

JONGWON LIM

Seoul, Republic of Korea

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Research Interests

High Energy Physics Experiment, Top & Higgs Physics, Tau Lepton, Machine Learning

Education

Mar.2020 - Aug.2022
Seoul, Republic of Korea

Master of Science in Physics, Hanyang University

- Advisor: Prof. Tae Jeong Kim
- Dissertation: "Search for charged lepton flavor violation in top quark sector with hadronic tau final state using CMS Run 2 data at $\sqrt{s} = 13$ TeV" [[pdf](#)]
- Honored with a Best Dissertation Award.

Mar.2016 - Feb.2020
Seoul, Republic of Korea

Bachelor of Science in Physics, Hanyang University

- Dual degree: Bachelor of Science in Mechanical Engineering
- Advisor: Prof. Tae Jeong Kim
- Bachelor's Thesis: "Study of identification of b-jets in the $t\bar{t}b\bar{b}$ using Deep Neural Networks"

Research Experience

Jan.2020 - Aug.2022
Genève, Switzerland

Search for the charged lepton flavour violation (cLFV) in the top quark sector using CMS Run2 data

CMS Collaboration, CERN

Team Leader: Prof. Tae Jeong Kim

- Led the analysis with generating simulation samples for the cLFV events adopting the Standard Model effective field theory (SMEFT) model.
- Analyzed the CMS Run2 data using ROOT, C++, and Python by comparing with simulated data using GEANT4.
- Applied deep neural network algorithms to identify rare cLFV signal events from the SM backgrounds using kinematic variables from top quark reconstruction for the cLFV and SM interactions.
- Set upper limits of cross section and branching fractions of the EFT operators for the cLFV interaction in 5σ confidence level with systematic and uncertainty studies.

Feb.2020 - Jul.2022
Seoul, Republic of Korea

Learning to increase matching efficiency in identifying additional b-jets in $t\bar{t}b\bar{b}$ process

Elementary Particle Physics Laboratory, Hanyang University

Advisor: Prof. Tae Jeong Kim

- Interdisciplinary study with the Department of Computer Science
- Contributed with generating more than 10M events of $t\bar{t}b\bar{b}$ and $t\bar{t}H(b\bar{b})$ simulated samples in a Monte-Carlo method using MadGraph, MadSpin, Pythia, and Delphes.
- Improved DNN performance for identifying b-jets by optimizing loss function of each nodes, proposing better identification of $t\bar{t}b\bar{b}$ events.

Mar.2019 - Nov.2020
Seoul, Republic of Korea

Identification of additional jets in the $t\bar{t}b\bar{b}$ events by using DNN

Elementary Particle Physics Laboratory, Hanyang University

Advisor: Prof. Tae Jeong Kim

- Initially participated as an undergraduate researcher, learning basic particle properties and data visualization using ROOT for data analysis.
- Learned how to produce simulated events using MadGraph and Delphes and conducted data analysis using C++.
- Improved DNN performance for identification of additional jets by changing nodes and layers of network.

Feb.2020
Seoul, Republic of Korea

The Second MadAnalysis5 workshop on LHC recasting @ Korea

Korea Institute for Advanced Science (KIAS)

Advisor: Prof. Benjamin Fuks, *Sorbonne University, France*

- Team project "Staus in the di-tau plus missing transverse energy channel."
- Learned both theories and experimental view of particle physics.
- Studied tau lepton properties by recasting published analysis using MadAnalysis and simulation samples.

Sept.2019 - Dec.2019
Seoul, Republic of Korea

Design of Collision Warning and Breaking Algorithm using Region-based Convolutional Neural Networks (RCNN)

Parallel Computing Laboratory, Hanyang University

Advisor: Prof. Sang Hwan Lee

- Participated in Mechanical Engineering graduate project for dual degree.
- Led a team project and developed algorithms for real-time object detection with RCNN applicable to two-wheeled robots for practical implementation.
- Won second place in the Mechanical Engineering Design presentation.

Work Experience

Sept.2022 - Jun.2024
Seoul, Republic of Korea

Seoul Metropolitan Fire & Disaster Headquarters

- Completed 3 weeks of basic military training at Korea Army Training Center.
- Served 21 months at Seoul Civil Disaster Experience Center as a social service personnel for Korea military service obligation.
- Learned to cope with emergency situations and help social minorities with embracing diversity and equity.

Publications

- [1] CMS Collaboration, "Search for charged-lepton flavour violation in top quark interactions with an up-type quark, a muon, and a τ lepton in proton-proton collisions at $\sqrt{s} = 13$ TeV," *Accepted for publication in Journal of High Energy Physics*, Apr. 2025. arXiv: 2504 . 08532 [hep-ex]. [Online]. Available: <https://cms-results.web.cern.ch/cms-results/public-results/publications/TOP-22-011/index.html>.
- [2] C. Jang, S. K. Ko, J. Choi, **J. Lim**, Y. K. Noh, and T. J. Kim, "Learning to increase matching efficiency in identifying additional b-jets in the $t\bar{t}b\bar{b}$ process," *The European Physical Journal Plus*, Jul. 2022. DOI: 10.1140/epjp/s13360-022-03024-8.
- [3] **J. Lim**, C. T. Lu, J. H. Park, and J. Park, "Implementation of the ATLAS-SUSY-2018-04 analysis in the MadAnalysis 5 framework (staus in the di-tau plus missing transverse energy channel; 139 fb^{-1})," *Modern physics letters A*, Jan. 2021. DOI: 10.1142/s0217732321410091.

