

BENJAMIN V. LEHMANN

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Pappalardo Postdoctoral Fellow, 2022–2025. [tinyurl.com/bvlppf]
Department of Physics, Massachusetts Institute of Technology.

E-mail: benvlehmann@gmail.com
Website: benvlehmann.com
Telephone: +1 (650) 564-7313

INSPIRE: inspirehep.net/authors/1737895
arXiv: arxiv.org/a/lehmann_b.1.html
ORCID: orcid.org/0000-0001-7735-4673

EDUCATION

Ph.D., Physics. University of California, Santa Cruz, August 2022.	<i>Advisor:</i> Stefano Profumo
MS, Mathematics. Stanford University, June 2016.	<i>Advisor:</i> Eleny Ionel
BS, Mathematics; BS, Physics, with honors. Stanford University, June 2015.	<i>Advisor:</i> Risa Wechsler

SELECTED AWARDS

Josephine de Karman Dissertation Fellowship
Josephine de Karman Fellowship Trust, 2021–2022.
A highly competitive dissertation-year fellowship open to applicants from all fields.

Honorable Mention, Ford Foundation Dissertation Fellowship competition
Ford Foundation & National Academies of Science, Engineering, and Medicine, March 2021.

Steck Family Prize for Graduate Research Excellence
UC Santa Cruz, April 2019.

ARCS Scholarship
ARCS Foundation, 2018–2019.
Only the department's best student is eligible for nomination for this significant award.

Marilyn Stevens Memorial Award
UC Santa Cruz Department of Physics, June 2018.
This award is granted for outstanding departmental service in addition to academic excellence.

Fridley Scholarship Award
University of California, Santa Cruz, May 2017.
The Fridley Scholarship is awarded to the single best student in the physical sciences at UCSC.

Regents' Fellowship
University of California, Santa Cruz, September 2016–September 2017.

SEMINARS

Seminar, University of Florida, November 2023.
Seminar, University of Illinois Urbana-Champaign, March 2023.

Kinetic recoupling of dark matter.

KICP Seminar, University of Chicago, March 2023.
New frontiers in dark matter direct detection.

Seminar, Fermilab Cosmic Physics Center, March 2023.
Kinetic recoupling of dark matter.

HETG Family Meeting Seminar, Harvard University, March 2023.
Developments in Directional DM detection in dielectrics.

Lighting New Lampposts Program Seminar, Simons Center for Geometry and Physics, February 2023.
Directional DM detection in dielectrics. [tinyurl.com/bddjxdbr]

Seminar, University of Texas at Austin, February 2023.
Kinetic recoupling of dark matter.

HETG Seminar, Harvard University, January 2023.
Kinetic recoupling of dark matter.

MIT/Tufts Cosmology Seminar, December 2022.
Kinetic recoupling of dark matter.

Seminar, Cornell University, November 2022.
Direct detection of dark matter far from the weak scale.

Seminar, McGill University, Canada, October 2022.
Direct detection of dark matter far from the weak scale.

Seminar, California Institute of Technology, October 2022.
Direct detection of dark matter far from the weak scale.

Seminar, K. N. Toosi University of Technology, Iran,* July 2022.
Primordial black holes and extrasolar systems.

Seminar, Weizmann Institute of Science, Israel, May 2022.
New physics from black holes with present-day tools.

Seminar, Technion – Israel Institute of Technology, Israel, May 2022.
Direct detection of dark matter far from the weak scale.

Particle Physics Joint Seminar, Hebrew University, Israel, April 2022.
Direct detection of dark matter far from the weak scale.

EPT Seminar, University of Maryland, February 2022.
Direct detection of dark matter far from the weak scale.

“Theory Colloquium”, CU Boulder, February 2022.
Direct detection of dark matter far from the weak scale.

Seminar, BSM PANDEMIC Series, December 2021.
Massive black hole binaries as particle physics laboratories.

KIPAC Tea Talk, Stanford University, November 2021.
Massive black holes as particle physics laboratories.

