Shih-Chieh Hsu

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Education

2003-2008 **Ph.D. in Elementary Particle Physics**
University of California San Diego, La Jolla, CA 92093
Thesis Advisor: Prof. Frank Würthwein
Thesis Title: *A Study of WW, ZZ and Higgs Production in $ll + \not{E}_T$ Channel at CDF Run II*

1999-2001 **Master of Science in Physics**
National Taiwan University, Taipei, Taiwan
Thesis Advisor: Prof. Paoti Chang
Thesis Title: *Study of the Charmless Hadronic Decay $B \to \eta' K$ with the Belle Detector*

1995-1999 **Bachelor of Science in Physics**
National Taiwan University, Taipei, Taiwan

Professional Appointments

2021 - **Director**
NSF HDR Institute: Accelerated Artificial Intelligence Algorithms for Data-Driven Discovery (A3D3)

2021 **Visisting Associate Professor (Sabattical)**
National Tsing Hua University Physics, HsinChu, Taiwan

2018 - **Associate Professor**
University of Washington, Physics, Seattle, WA 98195, USA

2018 - **Adjunct Associate Professor**
University of Washington, Elec. & Comp. Engineering, Seattle, WA, USA
National Tsing Hua University Physics, HsinChu, Taiwan

2012 - 2018 **Assistant Professor**
University of Washington, Physics, Seattle, WA 98195, USA

2012 - 2018 **Adjunct Assistant Professor**
University of Washington, Elec. & Comp. Engineering, Seattle, WA, USA
National Tsing Hua University Physics, HsinChu, Taiwan

2008-2012 **Chamberlain fellow**
Lawrence Berkeley National Laboratory, Berkeley, CA 94720, USA

Honors and Awards

2020	Special Recommendation Award for Youth Science Popularization - Chinese Translation of "We have no idea"
2016	DOE early career award
2015	UW undergraduate research mentor award
2014	US ATLAS scholar
2008-2012	Owen Chamberlain Fellowship in experimental particle physics and cosmology
2007	NSF/CERN Awards for the Young Scientist Forum in the 42nd Electroweak Moriond Conference
2003-2004	Graduate Academic Performance Scholarship, UCSD

Leadership and Service

2021-	Director, NSF HDR Institute: A3D3
2021-	Editorial Board chair, Search for mono s(VV)
2021-	Editorial Board member, Heavy Ion Flow
2021-	Analysis contact, Search for mono $s(b\bar{b})$
2021-	Chair, US ATLAS Speaker Committee
2020-	Co-Chair, Snowmass 2022 (Seattle, USA)
2020	Organization Committee, Fast Machine Learning (USA)
2019-	Member, UW Graduate Admission Committee
2019	Local chair, Dark Matter @ Large Hadron Collider 2019 (Seattle, USA)
2018	Local chair, Connecting The Dots Workshop 2018 (Seattle, USA)
2018-2020	Coordinator, Informal FASER tracking
2017	Local Organization Committee, Advanced Computing and Analysis Techniques in Physics Research Conference (Seattle, USA)
2017-2020	Manager, US ATLAS Analysis Center at LBNL
2016	Organization Committee, BSM Higgs Workshop 2016 (Hsing-Chu, Taiwan)
2015	Local chair, US ATLAS Hadronic Final State Forum 2015 (Seattle)
2015	Organization Committee, ATLAS Tracking Workshop 2015 (Chamonix, France)
2015	Reviewer, Run1 Top differential cross-section, PRD93 (2016) 072004
2015-2017	Co-convener, ATLAS Tracking Combined Performance
2015	Co-convener, EWK and Higgs session, DPF 2015 (Ann Arbor)
2015	Co-coordinator, ATLAS IBL Mechanical Stability Task force
2015	Co-editor, ATLAS 8 TeV mono-H search; Boosted W-tagging in Run1
2015-	Member, UW Research Experience for Undergraduate
2014	Reviewer, Run1 $WW\gamma$ and $WZ\gamma$ cross section, PRD90 (2014) 032008
2014	Local chair, US ATLAS Annual Meeting 2015
2013-2015	Co-coordinator, ATLAS Inner Detector Alignment
2013-2017	Member, UW Graduate Admission Committee
2012-	Mentor, UW QuarkNet Center
2011-2012	Contact, LHC Electroweak Diboson group
2011-2012	Co-convener, ATLAS Electroweak group
2011-2012	Analysis contact and co-editor, Standard Model ZZ production in ATLAS
2009-2010	Subgroup leader, ATLAS Pixel DAQ Digital Signal Processor (DSP) group
2009-2010	Leading developer, ATLAS Inner Detector Alignment
2009-2011	Code Developer, ATLAS ID Tracking and Muon Combined Performance
2006-2007	Monte Carlo coordinator, CDF Electroweak group
2003-2005	Administrator, CDS Central Analysis Farm
2001-2003	Coordinator of the electricity and water supply logistics for battle ship