- [4] J. Choi, T. J. Kim, **J. Lim**, J. Park, Y. Ryou, J. Song, and S. Yun, "Identification of additional jets in the $t\bar{t}b\bar{b}$ events by using deep neural network," *Journal of the Korean Physical Society*, Nov. 2020. DOI: [10.3938/jkps.77.1100](https://doi.org/10.3938/jkps.77.1100).

Conferences

- [1] **J. Lim***, and T.-J. Kim, Search for Charged Lepton Flavour Violation in top quark interaction with muon and tau in pp collisions at $\sqrt{s} = 13$ TeV. *2022 KPS Spring Meeting: Korean Physics Society*, Apr. 2022. [Poster session](#)
- [2] J. Choi, S.-Y. Choi, T.-J. Kim, **J. Lim***, J. Song, Y. Ryou, and S. Yun, Search for LFV in top quark sector with charm, muon, and tau final states. *2020 KPS Fall Meeting: Korean Physics Society*, Nov. 2020. [Oral session](#)

* Presenter at a conference

Scholarships & Awards

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| Aug.2022 Hanyang University | The Best Dissertation Award , Dean of Graduate School Selected based on outstanding publications and conference presentations as well as master's dissertation and defense. |
| Mar.2020 - Dec.2021 Hanyang University | Graduate Program Scholarship This scholarship covered tuition payments for 4 academic semesters. |
| Mar.2020 Hanyang University | Han Ki-su Scholarship , Department of Physics Awarded to outstanding undergraduate physics graduates pursuing graduate studies. |
| Feb.2020 Hanyang University | Academic Honor Award , College of Natural Science Graduated bachelor's degree with GPA above 3.75/4.5; Cum Laude |
| Dec.2019 Hanyang University | The 11th Capstone Design Fair , LINC Topic: "Design of Collision Warning and Breaking Algorithm using RCNN." |
| Dec.2019 Hanyang University | Mechanical Engineering Design Project Presentation , 2nd Place Topic: "Design of Collision Warning and Breaking Algorithm using RCNN." |
| Dec.2019 Hanyang University | Natural Science Academic Conference , 2nd Place Topic: "Identification of additional jets in the $t\bar{t}b\bar{b}$ events using Neural Network." |
| Sept.2017 Hanyang University | Hanyang Brain Scholarship , 3rd Place at Department of Physics Academic excellence scholarship (30% tuition reduction) |
| Sept.2017 Hanyang University | Learning Mate Program , 2nd Place Improved understanding of Modern Physics lectures through team-based learning. |

Teaching Experience

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| Mar.2020 - Dec.2021 Seoul, Republic of Korea | General Physics and Experiment 1 and 2 <ul style="list-style-type: none"> • Taught concepts of general physics and experiments in undergraduate level for four semesters. • Total 9 physics experiments were taught per semester and homework sets were graded weekly with Q&A. |
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Professional Membership

Jan.2020 - Aug.2022

Genève, Switzerland

CERN, USER

- Tau Data Quality Monitoring (DQM) graphical user interface development for experimental physics responsibilities (EPR 1 month).
- Made 4 presentations at Tau particle object group (POG).
- Weekly Top mass and properties physics group meeting.
- Access to CERN computing resources and collision data, and offline visit.

Schools

Sept.2021

Virtual, CERN

CMS Data Analysis School

- Basic introduction of high energy physics experiment at the CMS experiment.
- Participated in hands-on session "Search for an excited b quark decaying to a top quark and a W-boson." and made a short presentation.

Dec.2018

Yangpyeong, Rep. of Korea

Winter Camp on Particle Physics, Korea Institute for Advanced Study (KIAS)

- Took lectures about introduction to the Standard Model, cosmology, phenomenology on particle detector and future particle accelerator.
- Participated in team-based learning sessions for ROOT and MadGraph.

Oct.2018

Seoul, Republic of Korea

Fundamentals of Deep Learning for Computer Vision, NVIDIA

- Learned basic visual object identification using CUDA and convolutional neural network (CNN) algorithms.

Skills

- Particle data analysis on Linux using **ROOT**, **C**, **C++**, and **Python**.
- Machine learning using **Keras**, **Tensorflow** and **PyTorch**.
- **Parallel computing** and **cloud computing** for data analysis.
- Collaboration with Git and documentation using **Tex**.
- Production of simulation events using **MadGraph**, **MadSpin**, **Pythia**, and **Delphes**.
- Fluent in speaking and writing in **English**, IELTS 7.5 (test taken Feb. 03 2024)

Extracurricular Activities

Mar.2016 - Feb.2020

Hanyang University

Inertia, Computer club, Department of Physics

Team-based learning for programming languages - Python, C, C++

Mar.2016 - Feb.2020

Hanyang University

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Academic presentation: Introduction to Fluid Dynamics (2019)

Mar.2017 - Feb.2020

Hanyang University

2nd Violin, **Hanaklang**, Hanyang Amateur Orchestra

Participated in weekly orchestra rehearsal.

Sept.2016 - Dec.2016

Seoul, Republic of Korea

Volunteer at Children's Museum of National Folk Museum (30 hours)

Ensured safety for children and managed museum facilities.