HEP Seminar, UC San Diego, September 2021.
Extracting new physics from black holes with present-day tools.

4D Seminar, Berkeley Center for Theoretical Physics, September 2021.
Direct detection of dark matter far from the weak scale.

Seminar, NANOGrav Astrophysics Working Group Meeting, June 2021.

*In compliance with sanctions per [31 CFR § 560.538](#).

- Detecting new forces in the gravitational wave background.*
Seminar, SuperCDMS Science Meeting, April 2021.
Dark matter–electron scattering and the dielectric function.
- Seminar, Fermilab Cosmic Physics Center, March 2021.
Discovering new physics in the era of black holes. [tinyurl.com/e36mb94w]
- HEP Seminar, University of Notre Dame, October 2020.
New opportunities for primordial black holes across the scales.
- Joint UC Santa Cruz–UC Irvine theory seminar, May 2020.
FIMP dark matter at the KOTO experiment.
- SCIPP Seminar, Santa Cruz Institute for Particle Physics, January 2020.
Catching black holes in the lab.
- Cosmology Seminar, UC Santa Cruz, June 2016.
Some Assembly Required: Modeling Assembly Bias with Abundance Matching.

SELECTED CONFERENCE PRESENTATIONS

- Contributed talk, PLANCK 2023, May 2023.
Directional detection of dark matter with anisotropic response functions.
- Contributed talk, COSMO‘22, August 2022.
Direct detection with superconducting nanowires.
- Contributed talk, Dark Sectors of Astroparticle Physics (AstroDark-2021), December 2021.
Detecting new forces in the gravitational wave background.
- Contributed talk, APS Division of Particles and Fields Meeting (DPF), July 2021.
Detecting new forces in the gravitational wave background.
- Contributed talk, Cosmology From Home, July 2021.
Detecting new forces in the gravitational wave background. [youtu.be/iSQD4i-sjMA]
- Contributed talk, PPC 2021, May 2021.
Detecting new forces in the gravitational wave background.
- Poster, “A Rainbow of Dark Sectors” Conference (Aspen Center for Physics), March 2021.
Detecting new forces in the stochastic gravitational wave background.
- Contributed talk, International Conference on New Frontiers in Physics (ICNFP), October 2020.
FIMP dark matter at the KOTO experiment.
- Contributed talk, TASI student talks, June 2020.
Direct detection of primordial black hole dark matter.
- Contributed talk, Phenomenology 2020 Symposium (Pheno), May 2020.
FIMP dark matter at the KOTO experiment.
- Contributed talk, SUSY 2019, May 2019.
Dark sources of cosmic ray spikes on Earth’s doorstep.
- Contributed talk, Phenomenology 2019 Symposium (Pheno), May 2019.
Direct detection of primordial black hole dark matter.
- Contributed talk, SUSY 2018, July 2018.
Sub-MeV Dark Matter Interactions with Electrons: Cosmological Constraints and Detection Prospects

UNDERGRADUATE THESES SUPERVISED

I directly supervised the research work and writing process for the following undergraduate theses, under the oversight of my Ph.D. advisor.

Samuel D. English, January 2020–present.

The Hidden Friend's Wake: Dark Matter and a Binary at the Galactic Center.

Selected for **Honors** in the major.

Olivia G. Ross, November 2018–June 2021.

Next step: Ph.D. in Astronomy, Cornell University.

Searching for primordial black holes.

Steck Family Award for the single best senior thesis of 2020–2021 at UC Santa Cruz.

Paul Andreini, March 2016–September 2019.

Next step: Ph.D. in Physics, University of Oregon.

Time-evolution of the primordial black hole mass function.

Selected for **Honors** in the major.

Thomas Schwemberger, February 2018–December 2018.

Next step: Ph.D. in Physics, University of Oregon.

Constraints on Planck mass relics from primordial black hole evaporation with a generic initial mass function.

Selected for **Honors** in the major.

Anikeya Aditya, September 2016–June 2018.

Next step: Ph.D. in Materials Science, University of Southern California.

