

# Yonatan F. Kahn, Ph.D.

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## CONTACT INFORMATION

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## RESEARCH INTERESTS

High-energy theoretical physics (phenomenology): dark matter, supersymmetry, unconventional strategies for dark matter detection, MeV-scale dark forces

## POSITIONS

**Postdoctoral research associate**  
**Princeton University**  
Princeton, NJ USA

**September 2015 - present**

Current research:

- New experimental proposals (ABRACADABRA, PTOLEMY-G<sup>3</sup>) for detection of light dark matter.
- Low-threshold keV-MeV dark matter detection with Weyl semimetals and acoustic membranes.
- Phenomenology of new light weakly-coupled gauge forces. Supervised graduate student Siddharth Mishra-Sharma on surveying the parameter space for UV-complete models of MeV-scale abelian dark forces with axial couplings.
- Using neutrino experiments to search for MeV dark photons and dark matter. Supervised graduate student Matthew Moschella on analysis of current and future beam dump experiments to search for inelastic dark matter.

## EDUCATION

**Massachusetts Institute of Technology**  
Cambridge, MA USA

**September 2010 - June 2015**

Ph.D, physics, June 2015

- Thesis title: *Forces and Gauge Groups Beyond the Standard Model*
- Advisor: Jesse Thaler
- Thesis committee: Jesse Thaler, Allan Adams, Christoph Paus

**University of Cambridge**  
Cambridge, UK

**October 2009 - June 2010**

Certificate of Advanced Study in Mathematics, June 2010

- Completed Part III of the Mathematical Tripos in Applied Mathematics and Theoretical Physics
- Essay topic: *From Topological Strings to Matrix Models*

**Northwestern University**  
Evanston, IL USA

**September 2004 - June 2009**

B.A., physics and mathematics, June 2009

- Senior thesis: *Models of Dark Matter and the INTEGRAL 511 keV line*
- Senior thesis advisor: Tim Tait

B.Mus., horn performance, June 2009

HONORS AND  
AWARDS

APS J.J. and Noriko Sakurai Dissertation Award in Theoretical Particle Physics	<b>2016</b>
Andrew M. Lockett III Memorial Fund Award for graduate research	<b>2014</b>
National Science Foundation Graduate Research Fellowship	<b>2011-2014 (awarded 2010)</b>
University of Cambridge: graduated with Distinction (highest honors in the Part III program)	<b>2010</b>
Churchill Scholarship for study at the University of Cambridge	<b>2009</b>
Northwestern University	<b>2009</b>
• Summa cum laude in physics and mathematics	
• Departmental honors and Outstanding Senior Thesis in physics	
• Phi Beta Kappa Centennial Prize for highest overall GPA	
• Phi Beta Kappa	
Josephine de Kármán Fellowship	<b>2008</b>
Barry M. Goldwater Scholarship	<b>2007</b>

PUBLICATIONS

- Eder Izaguirre, Yonatan Kahn, Gordan Krnjaic, Matthew Moschella. 2017. Testing Light Dark Matter Coannihilation With Fixed-Target Experiments. arXiv:1703.06881
- Yonatan Kahn, Gordan Krnjaic, Siddharth Mishra-Sharma, Tim M.P. Tait. 2016. Light Weakly Coupled Axial Forces: Models, Constraints, and Projections. JHEP 1705 (2017) 002. arXiv:1609.09072.
- Yonit Hochberg, Yonatan Kahn, Mariangela Lisanti, Christopher G. Tully, Kathryn M. Zurek. 2016. Directional Detection of Dark Matter with Two-Dimensional Targets. Phys. Lett. B 772 (2017), 239-246. arXiv:1606.08849.
- Yonatan Kahn, Benjamin R. Safdi, and Jesse Thaler. 2016. Broadband and Resonant Approaches to Axion Dark Matter Detection. Phys. Rev. Lett. 117:141801. Phys. Rev. Lett. 117 (2016) 14:141801. arXiv:1602.01086.
- Yonatan Kahn, Daniel Roberts, and Jesse Thaler. 2015. The goldstone and goldstino of supersymmetric inflation. JHEP 1510 (2015) 001. arXiv:1504.05958.
- Adam Anderson, Patrick Fox, Yonatan Kahn, and Matthew McCullough. 2015. Halo-Independent Direct Detection Analyses Without Mass Assumptions. JCAP 1510 (2015) 10, 012. arXiv:1504.03333.
- Yonatan Kahn, Gordan Krnjaic, Jesse Thaler, and Matthew Toups. 2014. DAE $\delta$ ALUS and Dark Matter Detection. Phys. Rev. D91:055006. arXiv:1411.1055.
- Patrick Fox, Yonatan Kahn, and Matthew McCullough. 2014. Taking Halo-Independent Dark Matter Methods Out of the Bin. JCAP 10 (2014) 076. arXiv:1403.6830.
- Yonatan Kahn, Matthew McCullough, and Jesse Thaler. 2013. Auxiliary Gauge Mediation: A New Route to Mini-Split Supersymmetry. JHEP 1311 (2013) 161. arXiv:1308.3490.
- Yonatan Kahn and Jesse Thaler. 2012. Searching for an invisible  $A'$  vector boson with DarkLight. Phys. Rev. D86:115012. arXiv:1209.0777.
- Yonatan Kahn and Jesse Thaler. 2012. Locality in Theory Space. JHEP 1207 (2012) 007. arXiv:1202.5491.
- Simona Malace, Yonatan Kahn, Wally Melnitchouk, and C.E. Keppel. 2010. Confirmation of quark-

