

January 27, 2024

Zack Edward Sullivan

Professor of Physics
Illinois Institute of Technology

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Career Summary

Theoretical high-energy physicist, with a primary focus on improving connections between theory and experiment through phenomenological calculations of top-quark production and other particle processes. This research has generated over 80 publications, and more than 5000 citations.

Illinois Institute of Technology:

Associate Dean for Research and Graduate Education, Lewis College of Science and Letters	2022 – 2023
Professor	2018 –
Associate Professor	2014 – 2018
Assistant Professor	2008 – 2014

Chair line, American Physical Society Prairie Section	2020 – 2022
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Southern Methodist University:

Adjunct Assistant Professor	2007 – 2008
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Visiting Physicist, University of Chicago, Enrico Fermi Institute Joint Appointment with Argonne National Laboratory	2006
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Assistant Physicist, Argonne National Laboratory	2005
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Research Associate, Fermi National Accelerator Laboratory	2001 – 2005
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Postdoctoral Appointee, Argonne National Laboratory	1998 – 2001
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University of Illinois at Urbana-Champaign:

Research Assistant	1997 – 1998
GAANN Fellow	1995 – 1997
Teaching Assistant and Research Assistant	1993 – 1995

Solid state physics experimental research manufacturing metastable alloys and thin films, measuring structural, electrical and magnetic properties.

Research Assistant, Johns Hopkins University	1990 – 1993
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Education

Ph. D. Physics, University of Illinois at Urbana-Champaign, May 1998
 M. S. Physics, University of Illinois at Urbana-Champaign, October 1994
 B. A. Physics and Mathematics, Johns Hopkins University, May 1993

Students and postdocs mentored

Yaofu Zhou	undergraduate (2009–10)
Shayarneel Kundu	undergraduate (2020–22)
Michael Cardiff	undergraduate (2021–22)
Rachelle Rosiles	undergraduate (2024–)
Jacob Thomas	undergraduate (2024–)
Daniel Duffy	graduate, Ph.D. (2010–15)
Keith Pedersen	graduate, Ph.D. (2013–18)
Pedro Rivero Ramirez	graduate, Ph.D. (2018–21)
Mithila Mangedarage	graduate, Ph.D. (2021–)
Eli Regen	graduate, M.S. (2016–17)
Hengrui Zhan	graduate, M.S. (2016–17)
Arjun Menon	postdoc (2009–11)
Hao Zhang	postdoc (2011–13)
Tobias Neumann	postdoc (2017–20)

Awards

College of Science and Letters: Junior Faculty Research Award, 2012
 Division of Particles and Fields (DPF) Fellow for Snowmass 2001
 Excellence in Teaching Award, University of Illinois, Fall 1996
 Graduate Assistance in Areas of National Need (GAANN) Fellowship,
 U. S. Department of Education, 1995 – 97
 Donald E. Kerr Medal for the Most Outstanding Undergraduate in Physics, 1993
 Arthur R. and Rena A. Knipp Scholarship for Excellence in the Fields
 of Physics and Mathematics, 1992 – 93
 Elected Phi Beta Kappa, 1993; Sigma Pi Sigma, 1992; Golden Key National
 Honor Society, 1992

Memberships

Coordinated Theoretical/Experimental Project on QCD (CTEQ) Collaboration
 American Physical Society — Division of Particles and Fields, and Prairie Section
 International Symposium on Multiparticle Dynamics, Board of Elders

Teaching

Illinois Institute of Technology: (F–Fall, S–Spring, Sum–Summer)

123 General Physics I: Mechanics

— F 2019, F 2018, F 2017, F 2014, S 2013.

404 Subatomic Physics

— S 2017, S 2012.

491 Undergraduate Research (credit hours)

— S 2024 (3), S 2022 (3), F 2021 (3), S 2021 (3).

508 Analytical Dynamics

— F 2020, F 2017.

545 Particle Physics I

— F 2023, F 2022, F 2021, F 2020, F 2019, F 2018, F 2016, F 2015, F 2014,
F 2013, S 2012, F 2010, S 2009.

546 Particle Physics II

— S 2024, S 2022, S 2021, S 2020, S 2019, S 2018, S 2017, S 2016, S 2015, S 2014,
F 2012, S 2011, S 2010.

553 Quantum Field Theory

— S 2024, S 2023, S 2022, S 2019, S 2016, S 2015, S 2014, S 2013, F 2011, F 2009.

591 MS Thesis Research (credit hours)

— F 2020 (3), Sum 2017 (1), S 2017 (14), F 2016 (3).

594 Graduate Research (credit hours)

— S 2017 (4).

691 Ph.D. Thesis Research (credit hours)

— S 2024 (9), F 2023 (9), S 2023 (9), F 2022 (9), S 2022 (6), F 2021 (12),
S 2021 (10), F 2020 (7), S 2020 (7), F 2019 (7), S 2019 (1), F 2018 (1),
S 2018 (1), F 2017 (1), S 2017 (1), F 2016 (1), S 2016 (9), F 2015 (6),
S 2015 (10), F 2014 (10), S 2014 (6), F 2013 (6), S 2013 (6), F 2012 (3),
Sum 2012 (6), S 2012 (5).

IPRO 497-209 Developing a New Strategy to Search for Smuggled Nuclear Material

— F 2016, F 2015.

Southern Methodist University:

6321 Graduate classical mechanics, Spring 2007.

CTEQ Summer Schools:

Heavy quarks and new scales, virtual, September 2021.

Heavy quarks, Pittsburgh, PA, July 2019.

Heavy quarks and new scales, Mayaguez, Puerto Rico, June 2018.

Heavy quarks and new scales, Pittsburgh, PA, July 2017.

Heavy quarks and new scales, Beijing, China, July 2014.

The Standard Model, Madison, Wisconsin, July 2011.

Heavy quark production, Madison, Wisconsin, June 2009.

Top quark physics, Madison, Wisconsin, June 2007.

Research Grants

“Experimental and Theoretical Particle Physics at IIT”

PI of Theory Task (April 1, 2022–March 31, 2025)

U.S. Department of Energy under Contract No. DE-SC0008347 (renewal).

