Seth Koren, PhD

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Academic Appointments

University of Chicago, *Chicago, IL* 2020-Present
Mafalda and Reinhard Oehme Postdoctoral Fellow

Education

University of California, Santa Barbara, *Santa Barbara, CA* 2015-2020
Master of Arts in Physics 9/8/17
PhD in Physics 6/24/20
Thesis: *New Approaches to the Hierarchy Problem and their Signatures from Microscopic to Cosmic Scales* advised by Prof. Nathaniel Craig
Awarded the American Physical Society's 2022 Sakurai Dissertation Award
Research mentor to undergraduates Aidan Herderschee (→ UMichigan grad), Samuel Alipourfard (→ MIT grad), and Umut Can Öktem (→ UCDavis grad)
Worster Fellowship for summer mentorship (awarded 2017 and 2019)
Excellence in Teaching Award (2019) from the UCSB Graduate Student Association
This award recognizes the contributions of outstanding graduate students who have shown excellence in their role as a teaching assistant toward the teaching mission of UC Santa Barbara. Awarded annually to a handful of TAs university-wide.

University of Pennsylvania, *Philadelphia, PA* 2011- 2015
Bachelor of Arts in Physics and in Mathematics
Honors distinction in Physics, Concentration in Astrophysics, Summa Cum Laude
Master of Science in Physics
Benjamin Franklin Scholar, Integrated Studies Program, Cumulative GPA: 3.98
Elected Phi Beta Kappa as a junior
Roy and Diana Vagelos Science Challenge Award, full tuition scholarship
William E. Stephens Memorial Prize
Awarded annually to the graduating physics major who has demonstrated, during the course of his or her undergraduate course work, the most promise for a successful career as a scientist based on overall performance in all aspects of the undergraduate program as judged by members of the Physics and Astronomy faculty.

Montgomery County Community College, *Blue Bell, PA* 2010-2011
A few Economics and Business courses, Cumulative GPA: 4.0

Technical Experience

Extensive use of FeynRules → MadGraph → Pythia → Delphes → MadAnalysis for the simulation of cross-sections, hadronic and detector effects, and analysis thereof
Familiar with FeynCalc and FeynArts → FormCalc → LoopTools for the analytic calculation of matrix elements

Teaching Experience

Introduction to Particle Physics Seminar – Spring 2021
I volunteered to lead an undergraduate reading seminar on introductory particle physics as I was concerned students weren't getting time with professors during the pandemic. I lectured on important concepts and emphasized the role of quantum mechanics, and wrote mastery questions

for students to work on to firm their understanding. I also introduced particle simulation software and wrote a final project to reinterpret an ATLAS search and `discover' the Higgs.

Introduction to Quantum Mechanics 1 – Fall 2016, Fall 2017, Fall 2018
Complex Variables – Winter 2020

With Nathaniel Craig in Fall 2017, I worked to overhaul the Introductory Quantum Mechanics course using active learning methods and placing increased effort on pedagogy and on instructor accessibility. This worked marvelously and students both had better learning outcomes and reported feeling more comfortable in the classroom and with the material. Since then, our model has been implemented by many of the physics classes.

Leadership Experience

High Energy Grad Seminar Series

Organizer Sept 2017 – Sept 2019

In addition to organizing the seminar series, this position rendered me the spiritual leader of the high energy theory graduate students. In that role I've worked hard to create a welcoming and supportive environment and to foster a collaborative community.

Penn Secular Society, *Founder*

President Jan 2012 – May 2014

I created PSS to fill a void in the dialogue on campus surrounding philosophy, science and theology, and to provide community for a then-unrepresented population of students. The group became well-known at Penn for its efforts to encourage people to think critically about their beliefs, and fully succeeded in influencing and improving campus dialogue.

Internal Seminars

Amplitudes: On-Shell Methods and BCFW Recursion, 11/16
The Event Horizon Telescope and New Physics, 02/17
Phenomenology of Quantum Gravity with LIGO, 03/17
Noncommutative Field Theory, 05/17
Quantum Cosmology and the Wavefunction of the Universe, 11/17
Cosmology, BSM, Astrophysics, and More with Neutron Star Mergers, 01/18
Orbifold Compactification and the Orbifold Correspondence, 02/18
An Introduction to Grand Unification, 11/18
Early Universe Cosmology: What's Bin Known and What's Bin Shown, 1/20

Invited Talks

Twin Higgs Cosmology, **University of Pennsylvania**, July 2017
Higgs Decays to Long-Lived Particles at the CEPC, 2018 International Workshop on the High Energy Circular Electron-Positron Collider, **IHEP**, **Beijing**, November 2018
The (Second) Higgs at the Lifetime Frontier, Fifth Workshop of the LHC Long-Lived Particle Community, **CERN**, **Geneva**, May 2019
UV/IR Mixing and the Hierarchy Problem,
Yale Mossman Seminar, November 2019
SoCal Grads Fields and Strings at UC Los Angeles, February 2020
Cornell/University of Maryland Particle Phenomenology Seminar, October 2020
LBNL/UC Berkeley Particle Seminar, October 2020
Caltech High Energy Physics Seminar, October 2020
University of Michigan Particle Theory Seminar, November 2020
The Hydrogen Mixing Portal as a Novel Mechanism for Colder Baryons in 21 cm Cosmology
University of Toronto Theoretical High Energy Physics Seminar, November 2020
Fermilab Theoretical Physics Seminar, November 2020
A Cosmological Lithium Solution
Galileo Galilei Institute New Physics From The Sky Workshop, October 2021

