*LEPP, Cornell University*
*Physical Sciences Bldg., 245 Feeney Way*
*Ithaca, NY 14850*

*+1 (919)-349-0627*
*shomiller@cornell.edu*
*shomiller-academic.netlify.app*

# Samuel D. Homiller

**Curriculum Vitae**
Last Updated: February 5, 2025

## Academic Positions

- **Bethe Postdoctoral Fellow**, Cornell University
  Sept. 2024 - Present
- **Post-Doctoral Fellow**, Harvard University
  Sept. 2020 - Aug. 2024
- **DOE Graduate Research Fellow**, Brookhaven National Laboratory
  Aug. 2018 - Aug. 2019
- **Research Assistant**, YITP, Stony Brook University
  May 2017 - Aug. 2020
- **Undergraduate Research Assistant**, University of Illinois at Urbana-Champaign
  Aug. 2012 - Aug. 2015

## Research Interests

**Theoretical particle physics**, broadly including physics beyond the Standard Model and related aspects of Quantum Field Theory, particularly in relation to new physics related to the Higgs boson and electroweak symmetry breaking, models of flavor, and solutions to the strong CP problem.

## Education

- **Ph.D. in Physics, 2020**, Stony Brook University
  Advisor: Patrick Meade
  Thesis: Higgs Couplings as a Gateway to New Fundamental Physics
- **B.S., Physics, 2015**, University of Illinois at Urbana-Champaign
  Magna cum Laude, Highest Distinction
- **B.S., Mathematics, 2015**, University of Illinois at Urbana-Champaign
  Magna cum Laude, Highest Distinction
- **High School Diploma, 2011**, North Carolina School of Science and Math

## Notable Awards and Honors

- J. J. and Noriko Sakurai Dissertation Award in Theoretical Particle Physics, American Physical Society, 2021
- DOE Office of Science Graduate Research Fellowship, 2018 - 2019.
- Ernest M. Lyman Prize, University of Illinois, 2015.

## Publications

**Note:** Following high-energy physics convention, order of authorship was determined alphabetically.
An up-to-date list of my publications can be found at the Inspire-HEP database

### Recent Preprints (Awaiting Peer Review)

- "Lepton Flavor Violation: From Muon Decays to Muon Colliders" ,
  with P. Asadi, H. Bagherian, K. Fraser and Q. Lu,
  (to appear).
- "Fermion-Portal Dark Matter at a High-Energy Muon Collider" ,
  with P. Asadi, A. Radick and T. T. Yu,
  [arXiv:2412.14235], submitted to Phys. Rev. D.
- "Strange quark as a probe for new physics in the Higgs sector" ,
  with M. Basso et al.,
  [arXiv:2203.07535] (under ILD review, to be submitted to EPJC)

### Peer Reviewed Journal Articles

28. "Barr–Zee Diagrams at a High-Energy Muon Collider" ,
    with J. Lodman, A. Parikh and M. Reece,
    JHEP **12**, 134 (2024) [arXiv:2410.01873].
27. "Relevance of one-Loop SMEFT matching in the 2HDM" ,
    with S. Das Bakshi, S. Dawson and D. Fontes,
    Phys. Rev. D **109**, 075022 (2024) [arXiv:2401.12279].
26. "Zero Modes of Massive Fermions Delocalize from Axion Strings" ,
    with H. Bagherian, K. Fraser and J. Stout,
    JHEP **05**, 079 (2024) [arXiv:2310.01476].
25. "Wrinkles in the Froggatt–Nielsen Mechanism and Flavorful New Physics" ,
    with P. Asadi, A. Bhattacharya, K. Fraser and A. Parikh,
    JHEP **10**, 069 (2023) [arXiv.2308.01340].
24. "Chiral Nelson–Barr Models: Quality and Cosmology" ,
    with P. Asadi, Q. Lu and M. Reece,
    Phys. Rev. D **107**, 115012 (2023) [arXiv:2212.03882].
23. "Muon Collider Forum Report" ,
    with K. M. Black, et al.,
    JINST **19**, T02015 [arXiv:2209.01318].
22. "Role of dimension-eight operators in an EFT for the 2HDM" ,
    with S. Dawson, D. Fontes and M. Sullivan,
    Phys. Rev. D **106**, 055012 (2022) [arXiv:2205.01561].
21. "Oblique Lessons from the $W$ Mass Measurement at CDF II" ,
    with P. Asadi, C. Cesarotti, K. Fraser and A. Parikh,
    Phys. Rev. D **108**, 055026 (2023) [arXiv:2204.05283].
20. "Complementary Signals of Lepton Flavor Violation at a High-Energy Muon Collider" ,
    with Q. Lu and M. Reece,
    JHEP **07**, 036 (2022) [arXiv:2203.08825].

