Curriculum Vitae

Yongbin Feng

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EMPLOYMENT

- 09/2024 - Present, **Assistant Professor of Physics**
  Texas Tech University, Lubbock, Texas, USA
- 11/2020 - 08/2024, **Postdoctoral Research Associate**
  Fermi National Accelerator Laboratory, Batavia, Illinois, USA

EDUCATION

- **University of Maryland, College Park**, College Park, Maryland, USA
  Ph.D. in Physics, Aug. 2015 - Oct. 2020
- **University of Science and Technology of China**, Hefei, Anhui, China
  B.S. in Physics, Aug. 2011 - Jun. 2015

PROFESSIONAL EXPERIENCE

- Jun. 2024 - Present, Fast Machine Learning Coprocessor Group Coordinator
- Sep. 2023 - Present, CMS Standard Model Group Vector Boson (SMP-V) L3 Convener
- Feb. 2022 - Sep. 2023, CMS Machine Learning Production Group L3 Convener

SELECTED PUBLICATIONS

Publications with leading contributions (more than 30%) in the idea proposal, technical study, paper writing, and review response

- CMS Collaboration, "Search for a resonance decaying to a W boson and a photon in proton-proton collisions at $\sqrt{s} = 13$ TeV using leptonic W boson decays", `arXiv:2406.05737`. Submitted to *JHEP*
- CMS Collaboration, "Portable acceleration of CMS computing workflows with coprocessors as a service", `arXiv:2402.15366`. (Analysis Contact.) Accepted by *Comput. Softw. Big Sci.*
- CMS Collaboration, "Measurement of the inclusive cross sections for W and Z boson production in proton-proton collisions at $\sqrt{s} = 5.02$ and 13 TeV", `arXiv:2408.03744`. (Analysis Contact.) Submitted to *JHEP*
- T. Li et al., "Semi-supervised graph neural networks for pileup noise removal", *Eur. Phys. J. C* **83** (2023) 99, doi: 10.1140/epjc/s10052-022-11083-5, `arXiv:2203.15823`
- A. Apyan et al., "DarkQuest: A dark sector upgrade to SpinQuest at the 120 GeV Fermilab Main Injector", March, 2022. `arXiv:2203.08322`
- Y. Feng, "A New Deep-Neural-Network–Based Missing Transverse Momentum Estimator, and its Application to W Recoil". Doctoral dissertation, University of Maryland, 2020
- CMS Collaboration, "Search for new particles decaying to a jet and an emerging jet", *JHEP* **02** (2019) 179, doi: 10.1007/JHEP02(2019)179, `arXiv:1810.10069`

Publications with involvement in the idea proposal, technical study, paper writing, and review response

- H. Zhao et al., "Graph Neural Network-based Tracking as a Service", Feburary, 2024. arXiv:2402.09633
- CMS Collaboration, "Measurement of the inclusive cross section of Z boson production in pp collisions at $\sqrt{s} = 13.6\,\text{TeV}$", CMS Physics Analysis Summary CMS-PAS-SMP-22-017, CERN, Geneva, 2023
- M. Agarwal et al., "Applications of Deep Learning to physics workflows", June, 2023. arXiv:2306.08106
- S. Liu et al., "Structural Re-weighting Improves Graph Domain Adaptation", in *Proceedings of the 40th International Conference on Machine Learning (ICML)*, volume 202 of *Proceedings of Machine Learning Research*, p. 21778. July, 2023
- P. Harris et al., "Physics Community Needs, Tools, and Resources for Machine Learning", in *2022 Snowmass Summer Study*. March, 2022. arXiv:2203.16255
- C. Papageorgakis et al., "Dose rate effects in radiation-induced changes to phenyl-based polymeric scintillators", *Nucl. Instrum. Meth. A* **1042** (2022) 167445, doi: 10.1016/J.NIMA.2022.167445, arXiv:2203.15923

RESEARCH EXPERIENCE

Postdoctoral research

- Dec. 2020 - Present

  DarkQuest: probing the light dark matter with proton-fixed target experiment at Fermilab
  - Leading the developments and maintenance of the simulation framework and analysis chain. Guiding graduate and undergraduate students on DarkQuest research. Preparing the analysis using the data from the predecessor experiment SeaQuest.
  - Collaborating with the SpinQuest collaboration; studying and improving the displaced track and vertex reconstruction algorithm and performance.
  - Integrated the Electromagnetic calorimeter (EMCal) modules in the simulation package and verified the performance.
  - Participated in and led the data analysis of EMCal test beam at Fermilab in June 2024.

- Jan. 2022 - Present

  Measurements of differential W boson production cross sections
  - Co-leading the measurement of differential W boson production cross section with respect to W boson p_{T}. Analysis in progress. Expected to be released by fall 2024.
  - Working in the CMS W mass measurement team, researching the use of machine-learning-based (ML-based) W recoil estimations and calibrations for W mass measurements, as well as exploring potential improvements to the W mass result from W p_{T} measurement.

