Yun-Yi Pai

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Education

University of Pittsburgh, Pittsburgh, Pittsburgh, PA
Ph.D. in Physics, 2020. (Expected)
Thesis: Superconductivity and Mesoscopic Physics at $LaAlO_3/SrTiO_3$
Supervisor: Jeremy Levy
- Observed "1D nature" of the superconductivity at $LaAlO_3/SrTiO_3$
- Proposed a possible source of superconductivity in $SrTiO_3$ (a 50-year puzzle)
- Investigate superconductivity in 1D Zigzag nanowires
- Characterize electron waveguides, single electron transistors
- Work on instrumentation of milli-Kelvin scanning probe microscope

Cornell University, Ithaca, NY
Master of Science in Applied Physics, 2014.
Thesis: "Investigation and Perturbation of the Optical Properties of the Single Defects in Zinc Oxide"
Supervisor: Gregory David Fuchs

Visiting, Internship

Pennsylvania State University, State College, PA
July. 2019 - present
Supervisor: Long-Qing Chen
Model the ferroelastic morphology of $SrTiO_3$, using phase-field methods with High-Performance Computing (HPC) system.

Oak Ridge National Lab, Oak Ridge, TN
Sep. 2019 - present
Supervisor: Benjamin J. Lawrie and Ho-Nyung Lee
MilliKelvin optical characterization of $SrTiO_3$.

Honors

Dean's Tuition Scholarship 2020 Spring
Kenneth P. Dietrich School of Arts & Sciences Predoctoral Fellowship, 2019 Fall
Andrew Mellon Predoctoral Fellowship 2018-2019
Kenneth P. Dietrich School of Arts & Sciences Fellowship 2014-2015

Teaching

University of Pittsburgh, Pittsburgh, PA
Teaching Assistant
PHYS 0212 Introduction to Laboratory Physics, Jan. 2019 - Apr. 2019
PHYS 1426 Modern Physics Laboratory, Jan. 2018 - Apr. 2018
PHYS 0175 Basic Physics for Science and Engineering II, May 2015 - Jun. 2015
My website for PHYS 0175 http://www.pitt.edu/ yup7/

Cornell University, Ithaca, NY
Lab Assistant
AEP 2640 Computer Instrumentation Design, Aug. 2013 - Dec. 2013

Publications

Yun-Yi Pai, Hyungwoo Lee, Jung-Woo Lee, Anil Annadi, Guanglei Cheng, Shicheng Lu, Michelle Tomczyk, Mengchen Huang, Chang-Beom Eom, Patrick Irvin, Jeremy Levy, "One-Dimensional Nature of Pairing and Superconductivity at the $LaAlO_3/SrTiO_3$ Interface." *Phys. Rev. Lett.* **120**, 147001 (2018).

Yun-Yi Pai, Anthony Tylan-Tyler, Patrick Irvin, Jeremy Levy, "Physics of $SrTiO_3$-based heterostructures and nanostructures: a review." 2018 *Rep. Prog. Phys.* **81** 036503.

L. Chen, J. Li, Y. Tang, **Y-Y Pai**, Y. Chen, N. Pryds, P. Irvin and J. Levy, "Extreme reconfigurable nanoelectronics at the $CaZrO_3/SrTiO_3$ interface." *Advanced Materials*, **2018**, 1801794.

Yun-Yi Pai, Anthony Tylan-Tyler, Patrick Irvin, Jeremy Levy, "$LaAlO_3/SrTiO_3$: a tale of two magnetisms.", in Vol. 2, Sec. 5 of "Spintronics Handbook: Spin Transport and Magnetism, 2nd ed" by CRC Press (2019).

N. R. Jungwirth, **Y. Y. Pai**, H. S. Chang, Evan. R. MacQuarrie, K. X. Nguyen, and G. D. Fuchs, "A single-molecule approach to ZnO defect studies: single photons and single defects." *J. Appl. Phys.* **116**, 043509 (2014).

Yun-Yi Pai, Megan Briggeman, Hyungwoo Lee, Jung-Woo Lee, Xiaoxing Cheng, Muqing Yu, Mengchen Huang, Jianan Li, Chang-Beom Eom, Long-Qing Chen, Patrick Irvin, Jeremy Levy, "Superconductivity in 1D Zigzag Nanowires", *in preparation.*

Muqing Yu, **Yun-Yi Pai**, Dengyu Yang, Joe Albro, Kitae Eom, Jungwoo Lee, Chang-Beom Eom, Patrick Irvin, Jeremy Levy, "Shot-Noise Measurements of Waveguides with Attractive Electron-Electron Interactions", *in preparation.*

Dengyu Yang, **Yun-Yi Pai**, Yuhe Tang, Yang Hu, Hyungwoo Lee, Jung-Woo Lee, Chang-Beom Eom, Patrick Irvin, Jeremy Levy, "Surface Acoustic Wave Generation and Detection on $LaAlO_3/SrTiO_3$", *in preparation.*

Invited Talks

Materials Science Seminar, Penn State University, State College, PA. 11/19/2019.
Oak Ridge National Lab, Oak Ridge, TN. 8/29/2019.