19. "Towards a Muon Collider" ,
with C. Accettura et al.,
EPJC **83**, 864 (2023) [arXiv:2303.08533].

18. "Probing New Gauge Forces with a High-Energy Muon Beam Dump" ,
with C. Cesarotti, R. K. Mishra and M. Reece,
Phys. Rev. Lett. **130**, 071803 (2023) [arXiv:2202.12302].

17. "New Physics Searches at Kaon and Hyperon Factories" ,
with E. Goudzovskiet al.,
Rep. Prog. Phys. **86** 016201 (2023) [arXiv:2201.07805].

16. "The Muon Smasher's Guide" ,
with H. Al Ali et al.,
Rep. Prog. Phys. **85** 084201 (2022) [arXiv:2103.14043].

15. "Challenges for Unsupervised Anomaly Detection in Particle Physics" ,
with K. Fraser, R. K. Mishra, B. Ostdiek and M. D. Schwartz,
JHEP **03**, 066 (2022) [arXiv:2110.06948].

14. "The Impact of Dimension-8 SMEFT Contributions: A Case Study" ,
with S. Dawson and M. Sullivan,
Phys. Rev. D **104**, 115013 (2021) [arXiv:2110.06929].

13. "Searching for Leptoquarks at Future Muon Colliders" ,
with P. Asadi, R. Capdevilla and C. Cesarotti,
JHEP **10**, 182 (2021) [arXiv:2104.05720].

12. "Multi-Higgs Production Probes Higgs Flavor" ,
with D. Egaña-Ugrinovic and P. Meade,
Phys. Rev. D **103**, 115005 (2021) [arXiv:2101.04119].

11. "Uncovering the High Scale Higgs Singlet Model" ,
with P. P. Giardino and S. Dawson,
Phys. Rev. D **103**, 075016 (2021) [arXiv:2102.02823].

10. "Putting Standard Model EFT Fits to Work" ,
with S. Dawson and S. Lane,
Phys. Rev. D **102**, 055012 (2020) [arXiv:2007.01296].

9. "Validity of Standard Model EFT Studies of VH and VV Production at NLO" ,
with J. Baglio, S. Dawson, S. Lane and I. Lewis,
Phys. Rev. D **101**, 115004 (2020) [arXiv:2003.07862].

8. "Light scalars and the KOTO anomaly" ,
with D. Egaña-Ugrinovic and P. Meade,
Phys. Rev. Lett **124**, 191801 (2020) [arXiv:1911.10203].

7. "QCD Corrections in SMEFT Fits to $WZ$ and $WW$ Production" ,
with J. Baglio and S. Dawson,
Phys. Rev. D **100**, 113010 (2019) [arXiv:1909.11576].

6. "Higgs bosons with large couplings to light quarks" ,
with D. Egaña-Ugrinovic and P. Meade,
Phys. Rev. D **100**, 115041 (2019) [arXiv:1908.11376].

5. "Benchmarking simplified template cross sections in $WH$ production" ,
with J. Brehmer, S. Dawson, F. Kling and T. Plehn,
JHEP **11**, 034 (2019) [arXiv:1908.06980].

4. "Aligned and Spontaneous Flavor Violation" ,
with D. Egaña-Ugrinovic and P. Meade,
Phys. Rev. Lett **123**, 031802 (2019) [arXiv:1811.00017].

3. "Measurement of the Triple Higgs Coupling at a HE-LHC" ,
with P. Meade,
JHEP **03**, 055 (2019) [arXiv:1811.02572].

2. "Search for nucleon decays with EXO-200" ,
J. B. Albert et al. (EXO-200 Collaboration),
Phys. Rev. D **97**, 072007 (2018) [arXiv:1710.07670].

