David Wilkins Miller

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Education

2006 - 2011	Stanford University	Stanford, CA
Doctor of Philosophy, Physics		
2001 - 2005	University of Chicago	Chicago, IL
B.A. with honors, Physics, Specialization in Astrophysics		

Professional Experience

University of Chicago	2020–Present	Associate Professor of Physics
University of Chicago	2013–2020	Neubauer Family Assistant Professor of Physics
Enrico Fermi Institute	2011–2013	McCormick Fellow (ATLAS experiment)
SLAC, Stanford University	2006–2011	Graduate research assistant (ATLAS experiment)
CERN	2005–2006	Research technician (ATLAS experiment)
University of Chicago	2003–2005	Undergrad research assistant (CAST experiment)

Honors and Awards

Don York Faculty Initiative Award, 2018
National Science Foundation CAREER Award, 2015
Neubauer Family Assistant Professor Award, University of Chicago, 2013
ATLAS Thesis Award for outstanding contributions to ATLAS, 2011
IEEE Real-Time Conference Outstanding Paper Award, 2010
Stanford University Paul H. Kirkpatrick Graduate Teaching Award, 2007
National Science Foundation Graduate Research Fellowship, 2005-2008
American Physical Society LeRoy Apker Undergraduate Physics Achievement Award, 2005

Mentoring and Supervision (PhD students and Postdocs)

Anthony Badea	Schmidt AI+Science Fellow	Sep 2023 – present	
Benjamin Rosser	Fermi/McCormick Fellow	Jan 2022 – present	
Cecilia Tosciri	Postdoctoral (PD) Scholar	Sep 2020 – present	
Jesse Liu	Grainger Fellow	Sep 2019 – Dec 2021	(Fellow, Cambridge)
Reina Camacho	Postdoctoral (PD) Scholar	Jan 2015 – Dec 2017	(Faculty, CNRS)
Max Swiatlowski	Fermi/McCormick Fellow	Aug 2015 – Sep 2019	(Faculty, TRIUMF)
Teresa Du	Ph.D. student (Class of 2022)	Sep 2022 – present	
Gabe Hoshino	Ph.D. student (Class of 2021)	Sep 2021 – present	
Kristin Dona	Ph.D. student (Class of 2019)	Oct 2019 – present	
Jan Offermann	Ph.D. student (Class of 2018)	Oct 2018 – present	
Emily Smith	Ph.D. student (Class of 2017)	Oct 2017 – Oct 2023	(Lederman, FNAL)
Joakim Olsson	Ph.D. student (Class of 2012)	Oct 2013 – Sep 2018	(PD, UC Irvine)
Giordon Stark	Ph.D. student (Class of 2012)	Oct 2013 – Apr 2018	(PD, UC Santa Cruz)
Miles Wu	Ph.D. student (Class of 2012)	Apr 2014 – Feb 2017	(Jane Street, NYC)

Other Professional Activities and Background Information

Director of UChicago-Fermilab Strategic Partnership Initiatives, Sept 2023
Co-lead of the AI+Science Initiative for the UChicago Data Science Institute, March 2022
Panelist for Data Handling using Artificial Intelligence & Machine Learning, Snowmass 2020
Coordinator of real-time data filtering systems for ATLAS experiment, 2017–present
(Emily Smith) NDSEG Fellowship for "Machine Learning in SoCs and HEP Trigger Systems"
(Jan Offermann) DOE SCGSR Fellowship for "Jet Physics Using Neural Networks"
Member of the ICHEP Committee on Diversity and Outreach, August 2016
Elected member of the US LHC Users Association Executive Committee, 2016–2017
Co-Director of the 2014–2019 Enrico Fermi Institute Summer Interns Programs
Lane Tech College Prep Physics Outreach Program 2013–2014

Key Accomplishments

2013 - Present **Physics Department, University of Chicago**
Neubauer Family Assistant Professor (2013–2020), Associate Professor (2020–present)