Conference Talks

Yun-Yi Pai, Megan Briggeman, Hyungwoo Lee, Jung-Woo Lee, Mengchen Huang, Jianan Li, Chang-Beom Eom, Patrick Irvin, Jeremy Levy, "Superconductivity in 1D Zigzag Nanowires", 2019 APS March Meeting, P09.14.

Yun-Yi Pai, Hyungwoo Lee, Jung-Woo Lee, Anil Annadi, Guanglei Cheng, Shicheng Lu, Michelle Tomczyk, Mengchen Huang, Chang-Beom Eom, Patrick Irvin, Jeremy Levy, "One-Dimensional Nature of Pairing and Superconductivity at the $LaAlO_3/SrTiO_3$", 2018 Materials and Mechanisms of Superconductivity (M2S-2018), Beijing, Th-S48-05.

Yun-Yi Pai, Hyungwoo Lee, Jung-Woo Lee, Anil Annadi, Guanglei Cheng, Shicheng Lu, Michelle Tomczyk, Mengchen Huang, Chang-Beom Eom, Patrick Irvin, Jeremy Levy, "One-Dimensional Nature of Pairing and Superconductivity at the $LaAlO_3/SrTiO_3$", 2018 APS March Meeting, B30.12.

Yun-Yi Pai, Anthony Tylan-Tyler, Patrick Irvin, Jeremy Levy, "$LaAlO_3/SrTiO_3$: a tale of two magnetisms", 2017 APS March Meeting, A37a.12.

Yun-Yi Pai, Dong-Wook Park, Mengchen Huang, Anil Annadi, Hyungwoo Lee, Zhenqiang Ma, Chang-Beom Eom, Patrick Irvin, Jeremy Levy, "Vertical gating of sketched nanodevices", 2016 APS March Meeting, S24.3.

Yun-Yi Pai, Mengchen Huang, Hyungwoo Lee, Chang-Beom Eom, Patrick Irvin, Jeremy Levy, "$LaAlO_3/SrTiO_3$ field-effect nanodevices using in-situ-grown Au top gates", 2015 APS March Meeting, G13.4.

Service

Journal Review
ACS Nano Letter. Sep. 2019 - Present

Outreach
Lab tour For students from Taylor Allderdice High School. 2015, 2016, 2017
Investing Now! Science demo for students from under-represented groups. 2017

Expertise

Quantum Transport Measurements
Fabricate (conductive-AFM lithography) and characterize (5 years): quantum dots, electron waveguides, superconducting nanowires.

Instrument troubleshoots and maintenance: Quantum Design PPMS (4 years as the superuser) with experience on Quantum Design Vibration Sampling Magnetometry (PPMS-VSM) and Quantum Design dilution refrigerator (PPMS-DR).
Dilution refrigerators: Leiden CF900 (3 years as the superuser).
Helium leak detection: Adixen ASM 340, Inficon UL 1000.

Scanning Probe Microscopy
Asylum Research MFP-3D (>1,000 hours of usage; 2 years as the superuser), Asylum Research Cypher. Nanomagnetics milliKelvin-Scanning Probe Microscope (mK-SPM) (> 3 years).

C-AFM lithography. Setup the c-AFM lithography for electron waveguides with mK-SPM.

Confocal Microscopy and Single-Photon Characterization
Built a confocal microscope onto Asylum Research MFP-3D. Used time-correlated single-photon counting to characterize single photon source in ZnO. MilliKelvin Confocal Microscopy (mK-CFM).

Programming
GitHub: https://github.com/yypai
Python: data analysis and multi-index manipulation (Numpy, Scipy and Pandas), visualization (matplotlib, plot.ly), website (Django), interfacing instruments (PyVisa), machine learning (scikit-learn, lgbm), deep learning (Keras, tensorflow 2.0).

LabVIEW: NI-DAQmx, JKI state machine, etc; Mathematica; bash, zsh.

Database Management
https://yypai.github.io/database.html
I setup and manage (for 5 years) a lab-wide database in our research group. It collects the stats for various instruments of the lab as time series. It has now about 650 time-series and size about 400 GB. The database has successfully helped us troubleshoot our lab instruments numerous times.

CAD, Modeling and graphical design, multimedia
AutoCAD, Blender (my gallery: https://www.behance.net/yypai),
Pad2Pad (PCB design), Illustrator, Photoshop, InDesign, Lightroom, machine shop.