- Jan. 2021 - Aug. 2023

  Measurements of inclusive W and Z boson production cross sections
  - Led the measurements of the inclusive W and Z boson production cross sections and their ratios at 13 TeV and 5.02 TeV. Achieved the world's best precision on the cross section ratios between W^+ and W^- and between $\text{W}^\pm$ and Z. Analysis contact; CMS-PAS-SMP-20-004 released in August 2023; paper to be submitted to Journal of High Energy Physics.
  - Collaborating with the Karlsruhe Institute of Technology team and working on the first measurement of the inclusive W and Z boson production cross sections at 13.6 TeV. CMS-PAS-SMP-22-017 released for the measurement of Z boson production cross section in $\text{Z} \to \mu\mu$ channel. The measurement of W boson production cross section in progress.

- Dec. 2020 - Present

  SONIC: Service for Optimized Network Inference with Coprocessors

- Co-leading the study using coprocessors, such as GPUs, FPGAs, and Intelligent Processing Units (IPUs), etc to accelerate ML inference in CMS computing, with the focus on the inference as-a-Service approach
- Co-led the study testing different commercial computing clusters, such as Google Cloud and Amazon Web Services computing clusters, and High Performance Computing centers to accelerate remote CMS production jobs using as-a-Service
- Collaborating with NVIDIA, AMD, and Graphcore software developers on testing and improving the software for ML inference on GPUs and IPUs
- Analysis contact of CMS paper MLG-23-001. The first joint paper between the ML group and the offline and computing group to systematically study the performance of ML computing. Submitted to Computing and Software for Big Science and currently under review.
- Led the study on porting classical domain (non-ML) algorithms into as-a-service. Successfully demonstrated that this approach can run on the GPUs for the high-level trigger, and potentially save the GPU resources by more than 40%
- Collaborating with ATLAS colleagues and working on porting ML and non-ML-based track reconstruction algorithms to as-a-service, to accelerate event reconstruction
- Prepared SONIC tutorials; providing technical support for new postdocs and students

- Jan. 2021 - Present

  Semi-supervised graph neural network for pileup mitigation
  - Collaborating with computer scientists and leading the study on developing semi-supervised graph-neural-network models to train on charged particles for pileup mitigation, which allows the training on real collision data directly, without dependence on simulation
  - Methodology demonstration paper published in Eur. Phys. J. C 83 (2023). Currently leading the algorithm integration into CMS software and performance benchmark in full simulations and real data
  - Collaborated with computer scientists to develop domain adaptation algorithms on graphs and study the performances on the HEP dataset. Paper accepted by ICML

PhD research

- Apr. 2019 - Sep. 2019

  Installation of the CMS Hadronic Calorimeter (HCAL) Barrel Upgrade
  - Test and installation of the read-out modules and electronics for the barrel upgrade of the HCAL subdetector.

- Oct. 2018 - Nov. 2020

  DeepMET development and W recoil studies
  - Development and calibration of the deep-learning-based missing transverse momentum estimator (DeepMET). It achieves the best MET performance, with 10-20% better resolutions than PF and Puppi MET, and more robustness against pileup.
  - Standalone technical paper (JME-24-001) in preparation (Analysis contact).
  - Application of DeepMET in the recoil measurement of the W boson, to reduce the uncertainties of the W mass measurement from the W transverse momentum spectra.

- Jan. 2018 - Oct. 2020

  Search for new particles in the $W\gamma$ final state
  - Search for new particles in the Wγ final state, where W decays leptonically, using full Run-II data collected by CMS.
  - Work on the parametric modelings of signal and backgrounds, systematic uncertainty evaluations, limit settings, and analysis framework maintenance.

  - CMS-PAS-EXO-21-017 released in March 2024. Paper to be submitted to JHEP.

- Oct. 2016 - Feb. 2019

  Search for emerging jets
  - Search for the "dark QCD" model with the "emerging jet" signatures, using 2016 data collected by CMS.
  - Led the study of "emerging jet" tagging variables, event selection criteria, background estimations, and systematic uncertainties.

- Jan. 2016 - Jan. 2018

  Radiation damage study of plastic scintillators
  - Study of scintillator light yields for different materials, using cosmic ray, radioactive sources, and spectrophotometer.
  - Study of the HCAL Endcap radiation damage modeling, including total dose, dose rate, temperature dependence, and other effects during recovery.

- Jun. 2014 - Jul. 2015

  Study of $e^+e^- \to K^+K^-\pi^+\pi^-$ process at BESIII
  - Undergraduate research project: measurement of the cross section of $e^+e^- \to K^+K^-\pi^+\pi^-$ using data collected by the BESIII experiment, and search for possible tetraquark states in this process.