- Design and deployment of the broadband haloscope dish antenna for axion detection
- Design of the first self-driving data filtering and acquisition systems for physics
- First machine learning architecture for physics based on fundamental Lorentz symmetry
- Development of machine learning models for multi-processor system-on-chip devices
- Novel measurements and new physics searches with Lorentz-boosted hadronic objects
- Electronics for new global feature extraction (gFEX) trigger for boosted objects
- Design and construction of power and calibration systems for new MilliQan experiment
- Research coordination of 150+ ATLAS scientists for physics & performance analysis

2011 - 2013 **Enrico Fermi Institute, The University of Chicago**
McCormick Fellow, Postdoctoral Scholar (ATLAS experiment)

- Responsible for deployment of new jet algorithms used in measurements of and searches for highly boosted W bosons, top quarks, and di-boson resonances
- Coordinator of ATLAS SUSY RPV Physics and Jet Substructure Performance groups
- Contact physicist for the search for boosted supersymmetric gluino decays

2006 - 2011 **SLAC National Accelerator Laboratory, Stanford University**
Graduate student research assistant (ATLAS experiment)

- **Ph.D. thesis:** *Measurement of Hadronic Event Shapes and Jet Substructure in pp Collisions at $\sqrt{s} = 7$ TeV Center-of-Mass Energy with ATLAS at the LHC.*
- First measurements of hadronic events shapes and jet internal structures at the LHC
- First observation of jet quenching in heavy ion collisions
- Online measurement and characterization of the LHC beam for first collisions in 2009

2005 - 2006 **Enrico Fermi Institute, The University of Chicago**
Research technician (ATLAS experiment)

- ATLAS Tile Calorimeter front-end electronics connections team leader.
- *In situ* stability tests of front-end power supplies and on-detector electronics.
- Commissioning and tests of front-end electronics read-out chain integrity.

2003 - 2005 **Kavli Institute for Cosmological Physics, University of Chicago**
Undergraduate research assistant (CAST experiment)

- Design, construction, and installation of the CAST gamma-ray calorimeter at CERN
- Monitoring, DAQ, and analysis coordinator for calorimeter first run data
- Editor and corresponding author for publication of first calorimeter results
- Development of pulse shape discrimination and particle identification algorithms

Selected Publications

ATLAS Collaboration (Run 3 trigger coordination), "The ATLAS Experiment at the CERN Large Hadron Collider: A Description of the Detector Configuration for Run 3", *submitted to JINST*, (arXiv:2305.16623) (2023)

A. Bogatskiy, T. Hoffman, D. W. Miller, J. T. Offermann, X. Liu, "Explainable Equivariant Neural Networks for Particle Physics: PELICAN", Snowmass 2021 White Paper, *submitted to JHEP* (arXiv:2307.16506) (2022)

C. B. Adams, et al, "Axion Dark Matter", Snowmass 2021 White Paper, (arXiv:2203.14923) (2022)

R. Bartoldus, C. Bernius, D. W. Miller, "Innovations in trigger and data acquisition systems for next-generation physics facilities", Snowmass 2021 White Paper, (arXiv:2203.07620) (2022)

A. Bogatskiy, et al, "Symmetry Group Equivariant Architectures for Physics", Snowmass 2021 White Paper, (arXiv:2203.06153) (2022)

J. Liu, K. Dona, G. Hoshino, S. Knirck, N. Kurinsky, M. Malaker, D. W. Miller, A. Sonnenschein, et al, "Broadband solenoidal haloscope for terahertz axion detection", Phys. Rev. Lett. 128 (2022) 131801, (arXiv:2111.12103) (2021)

ATLAS Collaboration (corresponding author), "Search for charginos and neutralinos in final states with two boosted hadronically decaying bosons and missing transverse momentum in pp collisions at $\sqrt{s} = 13$ TeV with the ATLAS detector", Phys. Rev. D 104 (2021) 112010, (arXiv:2108.07586) (2021)

Y. Chen, K. Dona, C. Mahesh, D. W. Miller (conceptual design and creator), "Towards an Interpretable Data-driven Trigger System for High-throughput Physics Facilities", NeurIPS Machine Learning for Physical Sciences, 2020, (2104.06622) (2021)