“Simulating Quantum Field Theories: Toward Understanding Mass Using a Quantum Computer”

PIs: Pedro Rivero Ramirez, Ian Cloet, Zack Sullivan (January 1, 2020–December 31, 2022)

QISE-NET Triplet funded by National Science Foundation Award No. DMR-1747426.

“Apply Techniques from QIS to Solve Problems in NP”

PI: (August 1, 2018–July 31, 2022)

Argonne National Laboratory under Contract No. DE-AC02-06CH11357.

“Partial support for a Senior Research Associate”

PI: (October 1, 2017–September 30, 2020)

Fermi National Accelerator Laboratory under Contract No. DE-AC02-07CH11359.

“Improving our theoretical understanding of high energy collider experiment”

PI of theory task: (July 1, 2012–March 31, 2019)

U.S. Department of Energy under Contract No. DE-SC0008347.

“Partial support for Senior Research Associate Hao Zhang”

PI: (October 1, 2011–September 30, 2013)

Argonne National Laboratory under Contract No. DE-AC02-06CH11357.

“Revealing the connections between high energy theory and collider experiment”

PI of theory task: (July 1, 2010–June 30, 2012)

U.S. Department of Energy under Contract No. DE-FG02-94ER40840.

Other Funded Grants

“Travel Support for ISMD 2013”

PIs: Zack Sullivan and R. Russell Betts: (July 1, 2013–June 30, 2014)

National Science Foundation

“Student Travel Support for NuFact09 Workshop”

PIs: Daniel Kaplan, Zack Sullivan, and Yagmur Torun: (September 1, 2009–August 31, 2010)

National Science Foundation

Advisee Theses

1. Daniel Duffty, “New tools for jet analysis in high energy collisions,” Ph.D. thesis, Illinois Institute of Technology (2015).
2. Hengrui Zhan, “Understanding uncertainties in resolved photon structure,” M.S. thesis, Illinois Institute of Technology (2017).
3. Eli Regen, “Direct probes for R -parity violation at the LHC,” M.S. thesis, Illinois Institute of Technology (2017).
4. Keith Pedersen, “Expanding the HEP frontier with boosted B -tags and the QCD power spectrum,” Ph.D. thesis, Illinois Institute of Technology (2018).
5. Pedro Rivero Ramirez, “Quantum Computation for the understanding of mass: Simulating quantum field theories,” Ph.D. thesis, Illinois Institute of Technology (2021).

Graduate Thesis and Comprehensive Committees

Pedro Rivero Ramirez	(Ph.D. 2021, Comp. 2020)
Dr. Ivan Lepetic	(Ph.D. 2019, Comp. 2018)
Dr. Yichen Ji	(Ph.D. 2019, Comp. 2016)
Dr. Xianyi Zhang	(Ph.D. 2019, Comp. 2015)
Dr. Pranava Surukuchi	(Ph.D. 2019, Comp. 2015)
Dr. Keith Pedersen	(Ph.D. 2018, Comp. 2017)
Dr. Amichay Perry	(Ph.D. 2015, Comp. 2014)
Dr. José de Arcos	(Ph.D. 2015, Comp. 2013)
Dr. Gayle Ratliff	(Ph.D. 2015, Comp. 2013)
Dr. Daniel Duffty	(Ph.D. 2015, Comp. 2013)
Dr. Emily Draeger	(Ph.D. 2014, Comp. 2011)
Dr. Brandon Seilhan	(Ph.D. 2011, Comp. 2009)
Jonathan Echevers	(M.S. 2017)
Eli Regen	(M.S. 2017)
Hengrui Zhou	(M.S. 2017)

Department and University Service

Chair, Department of Physics AUCOPT, 2022–.

Chair, Department of Physics Strategic Planning Committee, 2017–2022.

Chair, M.S. Comprehensive/Ph.D. Qualifying Committee, Spring 2009–.

Chair, Physics Graduate Program Committee, Fall 2008–.

University Finance Committee, 2019–2021.

Chair, Ad hoc Committee on Co-terminal Degrees, 2017–2018.
Created Accelerated Masters Program (AMP) 2018

Chair, College of Science Strategic Planning Committee, 2017–2018.

University Graduate Studies Committee, Fall 2011–2017.

University Academic Computing Committee, Fall 2014–2016.

College of Science and Letters Academic Honesty Committee, Fall 2012–2013.

Physics Graduate Student Admissions Committee, 2010–2011.

Organizer of the Physics Informal Student/Faculty Nights, Spring 2009–2011.

Mentor of physics undergraduate teams in the annual IIT Pumpkin Launch,
October 2008, 2009.

Organizational and Public Service Experience

Chair line of the American Physical Society Prairie Section 2020–2022.

Co-chairman of the CTEQ Summer Schools (2017–, organizer since 2011);
lectured in 2007, 2009, 2011, 2014, 2017–2019, 2021.

International Advisory Committee, International Symposium on Multiparticle
Dynamics; and Board of Elders (2014–).

Wu-Ki Tung Award for Early-Career Research on QCD Committee (2016–2018)

Editor, Universe: Analysis Techniques and Algorithms for QCD Studies (2021)

Chairman of the APS Prairie Section Fall Meeting, Illinois Institute of Technology,
November 13–15, 2020.

Organizer of the 15th annual Fermilab-CERN Hadron Collider Physics Summer School,
Fermilab, August 10–21, 2020.

Chairman of the XLIIIrd International Symposium on Multiparticle Dynamics, IIT,
September 15–20, 2013.

Organizer of the Top Quark parallel session of the APS DPF 2011 conference,
Providence, RI, August 2011.

Local organizer of NuFact09: 11th International Workshop on Neutrino Factories,
Superbeams and Beta Beams, Illinois Institute of Technology, July 2009.

Chairman of Collider Physics 2009: Joint Argonne & IIT Theory Institute,
Argonne National Laboratory and Illinois Institute of Technology, May 2009.

Organizational and Public Service Experience (continued)

Organizer of the Argonne & University of Chicago Workshop on Collider Physics, Argonne National Laboratory, May 2006.