Teaching

Spring 2022	PHYS427: Neural Network for Signal Processing
Autumn 2021	PHYS248: Early Fall Start
Autumn 2021	PHYS123: Waves, Optics, and Heat
Spring 2021	NTHU PHYS51000: Hands-on Artificial Intelligence for Physics
Winter 2021	PHYS123 and 119 Lab instructors
Autumn 2020	PHYS248: Early Fall Start
Autumn 2020	PHYS123 and 119 Lab instructors
Autumn 2019	PHYS248: Early Fall Start
Winter 2019	PHYS123 and 119 Lab instructors
Autumn 2018	PHYS248: Early Fall Start
Winter 2018	PHYS123: Waves, Optics, and Heat
Autumn 2017	PHYS248: Early Fall Start
Autumn 2017	PHYS123: Waves
Winter 2017	PHYS433: Modern Physis Lab
Autumn 2016	PHYS428/PHYS576: advanced techniques in experimental particle physics
Autumn 2016	PHYS248: Early Fall Start
Autumn 2015	PHYS248C: Unraveling Dark Universe with the Large Hadron Collider
Autumn 2014	PHYS248C LHC: the discovery machine
Autumn 2014	PHYS121B: Mechanics
Autumn 2013	PHYS422A Introduction to Particle and Nuclear Physics
Autumn 2013	PHYS294A Introduction to Physics Research
Autumn 2013	PHYS428A/576B Advanced Technology for Experimental Particle Physics
Winter 2013	PHYS123A Waves
Autumn 2012	PHYS485A/494A Senior Honors Seminar

Teaching, Supervising and Outreach

2019	UW Engineering Discovery Days: LHC booth
2019	LHC Masterclass 2019
2018	UW Engineering Discovery Days: LHC booth
2018	LHC Masterclass & QuarkNet Cosmic Ray Workshop 2018
2018	Pacific Science Center weekend: LHC booth
2018	LHC Masterclass & QuarkNet Cosmic Ray Workshop 2017
2016	Paws-on-Science 2016 in Pacific Center - "Smashing Proton"
2016	LHC Masterclass & QuarkNet Cosmic Ray Workshop 2016
2015	Mary Gates Scholar: Tun Sheng Tan, Firdaus Soberi, John Spencer
2015	LHC Masterclass & QuarkNet Cosmic Ray Workshop 2015
2015	Paws-on-Science 2015 in Pacific Center - "Smashing Proton"
2014	LHC Masterclass & QuarkNet Cosmic Ray Workshop 2014
2014	Paws-on-Science 2014 in Pacific Center - "Smashing Proton"
2013	LHC Masterclass & QuarkNet Cosmic Ray Workshop 2013

Postdoctoral Researchers

2021-	Elham E. Khoda
2019-	Ke Li
2015-2018	Samuel Meehan (Science and Technology Poli, AAAS)
2013-2015	Lynn Marx (Data Science Lead, Solsten)

Ph.D. Students, primary supervisor

2021-	Ali Garabaglu
2020-	Qibin Liu (Shanghai JiaoTung University, co-supervise with Shu Li)
2019-	Alex Schuy
2019-	Haoran Zhao
2019-	Yue Xu (Tsinghua, co-supervise with Xin Chen)
2018-	Wangyun Su (Shanghai JiaoTung University, co-supervise with Shu Li)
2015-2021	John Spencer
2017-2021	Gang Zhang (Tsinghua, co-supervise with Xin Chen)
2017-2021	Wei Ding (Tsinghua, co-supervise with Xin Chen)
2013-2018	Nikola Whallon
2012-2017	Jia Jion Teoh (Osaka)

