Mia Liu

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Employment and Education.

- **Assistance Professor** — **West Lafayette, IN. USA**
  Assistance Professor, CMS Experiment — *Purdue University 2020- Now.*
- **Fermi National Accelerator Laboratory** — **Batavia, IL. USA**
  Postdoctoral Research Associate, CMS Experiment — *Fermilab 2015– 2020.*
- **Duke University** — **Durham, NC. USA**
  PhD, Supervisor: Prof. Al Goshaw. — *2009–2015*
  - Thesis: "Gauge Boson Coupling Measurements in Final States of W Boson Produced with Additional Photons with The ATLAS Detector"
- **Shandong University** — **Jinan, China**
  B.S in Physics, Cumulative GPA: 3.9 — *2005–2009*

Leadership positions, Awards, Scholarships

- **Co-convener for the CMS machine learning production group. 2019 -Now**
- **Coordinator of the Fast Machine Learning co-processor group at Fermilab. 2019- Now**
  Organize regular meetings to discuss activities on using co-processors for fast machine learning inference. 20 to 30 participants on average.
- **CMS LHC Physics Center (LPC) Distinguished Researcher. 2020**
  Awarded highly competitive fellowship to lead searches for heavy triboson production at the LPC at Fermilab and an effort in applying deep learning techniques for track finding in the CMS Level-1 muon trigger and its FPGA implementation.
- **Co-convener for the CMS Standard Model Multiboson Group. 2018-2019**
  Facilitate publication planning by identifying high priority analyses and needs in delivering these results. Average of 5 to 10 analyses actively on-going. Approximately 20-25 active members with about 250 people subscribed to the group mailing list.
- **Co-convener for the CMS SUSY trigger and Monte-Carlo group. 2017-2018**
  Managed Monte-Carlo contacts group to produce CMS 2017 simulation samples. Incorporated new generator settings, identified and mitigated issues in the new simulated samples. Active interactions with the analyzers to identify simulation sample needs for publications.
- **Leader in testing the CMS Phase 1 Forward Pixel detector (FPIX) at the tracker integration facility (TIF) at CERN. 2016- 2017**
  Responsible for testing 3 out of 4 half-cylinders for FPIX. Organized daily testing activities to identify necessary repairs and commissioned the detector. Streamlined testing procedure, advanced calibration procedure and organized shifts. About 30 people involved in the testing activities daily.
- **Reward and Recognition Award.** For outstanding contributions to the FPIX testing and commissioning. 2017. Fermilab
- **International Research Travel Fellowship and Dissertation Research Travel Award.** 2013-2014, Duke University.
- **Outstanding Student Scholarship.** 2005-2009, Shandong University.

Selected Research Experience.

- **Accelerated machine learning inference for trigger and computing applications. 2018- Now** Performed the first proof-of-concept study of FPGA hardware-accelerated machine learning using Project Brainwave by Microsoft Azure, integrated into CMS software as a service. Published in CSBS.

- **System testing and commissioning of FPIX for CMS. 2016-2017** Led the testing and commissioning of FPIX at the tracker integration facility at CERN.
- **Readout electronics testing and DAQ development of FPIX for CMS. 2015-2016** Successfully developed and tested service electronics for the forward pixel detector upgrade at Fermilab SiDet facility.
- **Phase 2 upgrade of the inner tracker for ATLAS. 2013-2014** Module and stavelet tests. Tested cooling pipe grounding design robustness against external electronic noises.
- **Monitoring of the wire aging effect of the TRT detector for ATLAS. 2010-2013** Developed procedure and tools using the transition radiation effect.
- **Search for Standard model (SM) Triboson production using 13 TeV data collected by the CMS detector. 2017-Now** Led the first search for the WWW process in CMS using LHC data collected in 2016 and published in PRD.
- **Searches for invisible Higgs decay using the ttH production mode in CMS. 2017-2018**
- **Search for electroweak production of charginos and neutralinos in the WH topology. 2016 -2017** Main analyzer and analysis contact, published in JHEP.
- **Searches for stop in one lepton final state with 13 TeV collected by the CMS detector. 2015-2017** Significantly advanced the sensitivity to top squarks with improved trigger and selection strategy.
- **PhD thesis: Measurements of vector bosons produced in association with additional photons using 7/8 TeV data collected by the ATLAS detector. (2011-2015)** Published in PRL and highlighted as an Editors' suggestion.

Selected Publications.