hadron duality in the neutron  $F_2$  structure function. *Phys. Rev. Lett.* 104:102001. arXiv:0910.4920.

Yonatan Kahn, Wally Melnitchouk, and Sergey Kulagin. 2009. New method for extracting neutron structure functions from nuclear data. *Phys. Rev. C* 79:035205. arXiv:0809.4308.

Yonatan Kahn, Michael Schmitt, and Tim M.P. Tait. 2008. Enhanced rare pion decays from a model of MeV dark matter. *Phys. Rev. D* 78:115002. arXiv:0712.0007.

Sven Heinemeyer, Yonatan Kahn, Michael Schmitt, and Mayda Velasco, 2007. An Experiment to Search for Light Dark Matter in Low-Energy  $ep$  Scattering. arXiv:0705.4056 (unpublished).

PROCEEDINGS AND  
WHITEPAPERS

Jim Alexander et al. 2016. Dark Sectors 2016 Workshop: Community Report. arXiv:1608.08632

Sergey Alekhin et al. 2015. A Facility to Search for Hidden Particles at the CERN SPS: the SHiP Physics Case. arXiv:1504.04855.

Yonatan Kahn. 2014. Unbinned halo-independent methods for emerging dark matter signals. arXiv:1411.4557. Proceedings of the Interplay between Particle and Astroparticle Physics (IPA 2014) Workshop, 18-22 August 2014, Queen Mary University of London.

Yonatan Kahn. 2013. Searching for an invisible dark photon with DarkLight. *AIP Conf. Proc.* 1563 (2013) 131-134.

Rouven Essig et al. 2013. Dark Sectors and New, Light, Weakly-Coupled Particles. arXiv:1311.0029. Report of the Community Summer Study 2013 (Snowmass); New, Light, Weakly Coupled Particles (NLWCP) subgroup of the Intensity Frontier.

Jan Balewski et al. 2013. DarkLight: A Search for Dark Forces at the Jefferson Laboratory Free-Electron Laser Facility. arXiv:1307.4432. Contributed to the Community Summer Study 2013 (Snowmass); New, Light, Weakly Coupled Particles (NLWCP) subgroup of the Intensity Frontier.

