

Pei-Zhu Lai

Applicant for the doctoral program in physics, fall 2024
Curriculum Vitae

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Education













- Sep 2018 - Aug 2020 **MS in Physics**, *National Central University*, Zhong-li, Taiwan
GPA: 4.00/4.00
Supervisor: Professor Chia-Ming Kuo
MS Thesis: Jet Performance at the Circular electron-positron Collider 
- Sep 2014 - Aug 2018 **BS in Physics**, *National Central University*, Zhong-li, Taiwan
GPA: 3.43/4.00
Supervisor: Professor Chia-Ming Kuo

Research Experience

- Sep 2018 - Aug 2020 **Research Assistant (part-time)**, *National Central University*, Zhong-li, Taiwan,
Supervisor: Professor Manqi Ruan and Professor Chia-Ming Kuo
- Participated in significant contributions at the Circular Electron-Positron Collider (CEPC), encompassing the comprehensive evaluation of jet angular and energy resolution, precise calibration of jet energy, assessment of boson mass resolution, measurement of W-mass, advancement in thrust clustering algorithms, and the development of an methodology for the separation of four jets events.
- Jun 2016 - Sep 2018 **Undergraduate Research Assistant (part-time)**, *National Central University*, Taiwan,
Supervisor: Professor Manqi Ruan and Professor Chia-Ming Kuo
- Conducted jet energy regression studies at the Compact Muon Solenoid (CMS) experiment, analyzed the detector acceptance at CEPC, and the jet energy resolution at CEPC.
- Jul - Sep 2017, 2018, 2019 **Summer Internship (full-time)**, *Institute of High Energy Physics*, Beijing, China
Supervisors: Professor Manqi Ruan, Associate Professor Zhijun Liang, Associate Professor Gang Li, and Professor Chia-Ming Kuo
- Collaborated on the aforementioned CEPC research topics in conjunction with my supervisors.

Publications

☆ indicates I am the first author of the paper

- 6 **Optimization of tracker configuration for the CEPC**, (2022) *JINST* 17 P11016,
10.1088/1748-0221/17/11/P11016, arXiv:2209.00397
- ☆ 5 **Jet performance at the Circular electron-positron Collider**, (2021) *JINST* 16 P07037,
10.1088/1748-0221/16/07/P07037, arXiv:2104.05029
- 4 **Data-taking strategy for the precise measurement of the W-boson mass with a threshold scan at circular electron positron colliders**, (2020) *Eur. Phys. J. C* 80, 66 ,
10.1140/epjc/s10052-019-7602-x, arXiv:1812.09855
- 3 **Precision Higgs Physics at CEPC**, (2019) *Chinese Phys. C* 43 043002 ,
10.1088/1674-1137/43/4/043002, arXiv:1810.09037
- 2 **CEPC Conceptual Design Report: Volume 2 - Physics & Detector**, (2018) *IHEP-CEPC-DR-2018-02*, *IHEP-EP-2018-01*, *IHEP-TH-2018-01*,
10.48550/arXiv.1811.10545, arXiv:1811.10545
- 1 **Reconstruction of physics objects at the Circular Electron Positron Collider with Arbor**, (2018) *Eur. Phys. J. C* 78, 426 ,
10.1140/epjc/s10052-018-5876-z, arXiv:1806.04879

Internal Analysis Notes

CEPC Collaboration

- 3 **Precision Higgs Physics at CEPC**, (2020), *IHEP-CEPC-DR-200-v3*
- 2 **Jet Reconstruction at CEPC**, (2020), *IHEP-CEPC-DR-164-v2*
- 1 **Physics Impact of the Solid Angle Coverage at CEPC**, (2017), *IHEP-CEPC-DR-165-v1*