Organizer of the Argonne National Laboratory Theory Institutes 2000–2002, 2005:

- Supersymmetry, Extra Dimensions, and Higgs Bosons, May 2005.
- Supersymmetry, Higgs and Extra Dimensions, September 2002.
- From Supersymmetry To Extra Dimensions, June 2001.
- SUSY and Higgs, April–May 2000.

Chairman of the “Balancing and Building the Field” working group at Snowmass 2001. Young Physicists’ Forum Steering Committee for Snowmass 2001, July 2001.

Organizer of the Argonne National Laboratory High Energy Physics Division Lunch Seminar Series, 1998–2001.

Hosted the theoretical high energy physics portion of the 1999 Argonne Open House.

Judge for Chicago Public Schools Regional Science Fair, IIT, January 2016.

Judge for the Chicago Public Schools Science Fair at Lane Tech Prep., December 2012.

Judge for the Chicago Public Schools Area 21 Science Fair, January 2010.

Participated in the Fermilab “Physics Questions” program.

Technical advisor for the “NOVA Fall 2003 Teacher’s Guide.”

Wrote “Smashing Particles” for the PBS NOVA show “The Elegant Universe” in 2003

Convenor of the Flavor Physics II session at the PHENO 2021 Symposium, May 2021.

Convenor of the Higher Orders III session at Loopfest XVIII, August 2019.

Convenor of the QCD session at the PHENO 2015 Symposium, May 2015.

Convenor of the Higgs session at the PHENO 2011 Symposium, May 2011.

Convenor of the Precision Calculation and Monte Carlo Tools session at the PHENO 2010 Symposium, May 2010.

Convenor of the Electroweak Gauge Bosons at the Tevatron session at the PHENO 2008 Symposium, April 2008.

Convenor of the QCD session at Frontiers in Contemporary Physics III at Vanderbilt University, May 2005.

Convenor of the “Weak Interactions of the Top Quark” discussion group at Thinkshop 2, Fermilab, November 2000.

Referee for *Physical Review Letters*, *Physical Review D*, *Physical Review X*, *Journal of High Energy Physics*, *Nature Communications*, *European Physical Journal A*, *European Physical Journal C*, *European Physical Journal P*, *Europhysics Letters*, *Computer Physics Communications*, *Annalen der Physik*, and the Particle Data Group.

Reviewed Publications

1. Zack Sullivan, “Supersymmetric QCD correction to top-quark production at the Fermilab Tevatron,” *Phys. Rev. D* **56**, 451 (1997).
2. T. Stelzer, Z. Sullivan, and S. Willenbrock, “Single-top-quark production via W -gluon fusion at next-to-leading order,” *Phys. Rev. D* **56**, 5919 (1997).
3. T. Stelzer, Z. Sullivan, and S. Willenbrock, “Single-top-quark production at hadron colliders,” *Phys. Rev. D* **58**, 094021 (1998).
4. D. Dicus, T. Stelzer, Z. Sullivan, and S. Willenbrock, “Higgs-boson production in association with bottom quarks at next-to-leading order,” *Phys. Rev. D* **59**, 094016 (1999).
5. Edmond L. Berger, B.W. Harris, and Z. Sullivan, “Single-top-squark production via R -parity-violating supersymmetric couplings in hadron collisions,” *Phys. Rev. Lett.* **83**, 4472 (1999).
6. B.W. Harris, E. Laenen, L. Phaf, Z. Sullivan, and S. Weinzierl, “Fully differential QCD corrections to single top quark final states,” *Int. J. of Mod. Phys. A* **16**, Suppl. **1A**, 379 (2001).
7. E.L. Berger, B.W. Harris, D.E. Kaplan, Z. Sullivan, T.M.P. Tait, and C.E.M. Wagner, “Low-energy supersymmetry and the Tevatron bottom-quark cross section,” *Phys. Rev. Lett.* **86**, 4231 (2001).
8. Edmond L. Berger, B.W. Harris, and Z. Sullivan, “Direct probes of R -parity-violating supersymmetric couplings via single-top-squark production,” *Phys. Rev. D* **63**, 115001 (2001).
9. B.W. Harris, E. Laenen, L. Phaf, Z. Sullivan, and S. Weinzierl, “Fully differential single-top-quark cross section in next-to-leading order QCD,” *Phys. Rev. D* **66**, 054024 (2002).
10. Zack Sullivan, “Fully differential W' production and decay at next-to-leading order in QCD,” *Phys. Rev. D* **66**, 075011 (2002).
11. F. Maltoni, Z. Sullivan, and S. Willenbrock, “Higgs-boson production via bottom-quark fusion,” *Phys. Rev. D* **67**, 093005 (2003).
12. Edmond L. Berger and Zack Sullivan, “Lower limits on R -parity-violating couplings in supersymmetric models with light squarks,” *Phys. Rev. Lett.* **92**, 201801 (2004).
13. Zack Sullivan, “Fast Evaluation of CTEQ Parton Distributions in Monte Carlos,” *Comput. Phys. Commun.* **168**, 25 (2005).
14. Zack Sullivan, “Understanding single-top-quark production and jets at hadron colliders,” *Phys. Rev. D* **70**, 114012 (2004).