Inferring the mass function of primordial black holes from gravitational wave observations.

Selected for **Honors** in the major.

Other undergraduate alumni:

Ava Webber, September 2020–June 2022.

Next step: Ph.D. in Astronomy at Clemson University.

Mason Hargrave, September 2018–June 2019.

Next step: Ph.D. in Physical, Mathematical, and Computational Biology at The Rockefeller University.

Jackson Yant, January 2016–June 2018.

Next step: Ph.D. in Physics, Dartmouth College.

PROFESSIONAL ACTIVITIES

Referee for The Astrophysical Journal (**ApJ**), European Physical Journal C (**EPJC**), Journal of High Energy Physics (**JHEP**), Physical Review D (**PRD**), and Physics of the Dark Universe (**PDU**).

Workshops and schools

GUINEAPIG Workshop.

University of Montreal, July 2023.

MITP Workshop on Theoretical Particle Cosmology in the Early and Late Universe.

MITP & Corfu Summer Institute, May 2023.

Program: Lighting new Lampposts for Dark Matter and Beyond the Standard Model.

Simons Center for Geometry and Physics, March 2023.

EXCESS2022 Workshop.

Karlsruhe Institute of Technology, February 2022.

Les Houches Summer School 2021: *Dark Matter*.
École de Physique des Houches, July–August 2021.

TASI 2020: *The Obscure Universe: Neutrinos and other Dark Matters*.
Theoretical Advanced Study Institute, June 2020.

37th Advanced School in Theoretical Physics: *New Ideas for Old Puzzles in Particle Physics*.
Israel Institute for Advanced Studies, December 2019–January 2020.

GGI Workshop: *Next Frontiers in the Search for Dark Matter*.
Galileo Galilei Institute, August–September 2019.

45th SLAC Summer Institute: *Cosmic Opportunities*.
SLAC, July 2017.

Committee service

Physics Values Committee, October 2022–present. **Co-chair**, November 2023–present.
Department of Physics, Massachusetts Institute of Technology.
[physvals.mit.edu]

Diversity and Climate Committee, February 2018–June 2022.
Department of Physics, UC Santa Cruz.
[www.physics.ucsc.edu/about/diversity/diversity-committee.html]

Colloquium Committee, June 2018–June 2022.
Department of Physics, UC Santa Cruz.

CUWiP 2022/2023 Local Organizing Committee at UC Santa Cruz, January 2020–January 2023.
Conference for Undergraduate Women in Physics.

SELECTED OUTREACH

Volunteer instructor, October 2022–present.
The Educational Justice Institute at MIT [teji.mit.edu].
Volunteer instructor in the Massachusetts correctional system.

Volunteer participant, October 2019–present.
Skype a Scientist [skypeascientist.com].
Skype a Scientist connects scientists with K–12 classrooms for live conversations.

Physics Collaborative facilitator, Department of Physics, January 2019–June 2022.
UC Santa Cruz.
Mentor for students in introductory physics courses.

Mentor for SPS/WiPA mentoring program, January 2018–June 2022.
Department of Physics, UC Santa Cruz.
Program matches undergraduates with graduate students for at least one quarter at a time.

Volunteer instructor, October 2016–June 2022.
UCSC Project for Inmate Education (PIE).
Volunteer instructor for mathematics and astronomy courses at Santa Cruz County Jail.

Peer mentor, August 2020–2021.
SU(5) [su5.group].
SU(5) was a peer mentorship organization supporting incoming physics graduate students.

Volunteer instructor, August 2015–December 2016.
Prison University Project (PUP) [prisonuniversityproject.org].
Volunteer instructor for mathematics courses at San Quentin State Prison in a degree-granting program.