K. Dona, J. Liu, N. Kurinsky, D. W. Miller, P. Barry, C. Chang, A. Sonnenschein, "Design and performance of a multi-terahertz Fourier transform spectrometer for axion dark matter experiments", JINST 17 P06014, (arXiv:2104.07157) (2021)

MilliQan Collaboration, "Sensitivity to millicharged particles in future proton-proton collisions at the LHC", Phys. Rev. D 104 (2021) 032002, (arXiv:2104.07151) (2021)

A. Bogatskiy, B. Anderson, J. T. Offermann, M. Roussi, D. W. Miller (conceptual design and creator), R. Kondor, "Lorentz Group Equivariant Neural Network for Particle Physics", *Proceedings of the International Conference on Machine Learning (ICML 2020)*, (arXiv:2006.04780) (2020)

ATLAS Collaboration (corresponding author), "Measurement of the jet mass in high transverse momentum $Z(\to b\bar{b})\gamma$ production at $\sqrt{s} = 13$ TeV using the ATLAS detector", *submitted to Phys. Lett. B*, (arXiv:1907.07093) (2019)

ATLAS Collaboration, "Identification of boosted Higgs bosons decaying into b-quark pairs with the ATLAS detector at 13 TeV", Eur. Phys. J. C 79 (2019) 836, (arXiv:1906.11005) (2019)

P. Berta, L. Masetti, D. W. Miller and M. Spousta, "Pileup and Underlying Event Mitigation with Iterative Constituent Subtraction", JHEP 08 (2019) 175, (arXiv:1905.03470) (2019)

ATLAS Collaboration (corresponding author), "Search for chargino and neutralino production in final states with a Higgs boson and missing transverse momentum at $\sqrt{s} =$ 13 TeV with the ATLAS detector", Phys. Rev. D 100, 012006, (arXiv:1812.09432) (2019)

MilliQan Collaboration, "A Letter of Intent to Install a milli-charged Particle Detector at LHC P5", (arXiv:1609.04669) (2016)

ATLAS Collaboration (corresponding author), "Performance of pile-up mitigation techniques for jets in pp collisions at $\sqrt{s} = 8$ TeV using the ATLAS detector", Eur. Phys. J. C (2016) 76:581 (arXiv:1510.03823) (2015)

P. Berta, M. Spousta, D. W. Miller, and R. Leitner, "Particle-level pileup subtraction for jets and jet shapes", JHEP 06 (2014) 092 (arXiv:1403.3108) (2014)

Selected Public Conference Papers

ATLAS Collaboration "Search for supersymmetry in final states with missing transverse momentum and multiple b-jets in proton-proton collisions at $\sqrt{s} = 13$ TeV with the ATLAS detector", ATLAS-CONF-2018-041 (2018)

ATLAS Collaboration "Search for resonances with boson-tagged jets in 15.5 fb^{-1} of pp collisions at $\sqrt{s} = 13$ TeV collected with the ATLAS detector", ATLAS-CONF-2016-055 (2016)

ATLAS Collaboration "Search for pair production of gluinos decaying via top or bottom squarks in events with b-jets and large missing transverse momentum in pp collisions at $\sqrt{s} = 13$ 13 TeV with the ATLAS detector ", ATLAS-CONF-2016-052 (2016)

ATLAS Collaboration "Search for pair-production of gluinos decaying via stop and sbottom in events with b-jets and large missing transverse momentum in $\sqrt{s} = 13$ TeV pp collisions with the ATLAS detector", ATLAS-CONF-2015-067 (2015)

ATLAS Collaboration (co-editor) "Properties of jets and inputs to jet reconstruction and calibration with the ATLAS detector using proton-proton collisions at $\sqrt{s} = 13$ TeV", ATL-PHYS-PUB-2015-036 (2015)

ATLAS Collaboration (co-editor) "A search for R-parity violating scalar top decays in all-hadronic final states with the ATLAS detector in $\sqrt{s} = 8$ TeV pp collisions", ATLAS-CONF-2015-026 (2015)

ATLAS Collaboration (co-editor) "Performance of pile-up subtraction for jet shapes in pp collisions at $\sqrt{s} = 8$ TeV", ATLAS-CONF-2013-085 (2013)