Master Students

2021-	Ian Lin (National Tsing-Hua University, co-supervise with Pai-Hsien Hsu)
2021	David Ho (National Tsing-Hua University Physics, co-supervise with Kingman Cheung)
2021	Kelvin Lin (UW ECE, co-supervise with Scott Hauck)
2021	Erickson Donavan (UW ECE, co-supervise with Scott Hauck)
2020	Po-Jan Cheng (National Tsing-Hua University Physics, co-supervise with Kingman Cheung)
2020	Richa Rao (UW ECE, co-supervise with Scott Hauck)
2020	Niharika Mittal (UW ECE, co-supervise with Scott Hauck)
2019	Shihlung(Allen) Chen (UW Physics)
2019	Douglas George Smith (UW ECE, co-supervise with Scott Hauck)
2019	Dustin Werran (UW ECE, co-supervise with Scott Hauck)
2018	Lev Kurilenko (UW ECE, co-supervise with Scott Hauck)
2017	Logan Adams (UW ECE, co-supervise with Scott Hauck)
2017	Kaifu Lam (UW Physics)
2016	Nicholas David Dreyer (UW Physics)
2016	Joseph Mayer (UW ECE, co-supervise with Scott Hauck)
2015	Shaw-Pin (Bing) Chen (UW ECE, co-supervise with Scott Hauck)

Undergraduate Students

2019-2020	Jakub Filipek
2018-2019	Firdaus Soberi
2014	Kevin Jamison (Mary Gates Scholar)
2013	William Johnson (Mary Gates Scholar), Kevin Jamison (NASA SURF fellow), Tony Burrus (CERN REU), Alex Emerman (CERN Semester Fellow), Jimin Kim
2012	Max Golub

High School Students

2021-	Ziqi Fang (Interlake High Gifted Internship)
2020-2021	Daniel Sun (Interlake High Gifted Internship)
2017-2019	Aditya Kannan (Interlake High Gifted Internship)
2017-2018	Pranay Mittal (Interlake High Gifted Internship)
2016-2017	Ruta Dhaneshwar (Interlake High Gifted Internship)
2015-2016	Chunyun Ding (Interlake High Gifted Internship)
2014-2015	Darren Leung (Interlake High Gifted Internship)

Invited Talks, Conferences and Workshops

Mar 2021	"Accelerating Particle Physics Discovery with Artificial Intelligence", Colloquium, National Cehng Kung University, Tainan
Dec 2020	"Summary of Fast ML for Science Workshop", HFS Trigger Workgroup
Jan 2020	"New LHC Experiments for Long-lived Particle Search", 16th Reconstres du Vietnam TEM 2020, Quy Nhon
Nov 2019	"Accelerating Discovery at the LHC with Machine Learning", Colloquium, Tsinghua University, Beijing
May 2019	"Searches for dark matter", LHCP 2019, Puebla, Mexicao
May 2019	"FASER – a new LHC detector for Long Lived Particles", Fermilab Wine and Cheese
Jan 2019	"FASER: ForwArd Search ExpeRiment at the LHC", IAS HEP 2019, Hong Kong
Dec 2018	"Tracking and Jet Substructure", HFSF 2018, LBNL
Apr 2018	"Dark Matter Search at the LHC using the Standard Model candles", Workshop, DM@LHC 2018, Heidelberg
Jan 2018	"ATLAS Inner Tracker Upgrade", Conference, IAS HEP 2018, Hong Kong
Oct 2017	"LHC Electroweak Physics", Workshop, Brookhaven Forum, BNL
Sep 2017	"Dark Matter with Boosted Higgs Boson", Seminar, Rugers, UPenn, and Stony Brook
Aug 2017	"Dark Matter with Jet substructure" (Invited Plenary), NTHU BSM workshop, Hsin-Chu, Taiwan
Apr 2017	"Dark Matter with Boosted Higgs Boson", Colloquium, ISU, Ames
Oct 2016	"Search for New Physics through the Higgs Boson" (Invited Plenary), KIAS workshop, Gwangju, Korea
Aug 2016	"Hunting for Dark Matter with Boosted Boson and Higgs in ATLAS", Wine & Cheese Seminar, FNAL
Aug 2016	"Exotics Physics Summary" (Invited Plenary), ICHEP 2016, Chicago
Nov 2015	"Mono-Higgs: an alternative probe for dark matter in the ATLAS", HEP seminar, Zurich
Oct 2015	"Boosted Boson identification in the ATLAS", HEP seminar, Stockholm
Aug 2015	"Performance of the ATLAS Pixel Detector Upgrade in Run2", DPF 2015, Ann Arbor
Aug 2014	"Status of Triboson and Vector Boson Scattering" (Invited Plenary), Physics at the LHC and Beyond 2014, Quy-Nhon, Vietnam
Mar 2014	"LHC Physics" (Invited lectures), Spring School of Particle and Field, Chang-Gen, Taiwan
Nov 2013	"The LHC, The Enrgy Frontier and the Next Big Discovery" (Colloquium), Chung-Li and Hsin-Chu, Taiwan
June 2013	"Study of Quartic Boson Coupling for Snowmass", Snowmass Energy Frontier All Hands-on Workshop, Seattle
Apr 2013	"Review of Top, W&Z and other Precision Measurement from ATLAS and CMS (Invited Plenary)", APS 2013, Boudler, Colorado (declined due to VISA issue)
Mar 2013	"New Physics Search in Multi-Gauge Boson Final State" (Invited Plenary), Cross-Strait Meeting on Particle Physics and Cosmology 2013, Chung-Li, Taiwan
Feb 2013	"Experimental Signatures of Vector Boson Scattering and Vector Boson Coupling", Snowmass Electroweak Working group in Duke, NC
Feb 2013	"Higgs Discovery" (Invited), Art Institute in Seattle, WA
Nov 2012	"Recent Diboson Update from ATLAS" (Invited), LHC Seminar, CERN, Geneva, Swiss
Oct 2012	"Vector Boson Scattering and Diboson search" (Invited), ATLAS Higgs Jamboree, LBNL, Berkeley, CA