15. E. Boos, S. Sherstnev, S. Slabospitsky, Z. Sullivan, and S. Weinzierl, “Top Physics,” in “Physics interplay of the LHC and the ILC,” edited by G. Weiglein, *et al.*, Phys. Rept. 426, 47 (2006).
16. Zack Sullivan, “Angular correlations in single-top-quark and Wjj production at next-to-leading order,” Phys. Rev. D **72**, 094034 (2005).
17. Zack Sullivan and Edmond L. Berger, “Missing heavy flavor backgrounds to Higgs production,” Phys. Rev. D **74**, 033008 (2006).
18. Zack Sullivan and Edmond L. Berger, “Trilepton production at the CERN LHC: Standard model sources and beyond,” Phys. Rev. D **78**, 034030 (2008).
19. Zack Sullivan and Edmond L. Berger, “Isolated leptons from heavy flavor decays: Theory and data,” Phys. Rev. D **82**, 014001 (2010).
20. Arjun Menon and Zack Sullivan, “Charm tagging and the $H \rightarrow W^+W^- \rightarrow l\nu c j$ semi-leptonic channel,” IIT-CAPP-10-03, arXiv:1006.1078 [hep-ph], submitted to JHEP.
21. Zack Sullivan and Arjun Menon, “A standard model explanation of a CDF dijet excess in Wjj ,” Phys. Rev. D **83**, 091504(R) (2011).
22. Arjun Menon and Zack Sullivan, “Higgs exclusion and the $H \rightarrow WW^* \rightarrow l\nu c j$ semi-leptonic channel at the Tevatron,” IIT-CAPP-11-09, arXiv:1109.6684 [hep-ph], submitted to Phys. Rev. D.
23. Daniel Duffy, Zack Sullivan, and Hao Zhang, “Top quark forward-backward asymmetry and W' bosons,” Phys. Rev. D **85**, 094027 (2012).
24. Edmond L. Berger, Zack Sullivan, and Hao Zhang, “Associated Higgs plus vector boson test of a fermiophobic Higgs boson,” Phys. Rev. D **86**, 015011 (2012).
25. Thomas Flacke, Arjun Menon, and Zack Sullivan, “Constraints on UED from W' searches,” Phys. Rev. D **86**, 093006 (2012).
26. Daniel Duffy and Zack Sullivan, “Model independent reach for W' bosons at the LHC,” Phys. Rev. D **86**, 075018 (2012).
27. Daniel Duffy and Zack Sullivan, “Searching for W' bosons through decays to boosted-top and boosted-bottom jets,” Phys. Rev. D **90**, 015031 (2014).
28. Edmond L. Berger, Zack Sullivan, and Hao Zhang, “LHC and Tevatron constraints on a W' model interpretation of the top quark forward-backward asymmetry,” Phys. Rev. D **88**, 114026 (2013).
29. Daniel Duffy and Zack Sullivan, “Searching for W' bosons at LHC with single top production,” in *Proceedings of the XLIIIrd International Symposium on Multiparticle Dynamics*, edited by Sergei Chekanov and Zack Sullivan (IIT Press, Chicago, 2014), p. 33.

30. Zack Sullivan and Daniel Duffy, “Toward the development of more robust jet definitions,” in *XLIVth International Symposium on Multiparticle Dynamics (ISMD 2014)*, edited by F. Fabbri and P. Giacomelli, EPJ Web of Conferences 90, 10001 (2015).
31. Seth Quackenbush and Zack Sullivan, “Parton distributions and the W mass measurement,” Phys. Rev. D **92**, 033008 (2015).
32. Keith Pedersen and Zack Sullivan, “ μ_x boosted-bottom-jet tagging and Z' boson searches,” Phys. Rev. D **93**, 014014 (2016).
33. Zack Sullivan and Keith Pedersen, “Flavor tagging TeV jets for physics beyond the Standard Model,” in *XLVth International Symposium on Multiparticle Dynamics (ISMD 2015)*, edited by T. Barillari, S. Bethke, S. Kluth, and S. Menke, EPJ Web of Conferences 120, 03001 (2016).
34. Daniel Duffy and Zack Sullivan, “A priority based noise tolerant jet framework and algorithm,” submitted to JHEP, IIT-CAPP-16-03, arXiv:1606.04497 [hep-ph].
35. Zack Sullivan and Keith Pedersen, “Searching for charged Higgs bosons with boosted top and boosted bottom jets,” in *XLVIth International Symposium on Multiparticle Dynamics (ISMD 2016)*, edited by I.-K. Yoo, EPJ Web of Conferences 141, 08015 (2017).
36. Keith Pedersen and Zack Sullivan, “Probing the two Higgs doublet wedge region with charged Higgs boson decays to boosted jets,” Phys. Rev. D **95**, 035037 (2017).
37. Zack Sullivan, “Are PDFs still consistent with Tevatron data?,” in *XLVIIth International Symposium on Multiparticle Dynamics (ISMD 2017)*, edited by A. Ayala Mercado and E. Cuautle Flores, EPJ Web of Conferences 172, 03008 (2018).
38. Zack Sullivan and Keith Pedersen, “Harnessing the QCD power spectrum for high energy physics,” in *XLVIIIth International Symposium on Multiparticle Dynamics (ISMD 2018)*, edited by A. Yang, W.Y. Wang, S.C.C. Ng, A.H. Chan, C.H. Oh, and K.K. Phua, EPJ Web of Conferences 206, 05005 (2019).
39. Tobias Neumann and Zack Sullivan, “Off-shell single-top-quark production in the Standard Model Effective Field Theory,” J. High Energy Phys. **06**, 022 (2019).
40. John Campbell, Tobias Neumann, and Zack Sullivan, “Single-top-quark production in the t -channel at NNLO,” J. High Energy Phys. **02**, 040 (2021).
41. Pedro Rivero, Ian C. Cloët, and Zack Sullivan, “An optimal quantum sampling regression algorithm for variational eigensolving in the low qubit number regime,” submitted to Phys. Rept., IIT-CAPP-20-06, arXiv:2012.02338 [quant-ph].
42. John Campbell, Tobias Neumann, and Zack Sullivan, “Testing parton distribution functions with t -channel single-top-quark production,” Phys. Rev. D **104**, 094042 (2021).
43. Keith Pedersen, Mithila Mangedarage, and Zack Sullivan, “Harnessing the global correlations of the QCD power spectrum,” arXiv:2312.08627 [hep-ph], submitted to Phys. Rev. D.

Books and Other Publications

- b1. Zack Edward Sullivan, “Testing the standard model with top quark production,” Ph. D. thesis, University of Illinois, Urbana-Champaign, Illinois, 1998, UMI-99-04602.
- b2. Daniel M. Kaplan, Zack Sullivan, and Maury C. Goodman, eds., “NEUTRINO FACTORIES, SUPERBEAMS, AND BETA BEAMS: 11th International Workshop on Neutrino Factories, Superbeams and Beta Beams–NuFact09,” AIP Conference Proceedings Volume 1222, 526 pgs. (AIP Press, Melville, New York, 2010) ISBN 978-0-7354-0763-3.
- b3. Sergei Chekanov and Zack Sullivan, eds., “Proceedings of the XLIIIrd International Symposium on Multiparticle Dynamics,” 340 pgs. (IIT Press, Chicago, 2014) ISBN 978-1-61597-002-5.

