Martin K. H. Kwok

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Work Experience

University of Nebraska-Lincoln, Research Assistant Professor — Batavia, IL — 2025 – present

Fermi National Accelerator Laboratory, Research Associate — Batavia, IL — 2020 – 2025

Education

Ph.D. **Brown University**, Physics — Providence, RI — 2014 – 2020
- Advisor: Prof. Greg Landsberg
- Thesis: Inclusive Search for a Lorentz-Boosted Higgs Boson Decaying into Bottom Quarks

M.Phil. **Chinese University of Hong Kong (CUHK)**, Physics — Hong Kong — 2012 – 2014
- Advisor: Prof. M. C. Chu
- Thesis: Sensitivity study of the Higgs decay channel WH → $\ell\nu b\bar{b}$ using the ATLAS detector in LHC Run II, and study of surface cosmic rays

B.S. **Chinese University of Hong Kong (CUHK)**, Physics — Hong Kong — 2009 – 2012

Professional Experience

TAC-HEP, Collaborator — 2023 – present

LHC Physics Center (LPC), Fermilab, Distinguished Researcher — 2023 – 2024

Center for Computational Excellence (CCE), Member, Portable Parallelization Strategies (PPS) team — 2020 – 2024

LHC Physics Center (LPC), Fermilab, Graduate Scholar — 2019 – 2020

CMS Collaboration, On-call DAQ expert and online software developer, CMS HCAL — 2016 – 2018

Research Highlights — Physics

New CMS triggers for long-lived particles using Muon Detector Showers — 2022 – present
- Developed and commissioned dedicated hardware triggers on muon detector showers, drastically improving CMS acceptance to LLP signatures for LHC Run 3

Long-lived particle searches with Muon Detector Showers — 2020 – present
- Coordinating multiple LLP search efforts using the novel MDS signature
- Set world-best limits on low-mass, long-lived heavy neutral leptons using muon detector showers; published in PRD

Boosted Higgs decaying into bottom quarks — 2019 – 2020
- Performed the inclusive search for Higgs decaying to bottom quarks using boosted jet substructure and machine learning; published in JHEP

Fast machine learning on ASICs — 2019 – 2020
- Designed a quantized autoencoder network to compress HGCAL front-end electronics data, capable of ultra-low-latency on-detector inference

Searches for microscopic black holes and sphalerons — 2016 – 2018
- Performed the first dedicated experimental search for electroweak sphalerons with CMS data; published in JHEP

CMS HCAL online software and DAQ — 2016 – 2018
- Developed Run Control features allowing concurrent commissioning of HCAL detector partitions during the phase-1 upgrade
- Built monitoring tools for debugging HCAL phase-1 front-end communication issues

Research Highlights — Computing

GPU portability for high energy physics reconstruction 2021 – present

- Migrated ~4k lines of CUDA for CMS HCAL energy reconstruction to the Alpaka portability library
- Designed and implemented a track-reconstruction benchmark mini-app (p2r) spanning Kokkos, Alpaka and other portability technologies

Awards

2025 — Breakthrough Prize in Fundamental Physics, CMS collaborations

2020 — Forrest Award for Excellent Work Related to Experimental Apparatus, Brown University

2015 — Award of Excellence as a Graduate Teaching Assistant, Brown University

2013 — Best Teaching Assistant Award, Chinese University of Hong Kong (CUHK)

Teaching and Outreach

2024 — Local organizer, APS Conference for Undergraduate Women and Gender Minorities in Physics (CU*iP), Fermilab

2024 — Lead facilitator for a new long exercise on Muon Detector Showers, CMSDAS, Fermilab. Students won the best presentation award

2023–2024 — Mentor, US-CMS Mentorship Program

2023–2024 — Local facilitator, LPC Hands-on Tutorials (Jets / Trigger), Fermilab

2023 — Instructor, Training to Advance Computational High Energy Physics in the Exascale Era (TAC-HEP)

2023 — Overseas mentor, Chung Chi College Mentor Program, Chinese University of Hong Kong (CUHK)

2020–2023 — Local facilitator, Jets and TTGamma exercises, CMSDAS, Fermilab

2019 — Member of local organizing committee, Saturday Morning Physics, Fermilab

Invited Seminars and Lectures

2026 Feb — Teaching CMS a new trick: novel signature for Long-Lived Particle searches, University of Nebraska-Lincoln, Lincoln, NE

2025 Oct — Teaching CMS a new trick: novel signature for Long-Lived Particle searches, University at Buffalo, Buffalo, NY

2025 Apr — Teaching CMS a new trick: novel signature for Long-Lived Particle searches, Northwestern University, Evanston, IL

2025 Mar — Teaching CMS a new trick: novel signature for Long-Lived Particle searches, Fermilab Wine and Cheese Seminar, Batavia, IL

