

CONTACT INFORMATION	Fermi National Accelerator Laboratory Particle Physics Division, Astrophysics Theory Website: http://home.fnal.gov/~sammcd00/ Email: sammcd00@fnal.gov	Citizenship: USA Phone: (215) 990-7036
RESEARCH INTERESTS	Dark matter: direct detection, indirect detection, model building, cosmological and astrophysical constraints, Asymmetric Dark Matter, Galactic center GeV excess, Supernova 1987A, Big Bang Nucleosynthesis. Field theory: finite temperature effects, effective theory, renormalization. Neutrinos: sterile neutrinos, low-energy nonunitarity, appearance anomalies.	
EMPLOYMENT	<p>Fermi National Accelerator Laboratory</p> <ul style="list-style-type: none"> • Postdoctoral Associate (6th floor) and KICP (associate fellow) September 2017-present • Schramm Fellow January 2019-present <p>C. N. Yang Institute for Theoretical Physics Postdoctoral Associate September 2014-September 2017</p>	
EDUCATION	<p>Ph.D., Physics. <i>Ratcheting up the Search for Dark Matter</i> August 2014 The University of Michigan, Ann Arbor. Advisor: Dr. Kathryn M. Zurek and Fermi National Accelerator Laboratory. Predoctoral Theory Fellowship, 2013-2014. Supervisor: Dr. Dan Hooper</p> <p>B.A., Physics and B.A., Math. Honors Thesis: <i>Effect of Electric Field on Fluorescence Intermittency Statistics of CdSe Nanocrystals</i> December 2008 The University of Pennsylvania. Advisor: Dr. Marija Drndic</p>	
AWARDS AND RECOGNITION	<p>Fermilab</p> <ul style="list-style-type: none"> • Schramm Fellowship • Predoctoral Theory Fellowship, 2013-2014, and URA Thesis Award, 2015 <p>The University of Michigan</p> <ul style="list-style-type: none"> • Rackham Predoctoral Fellowship, 2013-2014 <p>The University of Pennsylvania</p> <ul style="list-style-type: none"> • <i>Summa cum Laude</i>, with Distinction in Physics; Dean's List, all semesters; Benjamin Franklin Scholar; Phi Beta Kappa scholar 	
PUBLICATIONS	Prepared while at Fermilab as a postdoctoral associate:	
	<p>30. Gordan Krnjaic and SDM. <i>Implications of BBN Bounds for Cosmic Ray Upscattered Dark Matter</i>. arXiv:1908.00007 [hep-ph]. FERMILAB-PUB-19-358-A.</p> <p>29. Nikita Blinov, Kevin J. Kelly, Gordan Krnjaic, and SDM. <i>Constraining the Self-Interacting Neutrino Interpretation of the Hubble Tension</i>. arXiv:1905.02727 [astro-ph]. FERMILAB-PUB-19-175-A-T.</p>	

28. Dan Hooper, Gordan Krnjaic, and SDM. *Dark Radiation and Superheavy Dark Matter from Black Hole Domination*. arXiv:1905.01301 [hep-ph]. FERMILAB-PUB-19-186-A.
27. SDM and Michael S. Turner. *Nuclear Kinetic Equilibrium During Big Bang Nucleosynthesis*. arXiv:1811.04932 [hep-ph]. FERMILAB-PUB-18-625-A
26. SDM, Sanjay Reddy, and Srimoyee Sen. *A Deeply Bound Dibaryon is Incompatible with Neutron Stars and Supernovae*. arXiv:1809.06765 [hep-ph]. Phys. Rev. D **99**, no. 3, 035013 (2019). FERMILAB-PUB-18-490-A.
25. Rouven Essig, SDM, Hai-Bo Yu, and Yi-Ming Zhong. *Constraining Dissipative Dark Matter Self-Interactions*. arXiv:1809.01144 [hep-ph]. FERMILAB-PUB-18-437-A.
24. Dan Hooper, Gordan Krnjaic, Andrew J. Long, and SDM. *WIMPflation*. arXiv:1807.03308 [hep-ph]. Phys. Rev. Lett. **122**, no. 9, 091802 (2019). FERMILAB-PUB-18-309-A.
23. Asher Berlin, Dan Hooper, Gordan Krnjaic, and SDM. *Severely Constraining Dark Matter Interpretations of the 21-cm Anomaly*. arXiv:1803.02804 [hep-ph]. Phys. Rev. Lett. **121**, no. 1, 011102 (2018); selected as an **Editor's Choice** article. FERMILAB-PUB-18-066-A.
22. Bhaskaran Balaji, Ilias Cholis, Patrick J. Fox, and SDM. *Analyzing the Gamma-ray Sky with Wavelets*. arXiv:1803.01952 [astro-ph]. Phys. Rev. D **98**, no. 4, 043009 (2018). FERMILAB-PUB-18-057-A-T.
21. Jae Hyeok Chang, Rouven Essig, and SDM. *Supernova 1987A Constraints on Sub-GeV Dark Sectors, Millicharged Particles, the QCD Axion, and an Axion-like Particle*. arXiv:1803.00993 [hep-ph]. JHEP **1809**, 051 (2018). YITP-SB-18-01, FERMILAB-PUB-17-432-T.
20. Dan Hooper and SDM. *Robust Constraints and Novel Gamma-Ray Signatures of Dark Matter That Interacts Strongly With Nucleons*. arXiv:1802.03025 [hep-ph]. Phys. Rev. D **97**, 115006 (2018). FERMILAB-PUB-18-032-A.
19. SDM. *Is Self-Interacting Dark Matter Undergoing Dark Fusion?* arXiv:1711.00857 [hep-ph]. Phys. Rev. Lett. **120**, 221806 (2018); selected as an **Editor's Choice** article. FERMILAB-PUB-17-483-A-T.