Unrefereed Publications and Conference Proceedings

- c1. R. Frey, Z. Sullivan, *et al.*, “Top Quark Physics: Future Measurements,” in *Proceedings of the 1996 DPF/DPB Summer Study on High Energy Physics*, Snowmass, June 25–July 12, 1996, edited by D. Cassel, L.T. Gennari, and R.H. Siemann (SLAC, Stanford, 1997), p. 760.
- c2. Zack Sullivan, “Supersymmetric QCD correction to top-quark production at the Tevatron,” in *Proceedings of the 1996 DPF/DPB Summer Study on High Energy Physics*, Snowmass, June 25–July 12, 1996, edited by D. Cassel, L.T. Gennari, and R.H. Siemann (SLAC, Stanford, 1997), p. 797.
- c3. M. Carena, Z. Sullivan, *et al.*, “Report of the Higgs Working Group of the Tevatron Run 2 SUSY/Higgs Workshop,” in *Physics at Run II: the Supersymmetry/Higgs Workshop*, Fermilab, 1998, edited by M. Carena and J. Lykken (Fermilab, Batavia, 2000), p. 424.
- c4. C. Kao, D. Pierce, Z. Sullivan, and D. Wackerroth, “Supersymmetric Corrections to Standard Model Processes,” in *Physics at Run II: the Supersymmetry/Higgs Workshop*, Fermilab, 1998, edited by M. Carena and J. Lykken (Fermilab, Batavia, 2000), p. 70.
- c5. Zack Sullivan, “Single-top-squark production via baryon-number-violating couplings at the Fermilab Tevatron Collider,” in *Physics at Run II: the Supersymmetry/Higgs Workshop*, Fermilab, 1998, edited by M. Carena and J. Lykken (Fermilab, Batavia, 2000), p. 315.
- c6. Zack Sullivan, “R-parity-violating production of single top squarks with R-parity-conserving decays,” in *Proceedings of the XXXIVth Rencontres de Moriond: ’99 QCD and High Energy Hadronic Interactions*, Les Arcs, Savoie, France, March 20–27, 1999, edited by J. Trân Thanh Vân (Thê Giói Publishers, Hanoi, 2001), p. 399.
- c7. S. Willenbrock, Z. Sullivan, *et al.*, “Top Quark Physics,” in *Proceedings of the Workshop on Standard Model Physics (and More) at the LHC*, CERN, 1999, edited by G. Altarelli and M.L. Mangano (CERN, Geneva, 2000), p. 456.

- c8. Zack Sullivan, “A supersymmetric solution to the bottom-quark cross section anomaly,” in *Proceedings of the XXXVIth Rencontres de Moriond: QCD and High Energy Hadronic Interactions*, Les Arcs, Savoie, France, March 17–24, 2001, edited by Jean Trân Thanh Vân (Thê Giói Publishers, Hanoi, 2002), p. 93.
- c9. E.L. Berger, Z. Sullivan, *et al.*, “Summary: Working Group on QCD and Strong Interactions,” in *Proceedings of Snowmass 2001: the Future of Particle Physics*, Snowmass, July 1–20, 2001, edited by N. Graf (SLAC, Stanford, 2002), eConf C010630, P5001.
- c10. Z. Sullivan, R. Erbacher, and C. Potter, “Balancing and Building the Field,” in *Proceedings of Snowmass 2001: the Future of Particle Physics*, Snowmass, July 1–20, 2001, edited by N. Graf (SLAC, Stanford, 2002), eConf C010630, I003.
- c11. P.M. Nadolsky and Z. Sullivan, “PDF uncertainties in WH production at Tevatron,” in *Proceedings of Snowmass 2001: the Future of Particle Physics*, Snowmass, July 1–20, 2001, edited by N. Graf (SLAC, Stanford, 2002), eConf C010630, P510.
- c12. Z. Sullivan and P.M. Nadolsky, “Heavy-quark parton distribution functions and their uncertainties” in *Proceedings of Snowmass 2001: the Future of Particle Physics*, Snowmass, July 1–20, 2001, edited by N. Graf (SLAC, Stanford, 2002), eConf C010630, P511.
- c13. Zack Sullivan, “How to rule out Little Higgs at the LHC,” *Bull. Am. Phys. Soc.* **48**, No. 2, 216 (2003).
- c14. Zack Sullivan, “How to rule out Little Higgs (and constrain many other models) at the LHC,” in *Proceedings of the XXXVIIIth Rencontres de Moriond: QCD and High Energy Hadronic Interactions*, Les Arcs, Savoie, France, March 22–29, 2003, edited by Étienne Augé and Jean Trân Thanh Vân (Thê Giói Publishers, Hanoi, 2003), p. 379.
- c15. Zack Sullivan, “Faster Parton Distribution Evaluation in Monte Carlos,” FERMILAB-FN-755, hep-ph/0403055.
- c16. A. Juste, Z. Sullivan, *et al.*, “Report of the 2005 Snowmass Top/QCD Working Group,” in *Proceedings of the 2005 International Linear Collider Physics and Detector Workshop and 2nd ILC Accelerator Workshop*, Snowmass, August 14–27, 2005, edited by N. Graf (SLAC, Stanford, 2006), eConf C0508141, PLEN0043.
- c17. Higgs Working Group, Z. Sullivan, *et al.*, “Toward High Precision Higgs-Boson Measurements at the International Linear e^+e^- Collider,” in *Proceedings of the 2005 International Linear Collider Physics and Detector Workshop and 2nd ILC Accelerator Workshop*, Snowmass, August 14–27, 2005, edited by N. Graf (SLAC, Stanford, 2006), eConf C0508141, PLEN0044.
- c18. Zack Sullivan, “Understanding Light: Why we need a terascale photon collider,” in *Proceedings of the 2005 International Linear Collider Physics and Detector Workshop and 2nd ILC Accelerator Workshop*, Snowmass, August 14–27, 2005, edited by N. Graf (SLAC, Stanford, 2006), eConf C0508141, ALCPG0402.