SEMINARS, CONFERENCE TALKS, POSTERS

- *Towards better machine-learning model deployment - Inference as a service*
  Seminar presented at the Fermilab lab-wide AI meetings, Batavia, Illinois, USA, Jun, 2024

- *Recent electroweak precision measurements in CMS*
  Talk presented at the LHC Physics Conference (LHCP 2024), Boston, Massachusetts, USA, June 2024

- *Towards Preciser Examinations of the Standard Model*
  Seminar presented at the HEP Seminars of the University of Maryland, College Park, Maryland, USA, March 2024

- *Portable Acceleration of CMS Production Workflow with Inference as a service*
  Poster presented at the Advanced Computing and Analysis Techniques in Physics Research (ACAT) 2024, Stony Brook, New York, USA, March 2024

- *Towards Preciser Examinations of the Standard Model*
  Seminar presented at the HEP Seminars of Purdue University, West Lafayette, Indiana, USA, February 2024

- *Pushing the Precision Boundary of the Standard Model with Modern Tools*
  Colloquium of Department of Physics and Astronomy at Texas Tech University, Lubbock, Texas, USA, February 2024

- *Low pileup fiducial measurements in CMS*
  Talk presented at the LHC electroweak precision subgroup meeting, CERN, Switzerland, November 2023

- *DarkQuest*
  Seminar presented at Karlsruhe Institute of Technology, Karlsruhe, Germany, July 2023

- *DarkQuest - Probing dark sector with a proton fixed-target experiment at Fermilab*
  Invited talk presented at the 2023 Aspen Conference for Physics, Aspen, Colorado, USA, March 2023

- *Introduction to Graph Neural Networks*
  Seminar presented at the Fermilab lab-wide AI meetings, Batavia, Illinois, USA, November 2022

- *Exa.TrkX inference as-a-service*
  Talk presented at the Fast Machine Learning Workshop, Dallas, Texas, USA, October 2022
- *DarkQuest - Probing dark sector with a proton fixed-target experiment at Fermilab*
  Seminar presented at the SYSU-PKU Particle Physics Forum, Virtual, May 2022.
- *Semi-supervised graph neural network for pileup noise removal*
  Seminar presented at the University of Washington Machine Learning Forum, Virtual, May 2022.
- *DarkQuest - Searching for light dark matter with a proton fixed-target experiment at Fermilab*
  Talk presented at the 2022 Phenomenology Symposium, Pittsburgh, Pennsylvania, USA, May 2022.
- *Semi-supervised machine learning for pileup per particle identification with graph neural networks*
  Talk presented at the 2021 BOOST workshop, Virtual, August 2021.
- *Searching for light dark matter at Fermilab's proton-fixed target experiment: DarkQuest*
  Talk presented at the 2021 Particle Physics and Cosmology Workshop, Norman, Oklahoma, USA, May 2021.
- *Search for emerging jets and other long-lived states with the CMS experiment*
  Seminar presented at Experimental particle physics seminars of the University of Pennsylvania, Philadelphia, Pennsylvania, USA, November 2019.
- *Search for new particles decaying into a jet and an emerging jet*
  Poster presented at the 2019 Winter LHCC meeting Students Poster Session, CERN, Geneva, Switzerland, February 2019.
- *Search for New Physics with Emerging Jets*
  Talk presented at the 2018 APS April Meeting, Columbus, Ohio, USA, April 2018.

TEACHING EXPERIENCE

- *Instructor*, PHYS 3305 Electricy and Magnetism I, Texas Tech University, Fall 2024
- *Lecturer*, Hands-on demo of coprocessors as a service with SONIC at Computational HEP Traineeship Summer School, Fermilab, May 2024
- *Lead Facilitator*, Inference Hands-on session of the CMS Machine Learning Town Hall, CERN, July 2021
- *Lead Facilitator*, MET short exercise of CMS Data Analysis School (DAS) and LPC Hands-on Tutorial Sessions (HATS), Top mass measurement long exercise of CMS DAS 2022, Fermilab, January 2021 - January 2024
- *Facilitator*, Search for structures in the J/ψJ/ψ mass spectrum long exercise of CMS DAS 2024, HH($b\bar{b}b\bar{b}$) long exercise of CMS DAS 2021, Machine Learning Hands-on Advanced Tutorial (HATS) of the LHC Physics Center (LPC) HATS, Fermilab, January 2021 - January 2024
- *Teaching Assistant*, PHYS276 Electronics Lab, 3 sessions, about 40 students, Maryland, Fall 2015
- *Teaching Assistant*, Introduction to Electromagnetism (for first-year physics major undergraduate students), about 90 students, USTC, Spring 2015

SCHOLARSHIPS

- National Endeavor Scholarship, USTC, 2013
- Outstanding Student Scholarship (First Class), USTC, 2013, 2014, 2015
- Industrial Responsibility Scholarship, USTC, 2012

ORGANIZED ACTIVITIES

- Organizer, LPC Physics Forum, 2022 - Present
- Local Organizer, CERN-Fermilab Collider Physics Summer School, 2022