1. "First search for Lorentz and CPT violation in double beta decay with EXO-200" ,
J. B. Albert et al. (EXO-200 Collaboration),
Phys. Rev. D **93**, 072001 (2016) [arXiv:1601.07266].

## White Papers & Working Group Reports

Note: Standards for authorship on community-based reports in high-energy physics vary widely. Where relevant, my particular contributions to these reports are noted below.

- "MuCol Milestone Report No. 5: Preliminary Parameters" ,
with C. Accettura, et al., as part of the IMCC,
[arXiv:2411.02966].
- "Interim report for the International Muon Collider Collaboration (IMCC)" ,
with C. Accettura, et al., as part of the IMCC,
[arXiv:2407.12450].
- "Snowmass Early Career" ,
with G. Agarwal et al.,
[arXiv:2210.12004].
- "Physics Beyond the Standard Model at Energy Frontier for Snowmass 2021" ,
with T. Bose, A. Boveia, C. Doglioni (eds.) et al.,
[arXiv:2209.13128].
- "Report of the Topical Group on Higgs Physics for Snowmass 2021" ,
with S. Dawson, P. Meade, I. Ojalvo, C. Vernieri (eds.),
[arXiv:2209.07510].
- "The REDTOP Experiment: Rare $\eta/\eta'$ Decays to Probe New Physics" ,
with C. Gatto, M. Murray (eds.),
(Contributed to section "Scalar Portal Models"),
[arXiv:2203.07651].
- "The International Linear Collider: Report to Snowmass 2021" ,
with A. Aryshev et al., as part of the ILC Community,
[arXiv:2203.07622].
- "The physics case of a 3 TeV muon collider stage" ,
with J. de Blas et al. (eds.),

(Contributed section on "Lepton Flavor Violation"),
[arXiv:2203.07261].

- "Snowmass 2021 Community Survey Report" ,
with G. Agarwal et al.,
[arXiv:2203.07328].
- "Muon Collider Physics Summary" ,
with A. Wulzer et al.,
[arXiv:2203.07256],
- "Higgs Physics at the HL-LHC and HE-LHC" ,
with M. Cepeda, S. Gori, P. Ilten, F. Riva and M. Kado (eds.),
Contributed Section 3.4.2,
CERN Yellow Rep. Monogr. 7 (2019) 221-584, [arXiv:1902.00134].

## Professional Service

- Executive Committee Member — APS Division of Particles & Fields,
Early Career Member, Beginning January 2025.
- Convener of LHC Higgs Working Group 3 (BSM Higgs),
June 2024 - present.
- Parallel Track Convener, LHCP 2025 (BSM, TeV-Scale),
Taipei, Taiwan, May 5-10, 2024.
- Co-Convener of the Early Career Researcher Forum at the International Workshop on Future Linear Colliders (LCWS2024).
The University of Tokyo, Japan, July 8-11, 2024.
- Program Committee Member, Higgs and Effective Field Theory (HEFT) 2024,
University of Bologna, June 12-14, 2024.
- Organizing Committee Member for 2nd Annual US FCC Workshop,
Massachusetts Institute of Technology, March 25 - 27, 2024.
  - Organized "Brainstorming Session" on new opportunities and building a community of theorists around the FCC program.
- Co-organizer of the Cambridge High Energy Workshop (CHEW) 2022: Phase Transitions and Topological Defects in the Early Universe,
CMSA, Harvard University & Massachusetts Institute of Technology, August 2-5, 2022.
- Co-organizer of the Cambridge High Energy Workshop (CHEW) 2021: Axion Physics,
Harvard University & Massachusetts Institute of Technology, July 27 - 30, 2021.
- Snowmass 2021 Early Career (SEC) Leadership:
  - Theory Frontier SEC Liaison
  - Survey Team Member (Co-Leader from Oct. 2020 - Apr. 2021)
- Referee for *Physical Review Letters*, *Physical Review D*, *Journal of High Energy Physics*, *Nuclear Physics B*, *European Physics Journal C*, *SciPost Physics*, *Journal of Physics G*.
- Member of Working Group 2 (Higgs Physics) on the Physics of the HL-LHC, and Perspectives at the HE-LHC Program.