- c19. Zack Sullivan, “Angular correlations in single-top-quark and Wjj ,” in *Final Report of the Tev4LHC Workshop*, Fermilab, 2004–2005, edited by M. Carena and S. Mrenna (Fermilab, Batavia, 2006), Sec. 3.2.3.
- c20. Zack Sullivan, “Model independent searches for W' bosons,” in *Final Report of the Tev4LHC Workshop*, Fermilab, 2004–2005, edited by M. Carena and S. Mrenna (Fermilab, Batavia, 2006), Sec. 4.4.
- c21. Edmond L. Berger and Zack Sullivan, “Higgs boson decay into a pair of leptons,” in *Proceedings of the 9th Conference on the Intersections of Particle and Nuclear Physics*, Rio Grande, Puerto Rico, May 30–June 3, 2006, AIP Conf. Proc. **870**, 258 (2006).
- c22. Zack Sullivan, “Top Quark Physics at the ILC: Methods and Meanings,” in *Proceedings of the International Linear Collider Workshop 2008*, LCWS08, Chicago, IL, November 16–20, 2008, eConf C081116, 20855 (2009).
- c23. Edmond L. Berger and Zack Sullivan, “Trilepton production at the CERN LHC: SUSY Signals and Standard Model Backgrounds,” in *Proceedings of the European Physical Society Europhysics Conference on High Energy Physics*, EPS-HEP 2009, Krakow, Poland, July 16–22 2009, Proc. Soc. Eur. **PS-HEP2009**, 226 (2009).
- c24. P. Nath, Zack Sullivan, *et al.*, “The Hunt for New Physics at the Large Hadron Collider,” Nucl. Phys. Proc. Suppl. **200-202**, 185 (2010).
- c25. Zack Sullivan, “Theory lessons from the Tevatron for the LHC,” in Fall 2010 Meeting of the Prairie Section of the American Physical Society, Illinois Institute of Technology, Chicago, November 19–20, 2010.
- c26. Arjun Menon and Zack Sullivan, “Using charm tagging to discover the Higgs in the semi-leptonic channel,” in Fall 2010 Meeting of the Prairie Section of the American Physical Society, Illinois Institute of Technology, Chicago, November 19–20, 2010.
- c27. Yaofu Zhou and Zack Sullivan, “Fully Differential W -prime Production and Decay in Arbitrary Models,” in Fall 2010 Meeting of the Prairie Section of the American Physical Society, Illinois Institute of Technology, Chicago, November 19–20, 2010.
- c28. Zack Sullivan and Arjun Menon, “Reconciling the CDF Wjj and single-top-quark anomalies” in *Proceedings of the DPF-2011 Conference*, Providence, RI, August 8–13, 2011, edited by Thomas Speer, eConf C110809 (2011).
- c29. Zack Sullivan, “Theoretical remarks on top quark physics,” invited paper in Bull. Am. Phys. Soc. **57**, No. 3, 99 (2012).
- c30. Seth Quackenbush and Zack Sullivan, “Parton distributions and the W mass measurement,” Bull. Am. Phys. Soc. **57**, No. 16, 14 (2012).
- c31. Zack Sullivan and Daniel Duffy, “Search for W' bosons through decays to boosted top-jets,” Bull. Am. Phys. Soc. **58**, No. 4, 187 (2013).

- c32. R. Calkins, S. Chekanov, J. Conway, J. Dolen, R. Erbacher, J. Pilot, R. Poschl, S. Rappoccio, A. Schwartzman, Z. Sullivan, and B. Tweedie, “Reconstructing top quarks at the upgraded LHC and at future accelerators,” in *Planning the Future of U.S. Particle Physics: Report of the 2013 Community Summer Study of the APS Division of Particles and Fields*, edited by Norman A. Graf, Michael E. Peskin, and Jonathan L. Rosner, eConf C1307292, SNOW13-00075 (2014).
- c33. Zack Sullivan, “Next-to-leading order $pp \rightarrow W' \rightarrow tb$ production at 14 TeV and 33 TeV,” in *Planning the Future of U.S. Particle Physics: Report of the 2013 Community Summer Study of the APS Division of Particles and Fields*, edited by Norman A. Graf, Michael E. Peskin, and Jonathan L. Rosner, eConf C1307292, SNOW13-00120 (2014).
- c34. Daniel M. Kaplan and Zack Sullivan, “Towards Muon-Beam Standoff Detection of Fissile Contraband,” poster at the Muon Accelerator Program Spring Workshop 2014, Fermilab, May 27–31, 2014.
- c35. Zack Sullivan and Seth Quackenbush, “Improving parton distribution uncertainties in a W mass measurement at the LHC,” in *Proceedings of the Division of Particles and Fields (DPF 2015)*, edited by Monica Tecchio and Daniel Levin, eConf C150804 (2015).
- c36. Keith Pedersen and Zack Sullivan, “Flavor tagging TeV jets for BSM and QCD,” in *Proceedings of the Division of Particles and Fields (DPF 2015)*, edited by Monica Tecchio and Daniel Levin, eConf C150804 (2015).
- c37. Zack Sullivan, “Boosted-bottom jet tagging and BSM searches,” in *Proceedings of the 51st Rencontres de Moriond: QCD and High Energy Hadronic Interactions*, edited by Etienne Augé, Jacques Dumarchez, and J. Trân Thanh Vân (ARISF, Paris, 2016), p. 75.
- c38. Zack Sullivan and Keith Pedersen, “The reach for charged Higgs bosons with boosted bottom and boosted top jets,” *Bull. Am. Phys. Soc.* **62**, No. 1, 39, B11-8 (2017).
- c39. Keith Pedersen and Zack Sullivan, “Spherical harmonics for multiparticle final states,” in *Proceedings, Meeting of the APS Division of Particles and Fields (DPF 2017)*, edited by Michael Eads, eConf C170731 (2017).
- c40. Zack Sullivan, “A framework for PDFs at a photon collider,” *Bull. Am. Phys. Soc.* **63**, No. 4, B08.00007 (2018), <http://meetings.aps.org/Meeting/APR18/Session/B08.7>.
- c41. Zack Sullivan and Tobias Neumann, “Off-shell t -channel single-top-quark production at next-to-leading order in QCD in a Standard Model Effective Field Theory,” *Bull. Am. Phys. Soc.* **64**, No. 3, H13.00004 (2019), <http://meetings.aps.org/Meeting/APR19/Session/H13.4>
- c42. Zack Sullivan, John Campbell, and Tobias Neumann, “NNLO t -channel single-top-quark production revisited,” to appear in the *Bull. Am. Phys. Soc.* (2020).