Grants

2021-2026	PI, NSF Institute: Accelerated AI Algorithms for Data-Driven Discovery $15M (9 institutes)
2021-2024	PI, NSF Beyond Standard Model $450K
2021-2024	co-PI, NSF Collaborative: FASER $250K (UW)
2021-2021	PI, Simons (UCI) $26K
2021-2021	PI. US ATLAS Super Undergraduate $5K
2019-2022	co-PI, US ATLAS Software $339K
2019-2022	co-PI, NSF Collaborative: Advancing Science with Accelerated Machine Learning $2M (3 institutes)
2019-2022	PI, US ATLAS BoostCamp $24K
2018-2022	PI, US ATLAS Pixel $56K
2017-2022	PI, US ATLAS ITk Pixel $94K
2017-2017	PI, US ATLAS Felix $20K
2016-2022	PI, DOE mono-Higgs $750K
2015-2016	PI, NSF mono-Boson $150K
2014-2016	PI, US ATLAS Boosted Boson $55K
2012-2020	PI, QuarkNet $18K

References

Frank Wuerthwein, Prof. of Physics, UC San Diego, fkw@ucsd.edu
Beate Heinemann, Leading scientist at DESY and Prof. at the University of Freiburg , beate.heinemann@desy.de
Henry Lubatti, Prof. of Physics, University of Washington
Marumi Kado, LAL-Orsay, kado@lal.in2p3.fr
Stephane Willocq, Prof. of Physics, Amherst, stephane.willocq@cern.ch

Publications, Conference Notes and Proceedings

High Energy Physics is an international collaboration with a large number of people. I have in total **32** journal papers at BELLE, **215** journal papers at CDF, **969** journal papers at ATLAS, **2** journal papers at FASER, and **2** journal papers at FastML, In addition, I have 3 phenomenology papers with a few collaborators and 8 conference notes (proceedings). Here I highlight **10** journal publications that I am one of the primary authors with significant contributions and/or the main editor.

Journal Publications

ATLAS Collaboration

[1] ATLAS Collaboration, "Search for Dark Matter Produced in Association with a Dark Higgs Boson Decaying into $W^{\pm}W^{\mp}$ or ZZ in Fully Hadronic Final States from $\sqrt{s} = 13\,\text{TeV}$ pp Collisions Recorded with the ATLAS Detector," Phys. Rev. Lett. **126**, no.12, 121802 (2021) doi:10.1103/PhysRevLett.126.121802 [arXiv:2010.06548 [hep-ex]].