## Talks Given

### Plenary or Keynote Talks at Conferences and Workshops

- "Physics at Future Colliders: Higgs Factories and Beyond" ,
  Phenomenology Symposium 2025, University of Pittsburgh, May 20, 2025.
- "Effective Field Theories and Extended Scalar Sectors" ,
  Extended Scalar Sectors from All Angles Workshop, CERN, October 25, 2024.
- "Theory Perspective: Enhanced Higgs Yukawas" ,
  Higgs/Charm Workshop, MIT Laboratory for Nuclear Science, Cambridge, MA, May 31, 2024.
- "Muon Collider Complementarity" ,
  Muon Collider Physics Benchmark Workshop, PITT PACC, Pittsburgh, PA, November 16, 2023.
- "Matching to the SMEFT and Higher-Order Effects" ,
  MBI 2023, University of California, San Diego, CA, August 28, 2023.
- "EFT Complementarity & Relation to Underlying Models" ,
  Standard Model at the LHC 2023, Fermi National Accelerator Laboratory, July 12, 2023.
- "Interpreting SMEFT Results in Extended Scalar Sectors" ,
  The 19th Workshop of the LHC Higgs Working Group, November 30, 2022.
- "Summary of Parallel Discussions for EF09: BSM General Explorations" ,
  Energy Frontier Workshop, Brown University, April 1, 2022.
- "Higgs Couplings as a Gateway to New Fundamental Physics" ,
  APS April Meeting, April 17, 2021.
- "NLO QCD Effects on Diboson Production in the SMEFT" ,
  MBI 2021, Universita di Bicocca, Milan, Italy, August 24, 2021.

### Invited Seminars and Conference Talks

- "The Higgs, Flavor and the Path to New Physics" ,
  Special Seminar, University of Illinois, Urbana-Champaign, IL, February 7, 2025.
- "Leveraging the Higgs/Flavor Path to New Discoveries" ,
  Seminar on Future Research Directions, University of Pittsburgh, PA, January 24, 2025.
- "The Higgs, Flavor and the Path to New Physics" ,
  Special Colloquium, University of Pittsburgh, PA, January 23, 2025.
- "New Patterns of Flavor for New Physics" ,
  High Energy Physics Seminar, University of Oklahoma, Norman, OK, September 24, 2024.
- "Zero Modes of Massive Fermions and Axion Strings" ,
  High Energy Seminar, University of California, Davis, May 6, 2024.
- "Flavorful New Physics and Wrinkles in the Froggatt-Nielsen Mechanism" ,
  High Energy Physics Seminar, Caltech, April 15, 2024.
- "New Patterns of Flavor for New Physics" ,
  LPPC Seminar, Harvard University, Cambridge, MA, March 13, 2024.
- "Flavorful New Physics and Wrinkles in the Froggatt-Nielsen Mechanism" ,
  Nuclear and Particle Theory Seminar, MIT Center for Theoretical Physics, November 6, 2023.
- "Flavorful New Physics and Wrinkles in the Froggatt-Nielsen Mechanism" ,

Fermilab Theory Seminar, Fermi National Accelerator Laboratory, November 2, 2023.

