical and machine learning techniques in Python (OpenCV, TensorFlow) to develop a virtual parking attendant
- The system autonomously navigated a competition area, avoiding other vehicles and pedestrians, and performed license plate identification with 80% accuracy, achieving 2nd place in time required to complete competition tasks

May – September 2020

Autonomous Recycling Robot
Course Project, ENPH 480, *UBC*

Prototyped, constructed, and programmed a fully autonomous robot capable of detecting and retrieving randomly scattered soda cans to a 12-inch-tall recycling bin. Gained experience in:

- Assembling and troubleshooting of electronic circuits for noise-tolerant electromechanical systems
- State-machine programming of microcontrollers in C++, including developing algorithms for sonar detection and retrieval of soda scans

SKILLS

Nanoscale sample preparation
- Electron beam/photolithography
- Dry (RIE)/wet etching (HF)
- Electron beam evaporation
- Wiring bonding/sample preparation
- Wafer dicing

2D materials
- Dry transfer
- Exfoliation

Programming /Software
- Python (including QCodes), Igor Pro, C++, Java, MATLAB, LaTeX, Processing, Assembly
- Adobe Illustrator, Microsoft Office

Electro/Mechanical
- Machine shop: Lathe, Milling
- Experience with CAD, PCB design, Soldering

Language
- English, Mandarin/Cantonese Chinese

ADDITIONAL WORK EXPERIENCE

August 2020

Teaching Assistant Prof. Sarah Burke, *UBC*
PHYS 159 - Introductory Physics Laboratory for Engineers

- Created instructional materials and user interface features for an Arduino-based oscilloscope, supporting over 1,000 first-year engineering students in a swift transition to remote learning during the COVID-19 pandemic

May 2017

District Electoral Officer
Elections British Columbia

May – August 2017

Day Care Assistant
CPE Force Vive, Laval, Québec (French Speaking)

2017, 2018

Customer Service Representative for *PNE Vancouver, AMS UBC*

COMMUNITY SERVICE

2012 - 2018

Sergeant and Bagpipe Instructor
Army Cadets of Canada

- Trained new army cadets, learned and taught the Scottish bagpipes to members of the marching band

2018

General Council Secretary
Engineering Undergraduate Society, UBC