Awards

- 2020 **The Most Influential Paper Award of Chinese Physics Society**, *Chinese Physical Society (CPS)*
○ Awarded to the paper entitled "Precision Higgs physics at the CEPC", Chinese Physics C.
- 2020 **Honorable Mention of Oral Presentation in Annual Meeting**, *Physical Society of Taiwan (TPS)*
○ Awarded to my oral presentation entitled "The performance of jet reconstruction and distinguishment among multi-jet events at CEPC."
- 2019 **FOCI Fiber Optic Communications, Inc. Scholarship**, *National Central University*
○ Provision of financial support enabling students to conduct research and participate in international conferences.
- 2018 **SYSAGE Technology Scholarship**, *National Central University*
○ Provision of financial support enabling students to conduct research and participate in international conferences.
- 2018 **Honorable Mention of Undergraduates Student Thesis Award**, *Physical Society of Taiwan (TPS)*
○ Awarded to my contribution in the paper entitled "Reconstruction of physics objects at the Circular Electron Positron Collider with Arbor", *Eur. Phys. J. C*.
- 2017 **Undergraduates Student Research Scholarship**, *Ministry of Science and Technology (MOST)*
○ Provision of financial support to facilitate students' educational pursuits and research endeavors.
- 2016 **The Most Favorite Talk**, *National Central University*
○ The outcome of the presentation of my original project, the "Vortex Ring," was determined by the votes from a class of students at The Affiliated Zhongli Senior High School of National Central University (CLHS).

Presentations

Oral Presentations

- Jul 2020 **Differential Jet Performance at CEPC**, *Online mini-workshop on a detector concept with a crystal ECAL, IHEP, Beijing, China*, [↗](#) / [📄](#)
- Jan 2020 **The Performance of Jet Reconstruction and Distinguishment among Multi-jet Events at CEPC**, *Annual Meeting of the Physical Society of Taiwan, National Pingtung University, Pingtung, Taiwan*, [↗](#) / [📄](#)
- Nov 2019 **Jet Response at CEPC**, *The 2019 International Workshop on the High Energy Circular Electron Positron Collider, IHEP, Beijing, China*, [↗](#) / [📄](#)
- Oct 2019 **Jet Reconstruction Performance & Distinguish between Multi-jet Events**, *International Workshop for Future Linear Colliders 2019 (LCWS2019), Sendai, Japan*, [↗](#) / [📄](#)
- Jul 2019 **Jet Performance at CEPC**, *The CEPC Physics Detector Workshop, Peking University, Beijing, China*, [↗](#) / [📄](#)
- Nov 2018 **W-mass Measurement in Future Lepton Collider**, *The 2018 International Workshop on the High Energy Circular Electron Positron Collider, IHEP, Beijing, China*, [↗](#) / [📄](#)
- Nov 2018 **Jet Energy Scale & Jet Energy Calibration at CEPC**, *The 2018 International Workshop on the High Energy Circular Electron Positron Collider, IHEP, Beijing, China*, [↗](#) / [📄](#)
- May 2018 **Performance of Jets at CEPC**, *Taiwan Korea joint workshop on particle physics, National Central University, Zhong-li, Taiwan*, [↗](#) / [📄](#)
- May 2017 **Jet Energy Scale & Jet Energy Resolution at CEPC**, *The 2017 International Workshop on the High Energy Circular Electron Positron Collider, IHEP, Beijing, China*, [↗](#) / [📄](#)

Jun 2016 **Vortex Ring**, *Presentation for students from The Affiliated Zhongli Senior High School of National Central University (CLHS), National Central University, Zhong-li, Taiwan*, [📄](#)

Poster Presentations

Jul 2019 **Reconstruction of Physics Objects at the Circular Electron Positron Collider with Arbor**, *European Physical Society Conference on High Energy Physics (EPS), Ghent, Belgium*, [📄](#)

Jul 2019 **Performance of Jets at the Higgs Factory, CEPC**, *European Physical Society Conference on High Energy Physics (EPS), Ghent, Belgium*, [📄](#)

Jan 2019 **Performance of Jets at the Higgs Factory, CEPC**, *Annual Meeting of the Physical Society of Taiwan, National Chiao Tung University, Hsinchu, Taiwan*, [📄](#)

Jul 2018 **Jet Reconstruction at CEPC**, *39th International Conference of High Energy Physics (ICHEP), COEX, Seoul, Korea*, [📄](#)

Jun 2018 **Jet Reconstruction at CEPC**, *Annual Meeting of the Physical Society of Taiwan, National Central University, Zhong-li, Taiwan*, [📄](#)

Jan 2018 **Jet Reconstruction at CEPC**, *Annual Meeting of the Physical Society of Taiwan, National Taiwan University, Taipei, Taiwan*, [📄](#)

Jun 2017 **Physics Impact of Solid Angle Coverage at CEPC**, *Annual Meeting of the Physical Society of Taiwan, National Central University, Zhong-li, Taiwan*, [📄](#)

Jan 2017 **The use of multivariate techniques for the energy of b-quark jets**, *Annual Meeting of the Physical Society of Taiwan, Tamkang University, New Taipei City, Taiwan*, [📄](#)

Jun 2016 **Vortex Ring**, *Annual Meeting of the Physical Society of Taiwan, National Central University, Zhong-li, Taiwan*, [📄](#)

Other Activities

Aug 2019 **Weihai High Energy Physics School (WHEPS)**, *Shandong, China*, [🔗](#)

○ Mainly contributed to final report slides entitled "Chargino and Neutralino Searches at LHC."

