

Ruby Aoshuang Shi

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Education

Ph.D. in physics, Stanford University	2023/09
<i>Thesis: A study of two-dimensional superconductors with scanning SQUID microscopy</i>	
B.S. in physics with a minor in mathematics, UCLA	2016/08
<i>Magna Cum Laude with departmental highest honors</i>	

Research Experience

Postdoctoral scholar - Diamond nitrogen-vacancy center microscopy	2023/10 – Present
<i>Du group, Georgia Tech</i>	<i>Atlanta, GA</i>
<ul style="list-style-type: none">• Benchmarking imaging sensitivity and spatial resolution of a microwave-driven hexagonal boron nitride defects microscope• Improved the optically detected magnetic resonance contrast of an hBN ensemble by a factor of 10• Obtained static magnetic stray field map of a magnetic tunnel junction in various magnetic fields	
Graduate research assistant - Magnetic imaging of ferromagnetic flakes	2023/07 – 2023/09
<i>Goldhaber-Gordon group, Stanford</i>	<i>Stanford, CA</i>
<ul style="list-style-type: none">• Established procedures to locate and image small mesoscopic magnetic flakes• Imaged static and dynamic magnetism in a magnetic topological material, MnBi_2Te_4	
Graduate research assistant - Magnetic (SQUID) scanning microscopy	2017/01 – 2023/06
<i>Moler group, Stanford</i>	<i>Stanford, CA</i>
<ul style="list-style-type: none">• Performed magnetic microscopy of bulk and thin film high-temperature superconductors including cuprates, nickelates, and pnictides• Magnetically imaged 2D VdW monolayers and twisted few-layer heterostructures• Numerically simulated the superfluid density distribution in superconductors with defects to understand the susceptibility response and Lorentz force on vortices• Lowered the SQUID noise by a factor of 10 to reveal Pearl vortices in thin-film superconductors• Implemented software and performed electrical transport on superconducting devices, magnetic tunnel junctions, and VdW heterostructures such as WTe_2 and twisted graphenes• Calibrated and improved the electron temperature in a dilution refrigerator with a quantum dot• Designed a cryogenic scanning cage to load air-sensitive samples in a glovebox	
Graduate research assistant - Optical Kerr magnetometer	2016/09 – 2016/12
<i>Kapitlnik group, Stanford</i>	<i>Stanford, CA</i>
<ul style="list-style-type: none">• Measured the polar Kerr response of a heavy Fermion superconductor $\text{PrOs}_4\text{Sb}_{12}$	
Undergraduate research assistant - Crystal synthesis	2014/09 – 2016/08
<i>Ni group, UCLA</i>	<i>UCLA, CA</i>
<ul style="list-style-type: none">• Grew single crystals of pnictide superconductors and Dirac semi-metals by the flux method• Characterized samples with electrical transport and X-ray diffraction	

Other Courses

CS 229: Machine Learning

2020/04 - 2020/06

Midterm score: 97.5/100; No letter grade during COVID

Stanford

STATS 191: Introduction to Applied Statistics

2022/01 - 2022/03

Grade: A

Stanford

Publications

1. (In preparation) Benchmarking magnetic imaging sensitivity and spatial resolution of a hexagonal Boron nitride spin defect microscope
Ruby A. Shi, Gerald Q. Yan, Chunhui R. Du
2. (In preparation) Lorentz force on superconducting vortices near line defects
Ruby A. Shi
[Draft](#)
3. (In preparation) Inferring anisotropy in superconducting infinite-layer nickelate from vortices and local diamagnetic screening
Ruby A. Shi, Kyuho Lee, Bai Yang Wang, Yusuke Iguchi, Harold Y. Hwang, and Kathryn A. Moler
4. (Editor's suggestion) Scanning SQUID study of ferromagnetism and superconductivity in infinite-layer nickelates
Ruby A. Shi*, Bai Yang Wang, Yusuke Iguchi, Motoki Osada, Kyuho Lee, Berit H. Goodge, Lena F. Kourkoutis, Harold Y. Hwang, and Kathryn A. Moler
[Phys. Rev. Materials 8, 024802 \(2024\)](#)
5. Observation of superconducting vortices carrying a temperature-dependent fraction of the flux quantum
Yusuke Iguchi, **Ruby A. Shi**, Kunihiro Kihou, Chul-Ho Lee, Mats Barkman, Andrea L. Benfenati, Vadim Grinenko, Egor Babaev, and Kathryn A. Moler
[Science 380, 1244-1247 \(2023\)](#)
6. Magnetotransport properties of the single-crystalline nodal-line semimetal candidates CaTX ($T=\text{Ag}, \text{Cd}$; $X=\text{As}, \text{Ge}$)
Eve Emmanouilidou, Bing Shen, Xiaoyu Deng, Tay-Rong Chang, **Aoshuang Shi**, Gabriel Kotliar, Su-Yang Xu, and Ni Ni
[Phys. Rev. B 95, 245113 \(2017\)](#)
7. Effect of interlayer coupling on the coexistence of antiferromagnetism and superconductivity in Fe pnictide superconductors: A study of $\text{Ca}_{0.74}\text{La}_{0.26}(\text{Fe}_{1-x}\text{Co}_x)\text{As}_2$ single crystals
Shan Jiang, Lian Liu, Michael Schütt, Alannah M. Hallas, Bing Shen, Wei Tian, Eve Emmanouilidou, **Aoshuang Shi**, Graeme M. Luke, Yasutomo J. Uemura, Rafael M. Fernandes, and Ni Ni
[Phys. Rev. B 93, 174513 \(2016\)](#)