[2] ATLAS Collaboration, "Constraints on mediator-based dark matter and scalar dark energy models using $\sqrt{s} = 13$ TeV pp collision data collected by the ATLAS detector," JHEP **1905**, 142 (2019) [arXiv:1903.01400 [hep-ex]].

[3] ATLAS Collaboration, "Performance of top-quark and W-boson tagging with ATLAS in Run 2 of the LHC," Eur. Phys. J. C **79**, no. 5, 375 (2019) [arXiv:1808.07858 [hep-ex]].

[4] ATLAS Collaboration, "Search for Dark Matter Produced in Association with a Higgs Boson Decaying to $b\bar{b}$ using 36 fb^{-1} of pp collisions at $\sqrt{s} = 13$ TeV with the ATLAS Detector," Phys. Rev. Lett. **119**, 181804 (2017) [arXiv:1707.01302 [hep-ex]].

[5] ATLAS Collaboration, "Search for dark matter in association with a Higgs boson decaying to b-quarks in pp collisions at $\sqrt{s} = 13$ TeV with the ATLAS detector,"

[6] ATLAS Collaboration, "Search for dark matter produced in association with a hadronically decaying vector boson in pp collisions at $\sqrt{s} = 13$ TeV with the ATLAS detector," Phys. Lett. B **763**, 251 (2016) [arXiv:1608.02372 [hep-ex]].

[7] ATLAS Collaboration, "Search for dark matter produced in association with a Higgs boson decaying to two bottom quarks in pp collisions at $\sqrt{s} = 8$ TeV with the ATLAS detector," Phys. Rev. D **93**, no. 7, 072007 (2016), [arXiv:1510.06218 [hep-ex]].

[8] ATLAS Collaboration, "Searches for heavy diboson resonances in pp collisions at $\sqrt{s} = 13$ TeV with the ATLAS JHEP **1609**, 173 (2016) [arXiv:1606.04833 [hep-ex]].

[9] ATLAS Collaboration, "Identification of boosted, hadronically decaying W bosons and comparisons with ATLAS data taken at $\sqrt{s} = 8$ TeV," Eur. Phys. J. C **76**, no. 3, 154 (2016), [arXiv:1510.05821 [hep-ex]].

[10] ATLAS Collaboration, "Search for new particles decaying to ZZ using final states with leptons and jets with the ATLAS Phys. Lett. B **712**, 331 (2012), [arXiv:1203.0718 [hep-ex]].

[11] ATLAS Collaboration, "Measurement of the ZZ production cross section and limits on anomalous neutral triple gauge couplings in proton-proton collisions at $\sqrt{s} = 7$ TeV with the ATLAS detector," Phys. Rev. Lett. **108**, 041804 (2012), [arXiv:1110.5016 [hep-ex]].

[12] ATLAS Collaboration, "Measurement of the W^+W^- Cross Section in $\sqrt{s} = 7$ TeV pp Collisions with ATLAS," Phys. Rev. Lett. **107**, 041802 (2011), [arXiv:1104.5225 [hep-ex]].

[13] ATLAS Collaboration, "Measurement of the Upsilon(1S) Production Cross-Section in pp Collisions at $\sqrt(s) = 7$ TeV in ATLAS," Phys. Lett. B **705**, 9 (2011), [arXiv:1106.5325 [hep-ex]].

[14] ATLAS Collaboration, "Measurement of the centrality dependence of J/ψ yields and observation of Z production in lead-lead collisions with the ATLAS detector at the LHC," Phys. Lett. B **697**, 294 (2011), [arXiv:1012.5419 [hep-ex]].

[15] B. Abbott *et al.* [ATLAS IBL], "Production and Integration of the ATLAS Insertable B-Layer," JINST **13**, no.05, T05008 (2018) doi:10.1088/1748-0221/13/05/T05008 [arXiv:1803.00844 [physics.ins-det]].

FASER

[16] FASER, "The tracking detector of the FASER experiment," [arXiv:2112.01116 [physics.ins-det]].

[17] FASER, "The trigger and data acquisition system of the FASER experiment," JINST **16**, no.12, P12028 (2021) doi:10.1088/1748-0221/16/12/P12028 [arXiv:2110.15186 [physics.ins-det]].