July 2019 **CERN**, *Geneva, Switzerland*

○ One-day visit

Jul 2018 **International Summer school on TeV Experimental Physics (iSTEP)**, *Wuhan University, Wuhan, China*, [🔗](#)

○ Presented the final report for our group.

Gap Years

Aug 2021 - Present Dedicated a period of time to engage in focused study and preparation for admission into a Ph.D. program.

Aug 2020 - Aug 2021 Concluded the manuscript titled "Jet Performance at the Circular Electron-Positron Collider" and proceeded with its publication.

Teaching Experience

Sep 2018 - Jul 2020 **Teaching assistant; Experimental Method and Experimental Physics**, *Professor Chia-Ming Kuo, National Central University, Zhong-li, Taiwan*

Fourth Semester: 2 Projects: Vortex Ring and Measurement of Liquid Surface Tension with Acoustic Levitation

○ The "Vortex Ring" team, which was a revised version of my original project, secured the top position in the final presentation among students from The Affiliated Zhongli Senior High School of National Central University (CLHS), receiving the highest number of votes.

○ The group working on the "Measurement of Liquid Surface Tension with Acoustic Levitation" achieved the second highest number of votes in the same final presentation.

Third Semester: 2 Projects: Sand Pendulum and Torsional Pendulum, Bipolar Junction Transistor (BJT), Field-effect Transistor (FET)

- The "Torsional Pendulum" team received an Honorable Mention for the Poster Award at the Annual Meeting of the Physical Society of Taiwan (TPS) in the year 2020.
- The photograph depicting the experimental pendulum from the "Torsional Pendulum" team was chosen for publication in the Chinese version of Scientific American, in the June 2020 issue.

Second Semester: RC Circuit DC/AC, RLC Circuit DC/AC, Operational Amplifier (OPA), Electronic Filters

First Semester: Light Intensity, Light Gate, Simple Harmonic Motion (SHM) Experiment, Heavy Machining (Dench type lathe; milling, sawing, and drilling machines; and tap for nuts) (children's toy machines), Basic Data Analysis, Double-slit Experiment, 3D Printer (X'mas Tree), Temperature Control

Feb 2016 - Feb 2017 **Remedial Education Teacher; Elementary Mathematics,**
Taoyuan City Da Luen Elementary School, Zhong-li, Taiwan

- The remedial educational program initiated by the YongLin Education Foundation is guided by the noble aim of offering both educational and financial assistance to students originating from economically disadvantaged backgrounds, who confront obstacles in achieving satisfactory academic performance. I had the distinct privilege of wholeheartedly participating in this undertaking, committing two hours on two separate occasions each week to extend my support to these kids. My involvement encompassed aiding them in the successful completion of their homework assignments, as well as meticulously addressing their gaps in mathematical comprehension.

Leadership

Student Dormitory Committee,
Dormitory 13, National Central University, Zhong-li, Taiwan

Sep 2016 - Aug 2017 **Resident Caption**

- Distributing and collecting keys from residents, conducting presentations during residential meetings to remind residents of regulations, assisting for residential forums, regularly inspecting refrigerator cleanliness with the help of resident assistants, inspecting room conditions at the end of each semester, creating leaflets to inform residents about dormitory closing regulations, assisting emergency situation (e.g., calling an ambulance for a resident with a heartache or applying first aid for a bicycle injury)

Sep 2015 - Aug 2016 **Resident Assistant**

- Distributing and collecting keys from residents, regularly cleaning refrigerator, inspecting room conditions at the end of each semester, verifying residential IDs, and assisting for residential meeting and forums

Skills

Languages Chinese (native), English (fluent), Japanese (beginner)
Programming C, C++, ROOT, Python, Linux, HTCondor, Bash, LabVIEW (beginner), LaTeX