Journal Articles

- Distance-Weighted Graph Neural Networks on FPGAs for Real-Time Particle Reconstruction in High Energy Physics
- Compressing deep neural networks on FPGAs to binary or ternary precision with HLS4ML. (In preparation)
- Accelerated Machine Learning as a Service for Particle Physics Computing. (NeurIPS 2019 ML4PS workshop)
- Low-latency machine learning inference on FPGAs. (NeurIPS 2019 ML4PS workshop)
- FPGA-Accelerated Machine Learning Inference as a Service for Particle Physics Computing. (Published in Computing and Software for Big Science)
- Calorimetry with Deep Learning: Particle Classification, Energy Regression, and Simulation for High-Energy Physics. (submitted to EPJC)
- The CMS collaboration, First constraints on invisible Higgs boson decays using $t\bar{t}H$ production at $\sqrt{s}$= 13 TeV. (PAS).
- The CMS collaboration, Search for the production of $W^{\pm}W^{\pm}W^{\mp}$ events with two equally charged or three leptons at $\sqrt{s}$= 13 TeV. (PRD 100 (2019) 012004)
- The CMS collaboration, Combined search for electroweak production of charginos and neutralinos in proton-proton collisions at $\sqrt{s}$= 13 TeV. (JHEP 03 (2018) 160)
- The CMS collaboration, Search for electroweak production of charginos and neutralinos in the WH final state in proton-proton collisions at $\sqrt{s}$= 13 TeV. (JHEP11 (2017) 029)
- The CMS collaboration, Search for top squark pair production in pp collisions at $\sqrt{s}$= 13 TeV using single lepton events.(JHEP 10 (2017) 019)
- The CMS collaboration, Searches for pair production for third-generation squarks in $\sqrt{s}$=13 TeV pp collisions. (Eur. Phys. J. C 77 (2017) 327)
- The ATLAS collaboration, Measurements of Zγ and Z$\gamma\gamma$ production in pp collisions at $\sqrt{s}$= 8 TeV with the ATLAS detector. (Phys. Rev. D 93, 112002 (2016))
- The ATLAS collaboration, Evidence of W$\gamma\gamma$ production in pp collisions at $\sqrt{s}$=8 TeV and limits on anomalous quartic gauge couplings with the ATLAS detector (Phys. Rev. Lett. 115, 031802 (2015))
- The ATLAS collaboration, Search for Higgs boson decays to a photon and a Z boson in pp collisions at $\sqrt{s}$=7 and 8 TeV with the ATLAS detector. (Phys. Lett. B 732C (2014) 8-27)
- The ATLAS collaboration, Measurement of Wγ and Zγ production cross sections in pp collisions at $\sqrt{s}$= 7 TeV and limits on anomalous triple gauge couplings with the ATLAS detector. (Phys. Lett. B 717 (2012)

49-69)
- The ATLAS collaboration, Measurement of Wγ and Zγ production in proton-proton collisions at $\sqrt{s}$=7 TeV with the ATLAS Detector. (JHEP 1012 (2010) 060)

Conference presentations and seminars

- Invited Keynote: "FGPA as Machine Learning platform in HEP trigger applications." IEEE-NPSS Real Time Conference in Quy Nhon 2020.
- Invited plenary: "FPGA-accelerated machine learning inference as a service for particle physics computing". Fast Machine Learning workshop. FNAL. September 2019
- Plenary:"Measurement of Triboson Production and aQGCs". MBI 2019: Multi-Boson Interactions 2019. August 2019
- Invited plenary: "FPGA-accelerated machine learning inference as a solution for particle physics computing". ML in physics workshop. UC Berkeley. PASC 19. ETH May 2019, CPAD, Rhode Island Convention Center. Dec. 2018
- Plenary:"LHC Top and EWK results". SUSY 2019. Texas A&M University-Corpus Christi. May 2019.
- Invited plenary:"Overview of recent CMS results", LoopFest. Michigan State University. July 2018.
- Plenary:"Searches for direct production of weakly interacting SUSY states at the LHC (Gauginos, Higgsinos, Sleptons)", LHCP. Bologna. June 2018.
- Poster. "Construction and Commissioning of the CMS Phase 1 Pixel Detector". HSTD11. Hiroshima. Dec 2017.
- "Search for electroweak production of supersymmetry at CMS". EPS. Venice. July 2017.
- Plenary : "Status of the forward pixel in CMS". CMS week. CERN. April 2017.
- "Phase-1 upgrade of the CMS pixel detector", All experiments meeting special report. Fermilab. Feb 2017.
- Plenary: "SUSY searches using boosted techniques at 13 TeV in CMS". BOOST conference, Zurich, July 2016.
- "FPGA-accelerated machine learning inference as trigger and computing solutions in particle physics". Argonne National Lab. June 2019/ University of Oxford.2020/ University of Bristol 2020
- "Measure what is measurable and make measurable what is not so : Uncover new physics with bosons at the LHC and upgrades of the CMS detector to maximize the discovery potential". Notre Dame, Northwestern, Ohio State University, Michigan State University, University of Wisconsin-Madison, LBNL, BNL. January-December 2019.
- "Phase-I Upgrade of the CMS pixel detector", UC Davis and UCSB. April 2018.
- "Searches for direct stop production in13 TeV proton-proton collisions with CMS at the LHC", Duke University. May 2016, University of Chicago. April 2016.

Miscellaneous

- Journal Referee: PRL,Physics Letters B, Int. J. Mod. Phys. A. (IJMPA), CMS internal reviewer for 6 analyses.
- Local organizer for Topic Of The Week Seminars. Multiboson Workshop. Fast Machine Learning Workshop
- Supervised 8 PhD students, 5 undergraduate students, 4 summer interns at Fermilab. Led 5 outreach activities and workshops. Teaching assistant at Duke University for 4 semesters.
- Outreach
  - "Measure the speed of light using chocolate". EYH Chicago. 2019.
  - Saturday physics program at Fermilab.
  - Speaker at Soapbox Science. July 2018, Navy Pier. Chicago.
  - Volunteer at Adler Planetarium for special Halloween event in Chicago. 2017.
  - Summer research project with NCSSM student on the wire aging project. 2014

Referees.

- **Prof. Al Goshaw** Professor at Duke University. Email: goshaw@phy.duke.edu
- **Dr. Sergo R Jindariani** Scientist at Fermilab Email:sergo@fnal.gov