TEACHING EXPERIENCE

Teaching assistant, UC Santa Cruz Department of Physics, September 2016–June 2021.
Introductory Physics II (PHYS 5B), March 2021–June 2021.
Thermodynamics and Statistical Mechanics (PHYS 112), January 2021–March 2021.
General Chemistry III (CHEM 1C), September 2020–December 2020.
Particle Astrophysics (PHYS 129), January 2020–April 2020.
General Chemistry III (CHEM 1C), September 2019–December 2019.
Introductory Physics I Laboratory (PHYS 6L), April 2019–June 2019.
Computational Physics (PHYS 115), April 2019–June 2019.
Conceptual Physics (PHYS 1), January 2019–April 2019.
Mathematical Methods in Physics III (PHYS 116C), September 2018–December 2018.
Quantum Mechanics I (PHYS 139A), April 2018–June 2018.
Physics and Psychophysics of Music (PHYS / MUSC 80U), January 2018–March 2018.
Introductory Physics I (PHYS 6A), September 2017–December 2017.
Introductory Physics I Laboratory (PHYS 6L), June 2017–August 2017.
Introductory Physics I Laboratory (PHYS 6L), April 2017–June 2017.
Introductory Physics II Laboratory (PHYS 6M), January 2017–March 2017.
Introductory Physics I Laboratory (PHYS 6L), September 2016–December 2016.

PUBLICATIONS

An up-to-date list of publications can be found at <http://inspirehep.net/authors/1737895>.

* Project leader

† Equal contributor (alphabetical author order)

- [1] * **Benjamin V. Lehmann**, Logan Morrison, Stefano Profumo, and Nolan Smyth. Kinetic recoupling of dark matter. October 2023, [2310.20513](#).
- [2] * Yonit Hochberg, Eric David Kramer, Noah Kurinsky, and **Benjamin V. Lehmann**. Directional detection of light dark matter in superconductors. *Phys. Rev. D*, 107(7):076015, September 2023, [2109.04473](#). DOI [10.1103/PhysRevD.107.076015](#).
- [3] † Wolfgang Altmannshofer, Stefania Gori, **Benjamin V. Lehmann**, and Jianhong Zuo. UV physics from IR features: New prospects from top flavor violation. *Phys. Rev. D*, 107(9):095025, March 2023, [2303.00781](#). DOI [10.1103/PhysRevD.107.095025](#).
- [4] † Christian Boyd, Yonit Hochberg, Yonatan Kahn, Eric David Kramer, Noah Kurinsky, **Benjamin V. Lehmann**, and To Chin Yu. Directional detection of dark matter with anisotropic response functions. *Phys. Rev. D*, 108(1):015015, December 2022, [2212.04505](#). DOI [10.1103/PhysRevD.108.015015](#).
- [5] * Yonit Hochberg, **Benjamin V. Lehmann**, Ilya Charaev, Jeff Chiles, Marco Colangelo, Sae Woo Nam, and Karl K. Berggren. New constraints on dark matter from superconducting nanowires. *Phys. Rev. D*, 106(11):112005, December 2022, [2110.01586](#). **Editor's Suggestion**. DOI [10.1103/PhysRevD.106.112005](#).
- [6] * **Benjamin V. Lehmann** and Stefano Profumo. Black hole remnants are not too fast to be dark matter. *Phys. Dark Univ.*, 39:101145, November 2022, [2105.01627](#). DOI [10.1016/j.dark.2022.101145](#).
- [7] * **Benjamin V. Lehmann**, Ava Webber, Olivia G. Ross, and Stefano Profumo. Capture of primordial black holes in extrasolar systems. *JCAP*, 08:079, August 2022, [2205.09756](#). DOI [10.1088/1475-7516/2022/08/079](#).
- [8] † Daniel Davies, Michael Dine, and **Benjamin V. Lehmann**. Light Quarks at Large N . January 2022, [2201.05719](#). Contribution to a Festschrift for Peter Suranyi.