SEMINARS

Boston University **April 2017**

University of Maryland, College Park **April 2017**

SLAC **February 2017**

Weizmann/Tel Aviv University/Technion joint HEP seminar **January 2017**

UT Austin **December 2016**

Brown University **December 2016**

Perimeter Institute **November 2016**

Cornell University **September 2016**

Harvard University **September 2016**

Fermilab **April 2016**

Argonne National Lab **April 2016**

	UC Irvine	<b>April 2016</b>
	University of Oregon	<b>April 2016</b>
	YITP, Stony Brook University	<b>April 2016</b>
	MITP, University of Michigan	<b>March 2016</b>
	CCPP, New York University	<b>February 2016</b>
	SITP, Stanford University	<b>February 2016</b>
	MIT-Tufts Joint Cosmology Seminar	<b>December 2015</b>
	University of Minnesota	<b>October 2015</b>
	Perimeter Institute	<b>December 2014</b>
	Princeton University	<b>November 2014</b>
	University of Washington	<b>January 2014</b>
WORKSHOPS	<i>Developing New Tools for Dark Matter Searches</i> , Aspen Center for Physics	<b>September 2017</b>
	<i>Experimental Techniques in Table-Top Fundamental Physics</i> , Perimeter Institute	<b>August 2017</b>
	<i>Beyond WIMPs: from Theory to Detection</i> , Simons Center, Stony Brook University	<b>March 2017</b>
	<i>The LHC Awakens: A New Energy Frontier</i> , Aspen Center for Physics	<b>Aug-Sept 2016</b>
	<i>Precision for New Discoveries</i> , TRIUMF	<b>June 2016</b>
	<i>Dark Sectors Workshop 2016</i> , SLAC	<b>April 2016</b>
	<i>Pre-SUSY Summer School</i> , University of Manchester	<b>July 2014</b>
	<i>Theoretical Advanced Studies Institute (TASI)</i> , CU Boulder	<b>June 2013</b>
INVITED TALKS	<i>International Workshop on Baryon and Lepton Number Violation</i> , Case Western Reserve University	<b>May 2017</b>
	<i>2nd Workshop on Microwave Cavities and Detectors for Axion Research</i> , LLNL	<b>January 2017</b>
	<i>Symmetry Tests in Nuclei and Atoms</i> , UC Santa Barbara	<b>September 2016</b>
	<i>American Physical Society April Meeting 2016</i> , Salt Lake City	<b>April 2016</b>
CONFERENCE PRESENTATIONS	<i>Interplay of Particle and Astrophysics (IPA) 2014</i> , Queen Mary's University	<b>August 2014</b>
	<i>SUSY 2014</i> , University of Manchester	<b>July 2014</b>
	<i>Physics of Electron Beams</i> , MIT	<b>March 2013</b>

TEACHING

**Co-author, “Conquering the Physics GRE” (with Adam Anderson)**

A reference to help undergraduate students prepare for the Physics GRE. Revised Third Edition to be published by Cambridge University Press.

**Physics GRE Instructor, APS Bridge Program**

**July 2014-August 2015**

Developed and taught an 8-week Physics GRE prep course for students enrolled in the APS Bridge Program, a program designed to help minority physics students gain acceptance to graduate physics programs.

**Teaching assistant, MIT**

**September 2010-May 2015**

- 8.276 Nuclear and Particle Physics, Spring 2015 (guest lecturer)
- 8.324 Relativistic Quantum Field Theory II, Fall 2014 (full-time TA)
- 8.952 Particle Physics of the Early Universe, Spring 2014 (10% TA, sole grader)
- 8.831J Supersymmetric Quantum Field Theories, Fall 2013 (guest lecturer)
- 8.851 Effective Field Theory, Spring 2013 (10% TA, sole grader)
- 18.395 Group Theory with Applications to Physics, Fall 2012 (10% TA, sole grader, wrote all problem set solutions)
- 8.962 General Relativity, Spring 2011 (10% TA, shared grading responsibilities)
- 18.395 Group Theory with Applications to Physics, Fall 2010 (10% TA, sole grader, wrote all problem set solutions, gave last three lectures)

**Full-time instructor, MITES Calculus II**

**June - July 2011**

Taught 6-week single-variable calculus course, covering single-variable integral calculus and basic differential equations, for Minority Introduction to Engineering and Science (MITES) program at MIT. Wrote all lectures, problem sets, and exams, lectured 4.5 hours/week, gave office hours 2 hours/week.

SERVICE

Co-organizer, *Developing New Tools for Dark Matter Searches*, Aspen **August-September 2017**

Co-organizer, *Workshop on non-WIMP dark matter*, PCTS **November 2016**

Organizer, Princeton “Pheno & Vino” seminar **September 2016 - present**

Referee, *Physical Review Letters* **July 2015 - present**

Referee, *Physical Review D* **November 2013 - present**

Co-organizer, MIT beyond-the-Standard-Model journal club **2014 - 2015**

Co-organizer, MIT CTP graduate student lunch seminar **2012 - 2013**

EDUCATIONAL  
OUTREACH

**Part-time instructor and grader, Art of Problem Solving, Inc. June 2009 - June 2012**  
Alpine, CA USA

Taught and graded problem sets for web-based mathematics classes for advanced middle and high school students.

- Instructor: Precalculus (2011-2012), MATHCOUNTS Basics (Summer 2011)
- Assistant: Group Theory (Winter-Spring 2011)

**MIT+K12 Initiative****June - August 2011**

Made educational videos on physics topics:

- Doppler Effect: <http://k12videos.mit.edu/browse-videos/2014/4/17/the-doppler-effect>
- Poisson Spot: <http://video.mit.edu/watch/light-in-the-shadows-the-poisson-spot-8418/>
- The Shape of Sound: <http://video.mit.edu/watch/the-shape-of-sound-12958/>

- COMPUTER SKILLS
- Languages: C++, Python, some Linux and Unix, some Fortran
  - Analysis software: Mathematica, ROOT
  - Event generator simulations: MadGraph
  - Operating Systems: Unix/Linux, Mac, Windows

- LANGUAGES
- English (read, spoken, written)
  - French (read, spoken, written)