[18] FASER, "First neutrino interaction candidates at the LHC," Phys. Rev. D **104**, no.9, L091101 (2021) doi:10.1103/PhysRevD.104.L091101 [arXiv:2105.06197 [hep-ex]].

[19] H. Abreu *et al.* [FASER], "Technical Proposal: FASERnu," [arXiv:2001.03073 [physics.ins-det]].

[20] H. Abreu *et al.* [FASER], "Detecting and Studying High-Energy Collider Neutrinos with FASER at the LHC," Eur. Phys. J. C **80**, no.1, 61 (2020) doi:10.1140/epjc/s10052-020-7631-5 [arXiv:1908.02310 [hep-ex]].

[21] A. Ariga *et al.* [FASER], "FASER: ForwArd Search ExpeRiment at the LHC," [arXiv:1901.04468 [hep-ex]].

[22] A. Ariga *et al.* [FASER], "Technical Proposal for FASER: ForwArd Search ExpeRiment at the LHC," [arXiv:1812.09139 [physics.ins-det]].

[23] A. Ariga *et al.* [FASER], "FASER's physics reach for long-lived particles," Phys. Rev. D **99**, no.9, 095011 (2019) doi:10.1103/PhysRevD.99.095011 [arXiv:1811.12522 [hep-ph]].

[24] A. Ariga *et al.* [FASER], "Letter of Intent for FASER: ForwArd Search ExpeRiment at the LHC," [arXiv:1811.10243 [physics.ins-det]].

CDF Collaboration

[25] CDF Collaboration, "Measurement of the W^+W^- Production Cross Section and Search for Anomalous $WW\gamma$ and WWZ Couplings in $p\bar{p}$ Collisions at $\sqrt{s}$=1.96 TeV," Phys. Rev. Lett. **104**, 201801 (2010), [arXiv:0912.4500 [hep-ex]].

[26] CDF Collaboration, "Search for a Higgs Boson Decaying to Two W Bosons at CDF," Phys. Rev. Lett. **102**, 021802 (2009), [arXiv:0809.3930 [hep-ex]].

[27] CDF Collaboration, "Strong Evidence for ZZ Production in $p\bar{p}$ Collisions at $\sqrt{s} = 1.96$ TeV," Phys. Rev. Lett. **100**, 201801 (2008), [arXiv:0801.4806 [hep-ex]].

[28] CDF Collaboration, "Observation of WZ Production," Phys. Rev. Lett. **98**, 161801 (2007). arXiv:hep-ex/0702027

[29] E. Lipeles [for the CDF and D0 Collaborations], "WW and WZ Production at the Tevatron," arXiv:hep-ex/0701038.

Belle Collaboration

[30] K. Abe, *et al.* (Belle Collaboration), "Measurement of the Branching Fraction for $B \to \eta' K$ and Search for $B \to \eta' \pi^+$," Phys.Lett. B517 (2001) 309-318

Phenomenology and Machine Learning

[31] A. Shmakov, M. J. Fenton, T. W. Ho, S. C. Hsu, D. Whiteson and P. Baldi, "SPANet: Generalized Permutationless Set Assignment for Particle Physics using Symmetry Preserving Attention," [arXiv:2106.03898 [hep-ex]].

[32] J. Filipek, S. C. Hsu, J. Kruper, K. Mohan and B. Nachman, "Identifying the Quantum Properties of Hadronic Resonances using Machine Learning," [arXiv:2105.04582 [hep-ph]].

[33] Alessandro Roggero and Jakub Filipek and Shih-Chieh Hsu and Nathan Wiebe, "Quantum Machine Learning with SQUID'," [arXiv:2105.00098 [quant-ph]].

[34] R. Kiuchi, Y. Gu, M. Zhong, L. Kong, A. Schuy, S. C. Hsu, X. Shi and K. Zhang, "Physics potential for the H→ ZZ* decay at the CEPC," Eur. Phys. J. C **81**, no.10, 879 (2021) doi:10.1140/epjc/s10052-021-09653-0 [arXiv:2103.09633 [hep-ex]].

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[36] X. Ju, D. Murnane, P. Calafiura, S. C. Hsu *et al.* "Performance of a geometric deep learning pipeline for HL-LHC particle tracking," Eur. Phys. J. C **81**, no.10, 876 (2021) doi:10.1140/epjc/s10052-021-09675-8 [arXiv:2103.06995 [physics.data-an]].