- [9] †Jeff A. Dror, **Benjamin V. Lehmann**, Hiren H. Patel, and Stefano Profumo. Discovering new forces with gravitational waves from supermassive black holes. *Physical Review D*, 104(8):083021, October 2021, [2105.04559](#). DOI [10.1103/PhysRevD.104.083021](#).
- [10] †Yonit Hochberg, Yonatan Kahn, Noah Kurinsky, **Benjamin V. Lehmann**, To Chin Yu, and Karl K. Berggren. Determining Dark Matter–Electron Scattering Rates from the Dielectric Function. *Physical Review Letters*, 127:151802, October 2021, [2101.08263](#). DOI [10.1103/PhysRevLett.127.151802](#).
- [11] ***Benjamin V. Lehmann**, Olivia G. Ross, Ava Webber, and Stefano Profumo. Three-body capture, ejection, and the demographics of bound objects in binary systems. *Monthly Notices of the Royal Astronomical Society*, 505(1):1017–1028, April 2021, [2012.05875](#). DOI [10.1093/mnras/stab1121](#).
- [12] ***Benjamin V. Lehmann**, Stefano Profumo, and Jackson Yant. Model-independent discovery prospects for primordial black holes at LIGO. *Monthly Notices of the Royal Astronomical Society*, 501(3):3727–3740, December 2020, [2007.00021](#). DOI [10.1093/mnras/staa3806](#).
- [13] †Wolfgang Altmannshofer, **Benjamin V. Lehmann**, and Stefano Profumo. Cosmological implications of the KOTO excess. *Physical Review D*, 102(8):083527, October 2020, [2006.05064](#). DOI [10.1103/PhysRevD.102.083527](#).
- [14] ***Benjamin V. Lehmann** and Stefano Profumo. Cosmology and prospects for sub-MeV dark matter in electron recoil experiments. *Physical Review D*, 102(2):023038, July 2020, [2002.07809](#). DOI [10.1103/PhysRevD.102.023038](#).
- [15] †Adam Coogan, **Benjamin V. Lehmann**, and Stefano Profumo. Connecting direct and indirect detection with a dark spike in the cosmic-ray electron spectrum. *Journal of Cosmology and Astroparticle Physics*, 2019(10):063–063, October 2019, [1903.07177](#). DOI [10.1088/1475-7516/2019/10/063](#).
- [16] ***Benjamin V. Lehmann**, Christian Johnson, Stefano Profumo, and Thomas Schwemberger. Direct detection of primordial black hole relics as dark matter. *Journal of Cosmology and Astroparticle Physics*, 2019(10):046–046, October 2019, [1906.06348](#). DOI [10.1088/1475-7516/2019/10/046](#).
- [17] ***Benjamin V. Lehmann**, Stefano Profumo, and Jackson Yant. The maximal-density mass function for primordial black hole dark matter. *Journal of Cosmology and Astroparticle Physics*, 2018(04):007, April 2018, [1801.00808](#). DOI [10.1088/1475-7516/2018/04/007](#).
- [18] ***Benjamin V. Lehmann**, Yao-Yuan Mao, Matthew R. Becker, Samuel W. Skillman, and Risa H. Wechsler. The Concentration Dependence of the Galaxy-Halo Connection: Modeling Assembly Bias with Abundance Matching. *The Astrophysical Journal*, 834(1), December 2016, [1510.05651](#). DOI [10.3847/1538-4357/834/1/37](#).

SNOWMASS WHITE PAPERS

I contributed as an author to the following Snowmass white papers.

- [1] Daniel Carney et al. Snowmass2021 Cosmic Frontier White Paper: Ultraheavy particle dark matter. In *2022 Snowmass Summer Study*, March 2022. [2203.06508](#).
- [2] Masha Baryakhtar et al. Dark Matter In Extreme Astrophysical Environments. In *2022 Snowmass Summer Study*, March 2022. [2203.07984](#).
- [3] Simeon Bird et al. Snowmass2021 Cosmic Frontier White Paper: Primordial Black Hole Dark Matter. In *2022 Snowmass Summer Study*, March 2022. [2203.08967](#).
- [4] Arka Banerjee et al. Snowmass2021 Cosmic Frontier White Paper: Cosmological Simulations for Dark Matter Physics. In *2022 Snowmass Summer Study*, March 2022. [2203.07049](#).