- "Flavorful New Physics and Wrinkles in the Froggatt-Nielsen Mechanism" ,
  Elementary Particle Theory Seminar, University of Maryland, September 11, 2023.
- "The Quality and Cosmology of Nelson–Barr Models" ,
  Particle Theory Seminar, University of Chicago, May 17, 2023.
- "Models of Higgsed CP and their Cosmology" ,
  Particle Physics Seminar, University of Notre Dame, April 4, 2023.
- "Models of Higgsed CP and their Cosmology" ,
  LCTP Seminar, University of Michigan, March 29, 2023.
- "Putting SMEFT Fits to Work: Lessons from Matching Simple Models" ,
  Joint Cavendish-DAMTP HEP Phenomenology Seminar, Cambridge University, May 13, 2022.
- "Complementary Signals of Lepton Flavor Violation at a High-Energy Muon Collider" ,
  Particle Theory Seminar, Cornell University, April 13, 2022.
- "Complementary Signals of Lepton Flavor Violation at a High-Energy Muon Collider" ,
  Phenomenology Seminar, PITT PACC, Pittsburgh University, April 6, 2022.
- "Putting SMEFT Fits to Work: Lessons from Matching Simple Models" ,
  Phenomenology Seminar, ITP, Heidelberg University, December 8, 2021.
- "Higgs Flavor and Multi-Higgs Production" ,
  Boston University High Energy Seminar, October 7, 2021.
- "Highlights from EF02: BSM Higgs" ,
  Snowmass Day Energy Frontier Parallel Session, September 24, 2021.
- "Higgs Flavor and Multi-Higgs Production" ,
  Oklahoma State High Energy Seminar, September 9, 2021.
- "Putting SMEFT Fits to Work" ,
  HEFT 2021, University of Science and Technology of China, April 14, 2021.
- "Physics at a High-Energy Muon Collider" ,
  QCD-DM-BSM-LHC Meeting, MIT Center for Theoretical Physics, March 12, 2021.
- "Higgs Flavor and Multi-Higgs Production" ,
  Particle Physics on the Plains Theory Seminar, University of Kansas, March 9, 2021.
- "Higgs Flavor and Multi-Higgs Production" ,
  Particle Physics Seminar, Carleton University, March 8, 2021.
- "Putting SMEFT Fits to Work" ,
  LHC EFT WG Area 5 Meeting: Benchmark Scenarios from UV Models, February 8, 2021.
- "Complementary Probes of Lepton Flavor at a Muon Collider" ,
  PITT PACC Workshop: Muon Collider Physics, November 30, 2020.
- "Higgs and Flavor: Theories of Enhanced Light Yukawas" ,
  Higgs 2020, October 29, 2020.
- "The Higgs and New Physics with Flavor" ,
  YITP Seminar, Stony Brook University, April 9, 2020.

## Other Talks at Conferences and Workshops

- "Chiral Nelson–Barr Models: Quality and Cosmology" ,
  APS DPF Meeting / Phenomenology Symposium, Pittsburgh, PA, May 15, 2024.
- "A 10 TeV Muon Collider for the Future of Particle Physics" ,
  P5 Town Hall, SLAC National Accelerator Laboratory, May 4, 2023.
- "Precision Higgs Physics at High-Energy Muon Colliders" ,
  **Awarded best parallel presentation**
  Higgs 2021, Stony Brook University, October 19, 2021.
- "Higgs Flavor and Multi-Higgs Production" ,
  MIT QCD-DM-BSM-LHC Casual Seminar, MIT CTP, September 17, 2021.
- "The Higgs Inverse Problem" ,
  Snowmass EF01 Meeting, August 18th, 2021.
- "Putting SMEFT Fits to Work" ,
  Weak Interactions and Neutrinos 2021, June 9, 2020.
- "Higgs Flavor and Multi-Higgs Production" ,
  Phenomenology Symposium 2021, University of Pittsburgh, May 25, 2021.
- "Higgs Flavor and Multi-Higgs Production" ,
  PPC 2021, University of Oklahoma, May 20, 2021.
- Putting SMEFT Fits to Work,
  Higgs 2020, October 28, 2020.
- "Introduction to the Theory Frontier" ,
  Snowmass Early Career Frontier Introductory Series, August 21, 2020.
- "Theories of Enhanced Light Yukawa Couplings" ,
  Snowmass EF02 Meeting: Higgs and Flavor, August 7, 2020.
- "SMEFT Fits and the Higgs Inverse Problem" ,
  Preparatory Joint Sessions, Snowmass Energy Frontier Meeting, July 7, 2020.
- "Light Scalars and the KOTO Anomaly" ,
  Phenomenology Symposium 2020, University of Pittsburgh, May 4, 2020.
- "Flavorful Higgs Physics from the MeV to TeV scale" ,
  High Energy Theory Lunch Seminar, Brookhaven National Laboratory, May 1, 2020.
- "Light Scalars and the KOTO Anomaly" ,
  APS April Meeting 2020, Washington D.C., April 21, 2020.
- "The Higgs and New Physics with Flavor" ,
  LHC/BSM Journal Club, MIT Center for Theoretical Physics, April 10, 2020.
- "Higgs bosons with large couplings to light quarks" ,
  Brookhaven Forum 2019, Brookhaven National Laboratory, September 26, 2019.
- "Unearthing Kinematic Information in WH Production" ,
  APS DPF Meeting 2019, Northeastern University, August 01, 2019.
- "Spontaneous Flavor Violation and the 2HDM" ,
  Phenomenolgy Symposium 2019, University of Pittsburgh, May 07, 2019.
- "Spontaneous Flavor Violation and the 2HDM" ,
  High Energy Theory Lunch Seminar, Brookhaven National Laboratory, April 19, 2019.

