

# Jiachen He

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Portfolio: <https://jhe274.github.io/portfolio-bruce.github.io/>

## SKILLS SUMMARY

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- **Instrumentation & Electronics:** Laser Optics, Fiber Optics, Solid-State Lasers, Polarimeter, PIDs, cryogenic system, vacuum chamber, Fluxgate/Hall Effect Magnetometer, Lock-in Amplifier, Photoelastic Modulator (PEM), Electro-optic Modulator (EOM), RF Signal Generator, RF Amplifier, Spectrum Analyzer, Oscilloscope, Photo Detectors, Optical Chopper, DVMs.
- **Optical Metrology:** Polarization Modulation Ellipsometry, optical alignment, precision optical measurements, interferometry.
- **Languages:** English, Chinese(Mandarin), Python, C++, L<sup>A</sup>T<sub>E</sub>X
- **Software:** COMSOL Multiphysics, MATLAB, Mathematica, Autodesk Inventor, LabVIEW, Microsoft Office
- **Platforms:** Unix based OS (Linux, Mac OS), Microsoft Windows
- **Soft Skills:** Leadership, Effective Time Management, Event Coordination, Technical Writing, Public Speaking & Presentations, Data Analysis, Module Development, Strong Communication & Collaboration, Analytical Reasoning, Problem Solving, Project Management.

## PROFESSIONAL EXPERIENCE

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- **Graduate Research Assistant** University of Kentucky  
*Research on sensitive optical magnetometer using resonant Faraday effect* *August 2019 - Present*
  - **Software Development:** Strong background in scientific programming, developed Python package for the wavelength meter, facilitating efficient communication and buffer usage without relying on low-level SCPI commands.
  - **Data Analysis:** Created and implemented multiple Python scripts for comprehensive Faraday rotation data analysis. All scripts and packages are available on GitHub to promote transparency and collaboration in scientific research.
  - **Synchronous Data Acquisition (SDAQ):** Proficient in developing modular Python-based SDAQ systems for communication with scientific instruments such as digital I/O interfaces, wavelength meters, laser controllers, lock-in amplifiers, and Gaussmeters. The system efficiently initializes, configures, and synchronizes instruments, sending TTL-level pulse trigger signals and recording data in their buffers.
  - **Polarization Modulation Ellipsometer:** Expert in birefringence measurement system, including calibration and optimization. Performed precise optical alignment, utilizing lock-in amplifiers, Muller calculus, and waveform analysis to achieve sub- $\mu$ rad accuracy in sensitive optical signal measurements.
  - **Merritt Coil Development and Implementation:** Designed and simulated (using Python) a Merritt coil system, followed by Autodesk Inventor modeling to incorporate mechanical engineering tasks for its development and construction. Collaborated closely with machine shop teams to ensure successful project delivery.
  - **Magnetic Field Design:** Independently developed a magnet box prototype, using finite element analysis (COMSOL) tools and MATLAB Simulink to create uniform magnetic fields with shielding. This early-career project deepened my experience with FEA software and involved leveraging concepts like magnetic scalar potential and image fields.
  - **Laser Frequency Stabilization:** Extensive experience in spectroscopic laser frequency stabilization using PDH and DSAS techniques with alkali metals (Rb, K).
  - **Cryogenic and Vacuum Systems:** Contributed to system calibration and maintenance of a cryogenic system, gaining hands-on experience with vacuum technologies over five years.
  - **Ongoing Projects:** Machine learning algorithms for real-time magnetic field cancellation, software development for scientific instruments and implementing side-band laser locking using EOM.
- **Summer Research** University of Kentucky  
*Research on Etch Track-Directed Growth of Carbon Nanotubes on Graphite* *May 2018 - August 2018*
  - Making graphene/boron nitride samples with attached gold particles using chemical vapor deposition, studied frictional properties on the surface of graphene using microfluidic probe.
- **Graduation Project** Shenzhen University  
*Research on the Control System of Intelligent Fish Tank Based on Single Chip Microcomputer* *September 2015 - May 2016*
- **Open Laboratory Fund Project** Shenzhen University  
*Research on the Design of Temperature-controlled Automatic Watering Device* *September 2012 - October 2013*