Recent Seminars, Public Lectures, and Conference Talks

- “NNLO single-top-quark production and decay: Discrepancies resolved, PDFs challenged”*
 4/20/21 APS April meeting 2021 (virtual)
 5/26/21 PHENO 2021 Symposium, (virtual) Pittsburgh, PA
 7/13/21 APS DPF 2021, (virtual) Florida State U.
 7/14/21 ISMD 2021, (virtual) Scotland
- “Off-shell t -channel single-top-quark production at NLO in QCD in the Standard Model Effective Field Theory”*
 4/14/19 APS April meeting 2019, Denver, CO
- “Cleaning up t -channel single top: Anomalous couplings and complete NLO ”*
 11/10/18 CTEQ Workshop @ JLAB: Parton Distributions as a Bridge from Low to High Energies, Jefferson Lab
- “Harnessing the global correlations of the QCD power spectrum for high energy physics”*
 9/5/18 ISMD 2018, Singapore
- “A framework for PDFs at a photon collider”*
 4/14/18 APS April meeting 2018, Columbus, OH
- “Probing the limits of particle physics”*
 9/21/17 Illinois Institute of Technology, Colloquium
- “Are PDFs still consistent with Tevatron data?”*
 7/31/17 APS DPF 2017, Fermilab
 9/17/17 ISMD 2017, Tlaxcala, Mexico
- “The reach for charged Higgs bosons with boosted bottom and boosted top jets”*
 1/28/17 APS April meeting 2017, Washington DC
- “Is single-top telling us we are fitting the wrong degrees of freedom in gluon PDFs?”*
 11/18/16 CTEQ Collaboration meeting
- “Searching for charged Higgs bosons with boosted top and bottom jets”*
 8/29/16 Talk and poster at ISMD 2016, Jeju, South Korea
- “Game changing muon applications: beyond the high energy physics window”*
 5/3/16 Physics with muons beyond $g-2$ and $\mu 2e$, Fermilab
- “Boosted-bottom jet tagging and BSM searches”*
 3/21/16 51st Rencontres de Moriond: QCD and High Energy Interactions, La Thuile, Italy
- “Boosted-bottom jet tagging for Z' boson searches (and other physics beyond the standard model)”*
 11/23/15 University of Illinois, Chicago, Physics Seminar
- “Flavor Tagging TeV Jets for BSM and QCD”*
 10/5/15 Poster at ISMD 2015, Wildbad Kreuth, Germany
- “Improving parton distribution uncertainties in a W mass measurement at the LHC”*
 8/6/15 DPF 2015, Ann Arbor, MI

- “A better understanding of parton distributions and the W mass”*
5/5/15 PHENO 2015, Pittsburgh, PA
- “What do we learn from single top quarks?”*
4/9/15 Invited talk at Top at Twenty Workshop, Fermilab
- “Toward the development of more robust jet definitions”*
9/8/14 ISMD 2014, Bologna, Italy
- “Heavy quarks and new scales: Understanding subtleties of QCD”*
7/9/14 Beijing, China, July 2014.
- “So, you found a Higgs boson: Now what?”*
10/14/13 Illinois Institute of Technology, Colloquium
- “The challenges of high luminosity and jets”*
9/16/13 ISMD 2013, IIT, Chicago, IL
- “Search for W' bosons through decays to boosted top-jets”*
4/15/13 APS 2013, Denver, CO
- “The new DIS and Drell Yan: single top quarks and W' bosons”*
11/19/12 Jefferson Lab Theory Colloquium, VA
- “Distinguishing fermiophobic Higgs via associated Higgs plus vector boson production”*
5/8/12 PHENO 2012 Symposium, University of Pittsburgh, PA
- “Theoretical remarks on top quark physics”*
4/1/12 Invited talk at APS 2012, Atlanta, GA
- “Rise and decline of an anomaly”*
11/9/11 University of Oregon, Theory Institute Seminar
9/15/11 Illinois Institute of Technology, Colloquium
- “A standard model explanation of the CDF dijet excess in Wjj ”*
8/11/11 APS DPF 2011, Providence, RI
- “Higgs to Wc_j at the Tevatron and LHC”*
5/10/11 PHENO 2011 Symposium, University of Wisconsin, Madison
- “Theory lessons from the Tevatron for the LHC”*
11/19/10 Invited talk at the Fall 2010 Meeting of the APS Prairie Section, Chicago, IL
- “Isolated leptons in Higgs and SUSY: the forgotten background from heavy flavor decays”*
10/12/10 Johns Hopkins University
10/8/10 Indiana University, Bloomington
- “Isolated leptons from heavy flavor decays — theory and data”*
5/11/10 PHENO 2010 Symposium, University of Wisconsin, Madison
- “Dilepton and Trilepton Production: Standard Model sources and beyond”*
11/6/09 Joint Experimental–Theoretical Seminar, Fermilab