- "Measuring the Higgs Trilinear Coupling at an HE-LHC" ,
  High Energy Theory Lunch Seminar, Brookhaven National Laboratory, October 19, 2018.
- "Exploring the Higgs Sector" ,
  TASI 2018 Student Talk, University of Colorado, Boulder, June 22, 2018.
- "Measuring the Higgs Trilinear Coupling at an HE-LHC" ,
  Phenomenology Symposium 2018, University of Pittsburgh, May 8, 2018.
- "The Higgs Self-Coupling and Future Colliders" ,
  Hang Yuan Physics Lecture (No. 109), Shaanxi Normal University, Xi'an, China, April 16, 2018.
- "Measuring the Higgs Trilinear Coupling at an HE-LHC" ,
  HL/HE-LHC Meeting, Fermi National Accelerator Laboratory, April 5, 2018.
- "Measuring the Higgs Trilinear Coupling at an HE-LHC" ,
  Brookhaven Forum 2017, Brookhaven National Laboratory, October 12, 2017.
- "Search for Nucleon Decays in 136-Xe with EXO-200" ,
  Physics Undergraduate Research Symposium, University of Illinois, January 30, 2015.

## Teaching Experience

- **Teaching Assistant, Dept. of Physics, Stony Brook University**
  August 2015 - May 2018

  **Courses Taught or Graded For:**
  - PHY 524: Graduate Cosmology (Grader), Spring 2020
  - PHY 610: Quantum Field Theory I (Grader), Spring 2018
  - PHY 252: Modern Physics Laboratory, Fall 2016, Spring 2017
  - PHY 123: Classical Physics A (Laboratory), Summer 2016
  - PHY 134: Classical Physics Laboratory II, Spring 2016
  - PHY 133: Classical Physics Laboratory I, Fall 2015

## Workshops, Programs & Schools Attended

- Muon Collider Physics Benchmarking Workshop,
  November 16 - 18, 2023, University of Pittsburgh, PA.
- PITT PACC Workshop: LHC physics for Run 3,
  April 7 - 9, 2021, University of Pittsburgh, PA.
- PITT PACC Workshop: Muon collider physics,
  November 30 - December 2, 2020, University of Pittsburgh, PA.
- Lighting new Lampposts for Dark Matter and Beyond the Standard Model,
  February 23 - April 8, 2020, Simons Center for Geometry and Physics, Stony Brook, NY.
- ICTP Summer School on Particle Physics, June 2019,
  Abdus Salam International Center for Theoretical Physics, Trieste, Italy.
- Theoretical Advanced Study Institute (TASI), *Theory in an Era of Data*,
  June 2018, University of Colorado, Boulder, CO.
- Prospects in Theoretical Physics (PiTP), *Particle Physics at the LHC and Beyond*,
  July 2017, Institute for Advanced Study, Princeton, NJ.

- Workshop: Beyond WIMPs: From Theory to Detection, March 2017.
  Simons Center for Geometry and Physics, Stony Brook, NY.

## Experimental Collaborations

- REDTOP Collaboration, *Member*.
- EXO-200 Collaboration, *Undergraduate Researcher (Data Analysis)*.

## Additional Awards and Fellowships

- Robert E. Hetrick Oustanding Senior Thesis Award, 2015.
- University Achievement Scholar, University of Illinois at Urbana-Champaign, 2011 - 2015.
- Rosaline and Milton Sterman Travel Award, 2019.
- American Physical Society Division of Particles and Fields (DPF) Meeting Travel Award, 2019.
- Silsbee Prize (Travel Award), 2017.
- Phi Beta Kappa, 2015.
- Lorella M. Jones Summer Research Award, 2014.
- James Scholar, University of Illinois at Urbana-Champaign, 2011 - 2015.
- Dean's List, University of Illinois at Urbana-Champaign, Fall 2011 - Spring 2015.