## TEACHING EXPERIENCE

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- **University of Kentucky** Lexington, US  
*Graduate Teaching Assistant* *August 2017 - May 2019*
  - Instructed undergraduate students in Newtonian mechanics, electromagnetism, and physical optics through hands-on lab sessions and interactive recitations, fostering a deeper understanding of core physics concepts.
- **Beijing Dasheng Online Science and Technology Co., Ltd.** Shenzhen, China  
*Oral English Teacher (Online)* *February 2016 - July 2016*
  - As an online English instructor, I taught fundamental communication skills to adult learners, enhancing their oral proficiency.

## EDUCATION

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- **University of Kentucky** United States  
*Ph.D. in Physics* (Expected Graduation Date: May 2025) August 2019 - Present  
**Courses:** Advanced Mechanics, Quantum Mechanics, Electromagnetic Theory, Statistical Mechanics, Methods of Theoretical Physics, Solid State Physics, Fundamental Particle Physics, Computational Physics.  
**Focus:** Magnetic field design and modeling, electric and magnetic polarizability, light interaction with materials in magnetic field, laser & fiber optics, optical metrology, polarization modulation ellipsometry, optical homodyne detection, atomic spectroscopy, balanced polarimetry, laser frequency stabilization.
- **University of Kentucky** United States  
*M.S. in Physics* August 2017 - May 2019
- **Shenzhen University** China  
*B.E. in Measurement Control Technology and Instruments* September 2010 - July 2017  
**Thesis:** Research on the Control System of Intelligent Fish Tank Based on Single Chip Microcomputer.

## PUBLICATIONS

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- **Korsch, W., Broering, M., Timsina, A., Leung, K.K., Abney, J., Budker, D., Filippone, B.W., He, J., Kandu, S., McCrea, M. and Roy, M., 2024. Electric charging effects on insulating surfaces in cryogenic liquids.** Review of Scientific Instruments, 95(4).

## PRESENTATIONS

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### In Person

- **J. He, W. Korsch, “Resonant Faraday rotation measurements in a potassium vapor cell.”:** American Physical Society April meeting, Sacramento, April 2024

### Poster Presentations

- **J. He, W. Korsch, “Resonant Faraday rotation measurements in a potassium vapor cell.”:** Department of Physics & Astronomy, University of Kentucky, August 2024  
*Awarded Second Overall Best Poster*
- **J. He, W. Korsch, “A compact magnet design to create low-gradient magnetic field in the presence of magnetic shielding.”:** National Nuclear Physics Summer School, Massachusetts Institute of Technology, Cambridge, July 2022
- **J. He, W. Korsch, “A compact magnet design to create low-gradient magnetic field in the presence of magnetic shielding.”:** Department of Physics & Astronomy, University of Kentucky, August 2021

## LEADERSHIP & AWARDS

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- Graduate Student Congress (GSC) representative of Physics, University of Kentucky August 2023 - August 2024
- Graduate Student Congress (GSC) Conference Award April 2024
- Huffaker Travel Scholarship, Department of Physics & Astronomy, University of Kentucky July 2022, April 2024
- Departmental fellowship for graduate students with an outstanding curriculum August 2017 - May 2019
- Max Steckler Fellowship, Graduate School Fellowship, University of Kentucky August 2018

## VOLUNTEERING

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- **Raleigh International** Gorkha, Nepal  
*Venturer* July 2016 - August 2016
  - Created a simple webpage using online tools and successfully raised £2000 within two days to support a charity program aiding the earthquake-affected village of Chuwatar, Nepal.
  - Contributed to the construction of sanitary installations, water purification systems, and the laying of water pipelines, including excavating the foundation for a water reservoir to improve local living conditions and ensure a reliable clean water supply.
- **Beijing Youngs Group Public Relation Planning Co., Ltd.** Shenzhen, China  
*Volunteer Docent, Intel Developer Forum 2015* August 15, 2015 - August 21, 2015
  - Selected as one of the top 10 out of 500 volunteers and recognized as an “Exceptional Volunteer”.