Recent Conference Participation

- The 50th International Symposium on Multiparticle Dynamics, (virtual) July 12–16, 2021.
- APS DPF 2021, (virtual) July 12–14, 2021.
- PHENO 2021 Symposium, (virtual) Pittsburgh, PA, May 24–26, 2021.
- APS April meeting 2021, (virtual) April 13–16, 2021.
- APS Prairie Section 2020 Fall Meeting, (virtual) Illinois Tech, November 13–15, 2020.
- PHENO 2020 Symposium, (virtual) Pittsburgh, PA, May 4–6, 2020.
- APS April Meeting, (virtual) Denver, CO, April 18–21, 2020.
- LPC Workshop on Physics Connections between the LHC and EIC, Fermilab, November 13–15, 2019.
- In Search of New Physics Using SMEFT, Argonne, October 2–4, 2019.
- Loopfest XVIII, Fermilab, August 12–14, 2019.
- APS April meeting 2019, Denver, CO, April 13–16, 2019.
- CTEQ Workshop @ JLAB: Parton Distributions as a Bridge from Low to High Energies, November 8–10, 2018
- The XLVIIIth International Symposium on Multiparticle Dynamics, Singapore, September 3–8, 2018.
- APS April meeting 2018, Columbus, OH, April 14–17, 2018.
- The XLVIIth International Symposium on Multiparticle Dynamics, Tlaxcala City, Mexico, September 11–15, 2017.
- APS DPF 2017, Fermilab, July 31–August 4, 2017.
- 34th Academic Chairpersons Conference, New Orleans, LA, February 8–10, 2017.
- APS April meeting 2017, Washington DC, January 28–31, 2017.
- The XLVIth International Symposium on Multiparticle Dynamics, Jeju, South Korea, August 29–September 2, 2016.
- Physics with muons beyond $g-2$ and $\mu 2e$, Fermilab, May 3, 2016.
- The 51st Rencontres de Moriond: QCD and High Energy Interactions, La Thuile, Italy, March 19–26, 2016.
- The XLVth International Symposium on Multiparticle Dynamics, Wildbad Kreuth, Germany, October 4–9, 2015.
- APS DPF 2015, Ann Arbor, MI, August 4–8, 2015.
- PHENO 2015 Symposium, Pittsburgh, PA, May 4–6, 2015.
- Top at Twenty, Fermilab, April 9–10, 2015.
- The XLIVth International Symposium on Multiparticle Dynamics, Bologna, Italy, September 8–12, 2014.
- Workshop on QCD Tools for LHC Physics: From 8 to 14 TeV, “What’s needed and why?” Fermilab, November 14–15, 2013.
- The XLIIIrd International Symposium on Multiparticle Dynamics, IIT, September 15–20, 2013.

The following research was funded by my grants, and was produced by postdocs or students under my supervision.

Arjun Menon

- a1. H.-C. Cheng, W.-C. Huang, I. Low, and A. Menon, “Goldstini as the decaying dark matter,” *J. High Energy Phys.* **1103**, 019 (2011).
- a2. Q.-H. Cao, M. Carena, S. Gori, A. Menon, P. Schwaller, C.E.M. Wagner, and L.-T. Wang, “W plus two jets from a quasi-inert Higgs doublet,” *J. High Energy Phys.* **1108**, 002 (2011).
- a3. K. Kumar, A. Menon, and T.M.P. Tait, “Magnetic Fluffy Dark Matter,” *J. High Energy Phys.* **1202**, 131 (2012).

Hao Zhang

- a4. E.L. Berger, Q.-H. Cao, C.-R. Chen, J.-H. Yu, and H. Zhang, “Dynamical Origin of the Correlation between the Asymmetries A_{FB}^t and A_{FB}^ℓ ,” arXiv:1111.3641 [hep-ph], IIT-CAPP-11-11.
- a5. E.L. Berger, Q.-H. Cao, C.-R. Chen, J.-H. Yu, and H. Zhang, “The Top Quark Production Asymmetries A_{FB}^t and A_{FB}^ℓ ,” *Phys. Rev. Lett.* **108**, 072002 (2012).
- a6. E.L. Berger, Q.-H. Cao, J.-H. Yu, and H. Zhang, “Measuring Top Quark Polarization in Top Pair plus Missing Energy Events,” *Phys. Rev. Lett.* **109**, 152004 (2012).
- a7. E.L. Berger, Q.-H. Cao, C.-R. Chen, and H. Zhang, “Interpretations and Implications of the Top Quark Rapidity Asymmetries A_{FB}^t and A_{FB}^ℓ ,” *Phys. Rev. D* **88**, 014033 (2013).
- a8. E.L. Berger, Q.-H. Cao, J.-H. Yu, and H. Zhang, “Measuring Top-Quark Polarization in Top-Pair + Missing Energy Events,” in the *Proceedings of 48th Rencontres de Moriond “QCD and High Energy Interactions*,” La Thuile, Italy, March 9–16, 2013.
- a9. Haipeng An, Lian-Tao Wang, and Hao Zhang, “Dark matter with t -channel mediator: a simple step beyond contact interaction,” *Phys. Rev. D* **89**, 115014 (2014).

Keith Pedersen

- a10. Keith Pedersen, “Conditioning your quantile function,” arXiv:1704.07949 [stat.CO], submitted to the *Journal of the ACM*.

Tobias Neumann

- a11. Tobias Neumann, “NLO Higgs+jet at large transverse momenta including top quark mass effects,” *J. Phys. Comm.* **2**, 095017 (2018).
- a12. Tobias Neumann, “Recent developments in gluon fusion Higgs calculations,” in *13th Conference on the Intersections of Particle and Nuclear Physics (CIPANP 2018)*, edited by Wick Haxton, eConf C180529.

- a13. Johannes Artz, Robert V. Harlander, Fabian Lange, Tobias Neumann, and Mario Prausa, “Results and techniques for higher order calculations within the gradient flow formalism,” *J. High Energy Phys.* **06**, 121 (2019).
- a14. J. Campbell and T. Neumann, “Precision phenomenology with MCFM,” *J. High Energy Phys.* **12**, 034 (2019).
- a15. A. Valassi, T. Neumann *et al.*, “Challenges in Monte Carlo event generator software for High-Luminosity LHC,” *Comput. Softw. Big Sci.* **5**, no.1, 12 (2021).
- a16. Thomas Becher and Tobias Neumann, “Fiducial q_T resummation of color-singlet processes at N³LL+NNLO,” *J. High Energy Phys.* **03**, 199 (2021).