Stony Brook University Theoretical Physics Seminar, December 2021
APS Sakurai Dissertation Award Talk, New York, April 2022

Publications – h = 11 (h_{HEP} = 10)

19. "H Marks the Spot: Searching for Exotic Production of Higgs + X to Map Out New Physics"
S. Koren and U. Öktem
Phys. Rev. **D104** (2021) 035033, [arXiv:2102.06212 [hep-ph]]

18. "The Muon Smasher's Guide"
H. Al Ali et al.
Submitted to Rep. Prog. Phys arXiv:2103.14043 [hep-ph]

17. "The Hydrogen Mixing Portal, Its Origins, and Its Cosmological Effects"
L. Johns and S. Koren
Submitted to Phys. Rev. D arXiv:2012.06591 [hep-ph]

16. "Hydrogen Mixing as a Novel Mechanism for Colder Baryons in 21 cm Cosmology"
L. Johns and S. Koren
Submitted to Phys. Rev. Lett. arXiv:2012.06584 [hep-ph]

15. "The Hierarchy Problem: From the Fundamentals to the Frontiers"
S. Koren
PhD Thesis, [arXiv:2009.11870 [hep-ph]]

14. "Supersoft Stops"
T. Cohen, N. Craig, S. Koren, M. McCullough, J. Tooby-Smith
Phys. Rev. Lett. 125 (2020) 151801, [arXiv:2002.12630 [hep-ph]]

13. "IR Dynamics from UV Divergences: UV/IR Mixing, NCFT, and the Hierarchy Problem"
N. Craig and S. Koren
JHEP **03** (2020) 037, [arXiv:1909.01365 [hep-ph]]

12. "Freezing-in Twin Dark Matter"
S. Koren and R. McGehee
Phys. Rev. **D101** (2020) 055024, [arXiv:1908.03559 [hep-ph]]

11. "The Weak Scale from Weak Gravity"
N. Craig, I. Garcia Garcia, S. Koren
JHEP **09** (2019) 081, [arXiv:1904.08426 [hep-ph]]

10. "Exploring Strong-Field Deviations From General Relativity via Gravitational Waves"
S. Giddings, S. Koren, G. Treviño
Phys. Rev. **D100** (2019) 044005, [arXiv:1904.04258 [gr-qc]]

9. "Neutrino - DM Scattering and Coincident Detections of UHE Neutrinos with EM Sources"
S. Koren
JCAP **09** (2019) 013, [arXiv:1903.05096 [hep-ph]]

8. "Constructing N=4 Coulomb Branch Superamplitudes"
A. Herderschee, S. Koren, T. Trott
JHEP **08** (2019) 107, [arXiv:1902.07205 [hep-th]]

7. "Massive On-Shell Supersymmetric Scattering Amplitudes"
A. Herderschee, S. Koren, T. Trott
JHEP **10** (2019) 092, [arXiv:1902.07204 [hep-th]]

6. “The second Higgs at the lifetime frontier”
   S. Alipour-fard, N. Craig, S. Gori, S. Koren, D. Redigolo
   JHEP **07** (2020) 029, [arXiv:1812.09315 [hep-ph]]
5. “Discrete Gauge Symmetries and the Weak Gravity Conjecture”
   N. Craig, I. Garcia Garcia, S. Koren
   JHEP **05** (2019) 140, [arXiv:1812.08181 [hep-th]]
4. “Long Live the Higgs Factory: Higgs Decays to Long-Lived Particles at Future Lepton Colliders”
   S. Alipour-fard, N. Craig, M. Jiang, S. Koren
   Chin. Phys. **C43** (2019) 053101, [arXiv:1812.05588 [hep-ph]]
3. “Cosmological Signals of a Mirror Twin Higgs”
   N. Craig, S. Koren, T. Trott
   JHEP **05** (2017) 038, [arXiv:1611.07977 [hep-ph]]
2. “The Low-Mass Astrometric Binary LSR1610−0040”
   S. C. Koren, C. H. Blake, C. C. Dahn, H. C. Harris
   The Astronomical Journal **151** (2016) 57, [arXiv:1511.02234 [astro-ph.SR]]
1. “Characterizing Asteroids Multiply-Observed at Infrared Wavelengths”
   S. C. Koren, E. L. Wright, A. Mainzer
   Icarus **258** (2015) 82-91, [arXiv:1506.04751 [astro-ph.EP]]