ATLAS Collaboration "Performance of boosted top quark identification in 2012 ATLAS data", ATLAS-CONF-2013-084 (2013)

ATLAS Collaboration (co-editor) "Studies of the impact and mitigation of pile-up on large-R and groomed jets in ATLAS at $\sqrt{s} = 7$ TeV", ATLAS-CONF-2012-066 (2012)

ATLAS Collaboration (co-editor) "Performance of large-R jets and jet substructure reconstruction with the ATLAS detector", ATLAS-CONF-2012-065 (2012)

ATLAS Collaboration "Jet energy scale and its systematic uncertainty in proton-proton collisions at $\sqrt{s} = 7$ TeV in ATLAS 2010 data", ATLAS-CONF-2011-032 (2011)

ATLAS Collaboration (co-editor) "In-situ jet energy scale and jet shape corrections for multiple interactions in the first ATLAS data at the LHC", ATLAS-CONF-2011-030 (2011)

ATLAS Collaboration (co-editor) "Properties of Jets and Inputs to Jet Reconstruction and Calibration with the ATLAS Detector Using Proton-Proton Collisions at $\sqrt{s} = 7$ TeV", ATLAS-CONF-2010-053 (2010)

ATLAS Collaboration "Characterization of Interaction-Point Beam Parameters Using the pp Event-Vertex Distribution Reconstructed in the ATLAS Detector at the LHC", ATLAS-CONF-2010-027 (2010)

ATLAS Collaboration (co-editor) "Properties and internal structure of jets produced in proton-proton collisions at $\sqrt{s} = 900$ GeV", ATLAS-CONF-2010-018 (2010)

ATLAS Collaboration "Inputs to Jet Reconstruction and Calibration with the ATLAS Detector Using Proton-Proton Collisions at $\sqrt{s} = 900$ GeV", ATLAS-CONF-2010-016 (2010)

ATLAS Collaboration "Performance of the ATLAS Inner Detector Trigger algorithms in p-p collisions at $\sqrt{s} = 900$ GeV", ATLAS-CONF-2010-014 (2010)

Published Conference Proceedings

Miller, D. W. "New dark-sector LHC experiments milli$Q$an, FASER, MATHUSLA, CODEX-b" forthcoming in the Proceedings of the 7th Annual Conference on Large Hadron Collider Physics - LHCP2019, LHCP (2019)

Miller, D. W. "Techniques for tagging hadronically decaying W/Z/top and Higgs particles in ATLAS" forthcoming in the Proceedings of the 7th Annual Conference on Large Hadron Collider Physics - LHCP2019, LHCP (2019)

Miller, D. W. "Inclusive searches for squarks and gluinos in fully hadronic final states with the ATLAS detector" Proceedings of the 2016 International Conference On High Energy Physics, ICHEP (2016) [DOI: 10.22323/1.282.0112]

Miller, D. W. "gFEX, the ATLAS Calorimeter Global Feature Extractor for the Phase-I upgrade of the ATLAS experiment" Proceedings of the 2016 International Conference On High Energy Physics, ICHEP (2016) [DOI: 10.22323/1.282.1055]

Miller, D. W. "Studies of the internal properties of jets and jet substructure with the ATLAS Detector" Proceedings of the 2011 Europhysics Conference On High Energy Physics, EPS-HEP (2011) [arXiv:1110.5995]

Miller, D. W. "Jet substructure in ATLAS" Proceedings of the Division of Particles and Fields of the American Physical Society, DPF (2011) [arXiv:1110.1094]

Miller, D. W. "Online Measurement of LHC Beam Parameters with the ATLAS High Level Trigger" Proceedings of the 17th IEEE Real-Time Conference (2010) [DOI: 10.1109/RTC.2010.5750367]

Miller, D. W. "First measurement of jets and missing transverse energy with the ATLAS calorimeter at $\sqrt{s} = 900$ GeV and $\sqrt{s} = 7$ TeV" Proceedings of the 14th International Conference on Calorimetry in High Energy Physics, CALOR (2010) [DOI: 10.1088/1742-6596/293/1/012064]