Conference Presentations

1. Direct observation of vortices in infinite-layer nickelate superconductors
R Shi, K Lee, BY Wang, Y Iguchi, H Hwang, K Moler
APS March Meeting Abstracts 2023, S19. 006

2. Coexistence of ferromagnetism and superconductivity in infinite-layer nickelates
R Shi, BY Wang, Y Iguchi, M Osada, K Lee, H Hwang, K Moler
 APS March Meeting Abstracts 2022, T57. 005
 Talk [link](#)
3. Study of over-doped thin film LSCO with scanning SQUID microscopy
R Shi, C Adamo, J Kirtley, JS Dodge, K Moler
 APS March Meeting Abstracts 2019, R08. 013
 Talk [slides](#)
4. SQUID imaging of edge magnetization and weak local diamagnetism in un-doped Ba122
R Shi, J Palmstrom, J Kirtley, H Noad, K Moler, I Fisher
 APS March Meeting Abstracts 2018, A14. 013
 Talk [slides](#)

Other Conference Contributions

1. Observation of superconducting vortices carrying a temperature-dependent fraction of the flux quantum
 Y Iguchi, **R Shi**, K Kihou, CH Lee, M Barkman, A Benfenati, V Grinenko, E Babaev, K Moler
 APS March Meeting Abstracts 2023, D28. 004
2. Imaging dissipative current in superconducting Niobium film using scanning SQUID susceptometry
 E Mueller, J Kirtley, **R Shi**, H Man, K Moler
 APS March Meeting Abstracts 2023, G49. 011
3. Transport and thermodynamic properties of Dirac antiferromagnetic CuMnAs single crystals
 N Ni, E Emmanouilidou, H Cao, B Shen, J Xing, **A Shi**
 APS March Meeting Abstracts 2017, S37. 015
4. Transport properties and ARPES measurements of the Dirac line-node semimetals CaTX
 E Emmanouilidou, B Shen, **A Shi**, N Ni, C Liu, X Deng, G Kotliar, S Xu
 APS March Meeting Abstracts 2017, X44. 003
5. Time Reversal Symmetry of A and B phases of PrOs₄Sb₁₂
 E Levenson-Falk, E Schemm, **R Shi**, MB Maple, A Kapitulnik
 APS March Meeting Abstracts 2017, H39. 012
6. The Interplay of Fe and Ce Magnetism in Ca_{0.71} Ce_{0.29}(Fe_{1-x}Cox)As₂ single crystals
 S Jiang, L Liu, H Cao, W Tian, E Emmanuelidu, **A Shi**, Y Uemura, N Ni
 APS March Meeting Abstracts 2016, X11. 004

Awards & Honors

EDGE Doctoral Fellowship

Office of the vice provost for graduate education, Stanford

2016 - 2018

Magna Cum Laude

UCLA

2016

Hong Kong electric company award for outstanding physics student

Hong Kong Baptist University

2015

Teaching & grading

PHYS 44 Electricity and magnetism lab <i>Physics department</i>	2019/04 – 2019/06 <i>Stanford</i>
PHYS 45 Light and heat <i>Physics department</i>	2017/09 - 2017/12 <i>Stanford</i>
PHYS 44 Electricity and magnetism lab <i>Physics department</i>	2017/04 - 2017/06 <i>Stanford</i>
PHYS 115C Quantum mechanics <i>Physics department</i>	2016/04 - 2016/06 <i>UCLA</i>

Leadership & Activities

Community Associate <i>Escondido Village</i> <ul style="list-style-type: none">Organized neighborhood events for on-campus residents	2021/09 – 2022/03 <i>Stanford, CA 94305</i>
Stanford PIE talk speaker <i>Physics department</i> <ul style="list-style-type: none">Gave an introduction about experimental condensed matter physics to prospective PhD students	2020/10 <i>Stanford, CA 94305</i>
Women in science mentor <i>Women community center</i> <ul style="list-style-type: none">Mentored female undergraduate students in STEM	2019/09 - 2021/06 <i>Stanford, CA 94305</i>
Undergrad summer research facilitator <i>Physics department</i> <ul style="list-style-type: none">Gauged physics undergrad students through research	2019/06 - 2019/09 <i>Stanford, CA 94305</i>
EDGE mentor <i>Office of the vice provost for graduate education</i> <ul style="list-style-type: none">Mentored first-year EDGE fellows	2018/09 - 2019/06 <i>Stanford, CA 94305</i>
Physics new graduate student mentor <i>Physics department</i> <ul style="list-style-type: none">Mentored first-year physics PhD students	2017/09 - 2019/06 <i>Stanford, CA 94305</i>

Specialized Skills

Programming Languages: Python (scientific programming and simulation), Matlab (data processing), R (regression on large datasets)
Designing: Solidworks (Hardware drawing and simulation), Eagle (Printed circuit board design), KLayout (Device design for electron beam-/photo-lithography)
Experimental techniques: Cryogenic-temperature refrigerators, Scanning electron microscopy, Focused ion beam, Superconducting quantum interference device microscopy, Lab electronics, Electrical transport measurements, Radio-frequency drive of optically active defects
Languages: English (Fluent), Mandarin (Native), Cantonese (Working proficiency)