2023 Sep — Searching for Heavy Neutral Leptons with muon detectors in the CMS experiment, Seminar, Université catholique de Louvain, Louvain-la-Neuve, Belgium

2023 Feb — Introduction to NVIDIA profiling tools: Nsight Systems and Nsight Compute, TAC-HEP GPU/FPGA training module (lecture)

Selected Conference Talks — Physics

2024 Sep — Review of recent searches for Heavy Neutral Leptons in CMS, NuFact 2024, Argonne National Laboratory, IL

2024 Jul — Searches for Heavy Neutral Leptons in CMS, ICHEP 2024, Prague, Czechia

2024 Jul — CMS: HNLs in the muon system, LLP 2024, Tokyo, Japan

2023 May — Non-resonant searches at the TeV scale, LHCP 2023 (plenary)

2022 Nov — Triggering on hadronic showers produced in decays of long-lived particles in CMS muon detectors, IEEE NSS MIC RTSD 2022 (poster)

2022 Oct — What's new for Run 3 for LLPs at CMS?, LLP 12

2020 Jul — Search for boosted Higgs bosons decaying into bottom quark pairs in CMS, BOOST 2020

2019 Aug — VH(bb) and search for boosted ggH → $b\bar{b}$ in CMS, QCD at LHC 2019

Selected Publications — Physics

2026 Sep — CMS Collaboration, Strategy and performance of the CMS long-lived particle trigger program in proton-proton collisions at $\sqrt{s}$ = 13.6 TeV, Phys. Rept. 1205 (2027) 1

2026 Jun — M. Abbott et al., High Multiplicity Trigger for long-lived particles in CMS detector, JINST 21 (2026) P07040

2025 Feb — MAIA Collaboration, MAIA: A new detector concept for a 10 TeV muon collider, arXiv:2502.00181

2024 Jul — CMS Collaboration, Search for long-lived heavy neutral leptons decaying in the CMS muon detectors in proton-proton collisions at $\sqrt{s}$ = 13 TeV, Phys. Rev. D 110 (2024) 012004

2024 May — CMS Collaboration, Review of searches for vector-like quarks, vector-like leptons, and heavy neutral leptons in proton-proton collisions at $\sqrt{s}$ = 13 TeV at the CMS experiment, Phys. Rept. 1115 (2025) 570

2021 May — G. Di Guglielmo et al., A reconfigurable neural network ASIC for detector front-end data compression at the HL-LHC, IEEE Trans. Nucl. Sci. 68 (2021) 2179

2020 Dec — CMS Collaboration, Inclusive search for highly boosted Higgs bosons decaying to bottom quark-antiquark pairs in proton-proton collisions at $\sqrt{s}$ = 13 TeV, JHEP 12 (2020) 085

2019 Jan — CMS Collaboration, Search for low-mass resonances decaying into bottom quark-antiquark pairs in proton-proton collisions at $\sqrt{s}$ = 13 TeV, Phys. Rev. D 99 (2019) 012005

2018 Nov — CMS Collaboration, Search for black holes and sphalerons in high-multiplicity final states in proton-proton collisions at $\sqrt{s}$ = 13 TeV, JHEP 11 (2018) 042

2017 Nov — CMS Collaboration, Search for black holes and other new phenomena in high-multiplicity final states in proton-proton collisions at $\sqrt{s}$ = 13 TeV, Phys. Lett. B 774 (2017) 279

Selected Conference Talks — Computing

2023 May — Application of performance portability solutions for GPUs and many-core CPUs to track reconstruction kernels, CHEP 2023, Norfolk, VA

2022 Oct — Application of portable parallelization strategies for GPUs on track reconstruction kernels, ACAT 2022

2021 Aug — Portable Parallelization Strategies — metrics, IRIS-HEP topical meeting

2021 May — Performance of CUDA unified memory in CMS heterogeneous pixel reconstruction, vCHEP 2021

Selected Publications — Computing

2025 May — M. Atif et al., Packaging HEP heterogeneous mini-apps for portable benchmarking and facility evaluation on modern HPCs, EPJ Web Conf. 337 (2025) 01188

2024 Sep — H. Ather et al., Exploring code portability solutions for HEP with a particle tracking test code, Front. Big Data 7 (2024) 1485344

2023 Jun — M. Atif et al., Evaluating portable parallelization strategies for heterogeneous architectures in high energy physics, arXiv:2306.15869

2022 Mar — M. Bhattacharya et al., Portability: a necessary approach for future scientific software, arXiv:2203.09945 (Snowmass 2021 contribution)

2021 Feb — M. Kortelainen et al., Performance of CUDA unified memory in CMS heterogeneous pixel reconstruction, EPJ Web Conf. 251 (2021) 03035

Full Publication List

Full publication list (1002 papers, 82409 citations): INSPIRE-HEP