[37] A. Andreassen, S. C. Hsu, B. Nachman, N. Suaysom and A. Suresh, "Parameter estimation using neural networks in the presence of detector effects," Phys. Rev. D **103**, no.3, 036001 (2021) doi:10.1103/PhysRevD.103.036001 [arXiv:2010.03569 [hep-ph]].

[38] Y. L. Chung, S. C. Hsu and B. Nachman, "Disentangling Boosted Higgs Boson Production Modes with Machine Learning," doi:10.1088/1748-0221/16/07/P07002 [arXiv:2009.05930 [hep-ph]].

[39] MATHUSLA, "An Update to the Letter of Intent for MATHUSLA: Search for Long-Lived Particles at the HL-LHC," [arXiv:2009.01693 [physics.ins-det]].

[40] T. Aarrestad *et al.* [HEP Software Foundation], "HL-LHC Computing Review: Common Tools and Community Software," doi:10.5281/zenodo.4009114 [arXiv:2008.13636 [physics.comp-ph]].

[41] X. Chen, Y. Xu, Y. Wu, Y. P. Kuang, Q. Wang, H. Chen, S. C. Hsu, Z. Hu and C. Li, "Search for a generic heavy Higgs at the LHC," Phys. Lett. B **804**, 135358 (2020) doi:10.1016/j.physletb.2020.135358 [arXiv:1905.05421 [hep-ph]].

[42] F. An, Y. Bai, C. Chen, X. Chen, Z. Chen, J. Guimaraes da Costa, Z. Cui, Y. Fang, C. Fu and J. Gao, *et al.* "Precision Higgs physics at the CEPC," Chin. Phys. C **43**, no.4, 043002 (2019) doi:10.1088/1674-1137/43/4/043002 [arXiv:1810.09037 [hep-ex]].

[43] Y. T. Chien, Z. Montague, A. Emerman, S. C. Hsu and S. Meehan, Phys. Rev. D **101**, no.11, 114006 (2020) doi:10.1103/PhysRevD.101.114006 [arXiv:1711.11041 [hep-ph]].

[44] J. Chang, K. Cheung, **S.-C. Hsu** and C. T. Lu, "Detecting multimuon jets from the Higgs boson exotic decays in the Higgs portal framework," Phys. Rev. D **95**, no. 3, 035012 (2017) [arXiv:1607.07550 [hep-ph]].

[45] D. Guest, J. Collado, P. Baldi, **S.-C. Hsu**, G. Urban and D. Whiteson, "Jet Flavor Classification in High-Energy Physics with Deep Neural Networks," Phys. Rev. D **94**, no. 11, 112002 (2016) [arXiv:1607.08633 [hep-ex]].

Fast Machine Learning

[46] A. Elabd, V. Razavimaleki, S. Y. Huang, J. Duarte, M. Atkinson, S. C. Hsu *et al.* "Graph Neural Networks for Charged Particle Tracking on FPGAs," [arXiv:2112.02048 [physics.ins-det]].

[47] A. M. Deiana, N. Tran, J. Duarte, P. Harris, S. Hauck, M. Liu and M. S. Neubauer, S. C. Hsu *et al.* "Applications and Techniques for Fast Machine Learning in Science," [arXiv:2110.13041 [cs.LG]].

[48] FastML, "hls4ml: An Open-Source Codesign Workflow to Empower Scientific Low-Power Machine Learning Devices," [arXiv:2103.05579 [cs.LG]].

[49] D. S. Rankin, J. Krupa, P. Harris, N. Tran, S. Hauck and S. C. Hsu, *et al.* "FPGAs-as-a-Service Toolkit (FaaST)," doi:10.1109/H2RC51942.2020.00010 [arXiv:2010.08556 [physics.comp-ph]].

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[51] J. Duarte, P. Harris, S. Hauck, B. Holzman, S. C. Hsu, S. Jindariani, S. Khan, B. Kreis, B. Lee and M. Liu, *et al.* "FPGA-accelerated machine learning inference as a service for particle physics computing," Comput. Softw. Big Sci. **3**, no.1, 13 (2019) doi:10.1007/s41781-019-0027-2 [arXiv:1904.08986 [physics.data-an]].

Book

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Working Group Report

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