Prepared while at YITP Stony Brook as a postdoctoral associate:

18. SDM, Hiren H. Patel, and Harikrishnan Ramani. *Dark Photon Decay Beyond The Euler-Heisenberg Limit*. Phys. Rev. D **97**, no. 7, 073005 (2018). arXiv:1705.00619 [hep-ph]. YITP-SB-17-14.
17. Samuel Witte, Vera Gluscevic, and SDM. *Prospects for Distinguishing Dark Matter Models Using Annual Modulation*. JCAP **1702**, no. 02, 044 (2017). arXiv:1612.07808 [hep-ph]. YITP-SB-16-51.

16. Jae Hyeok Chang, Rouven Essig, and SDM. *Revisiting Supernova 1987A Bounds on Dark Photons*. JHEP **1701**, 107 (2017). arXiv:1611.03864 [hep-ph]. YITP-SB-16-44.
15. SDM, Patrick Meade, and Harikrishnan Ramani. *Singlet Scalar Resonances and the Diphoton Excess*. Phys. Lett. B **755**, 353 (2016). arXiv:1512.05326 [hep-ph]. YITP-SB-15-47.
14. SDM, Ilias Cholis, Patrick J. Fox, and Samuel K. Lee. *Wavelet-Based Techniques for the Gamma-Ray Sky*. JCAP **1607**, 07, 045, (2016). arXiv:1512.00012 [astro-ph]. YITP-SB-15-43.
13. Asher Berlin, Dan Hooper, and SDM. *Dark matter elastic scattering through Higgs loops*. Phys. Rev. D **92**, no. 12, 123531 (2015). arXiv:1508.05390 [hep-ph]. YITP-SB-15-29.
12. Hooman Davoudiasl, Dan Hooper, and SDM. *Inflatable Dark Matter*. Phys. Rev. Lett. **116**, 031303 (2016); selected as an **Editor's Choice** article. arXiv:1507.08660 [hep-ph]. YITP-SB-15-26.
11. Vera Gluscevic, Moira Gresham, SDM, Annika H. G. Peter, and Kathryn M. Zurek. *Identifying the Theory of Dark Matter with Direct Detection*. JCAP **1512**, 12, 057 (2015). arXiv:1506.04454 [hep-ph]. YITP-SB-15-16. Associated code publicly available on github and ASCL.

Prepared while at Fermilab as a Fermilab Fellow:

10. SDM. *Lining up the Galactic Center Gamma-Ray Excess*. Phys. Dark Univ. **7-8**, 12 (2015). arXiv:1406.6408 [hep-ph]. FERMILAB-PUB-14-205-A-T.
9. Asher Berlin, Pierre Gratia, Dan Hooper, and SDM. *Hidden Sector Dark Matter Models for the Galactic Center Gamma-Ray Excess*. Phys. Rev. D **90**, 015032 (2014). arXiv:1405.5204 [hep-ph]. MCTP-14-12, FERMILAB-PUB-14-134-A.
8. Asher Berlin, Dan Hooper, and SDM. *Simplified Dark Matter Models for the Galactic Center Gamma-Ray Excess*. Phys. Rev. D **89**, 115022 (2014). arXiv:1404.0022 [hep-ph]. MCTP-14-07, FERMILAB-PUB-14-060-A.
7. Ilias Cholis, Dan Hooper, and SDM. *Dissecting the Gamma-Ray Background in Search of Dark Matter*. JCAP **1402**, 014 (2014). arXiv:1312.0608 [astro-ph]. MCTP-13-40, FERMILAB-PUB-13-546-A.
6. Rouven Essig, Eric Kuflik, SDM, Tomer Volansky, and Kathryn M. Zurek. *Constraining Light Dark Matter with Diffuse X-Ray and Gamma-Ray Observations*. JHEP **1311**, 193 (2013). arXiv:1309.4091 [hep-ph]. MCTP-13-27, FERMILAB-PUB-13-377-A-T.

Prepared while a graduate student at the University of Michigan and a member of the Michigan Center for Theoretical Physics (**MCTP**):

5. Clifford Cheung, SDM, and Kathryn M. Zurek. *Inspecting the Higgs for New Weakly Interacting Particles*. JHEP **1304**, 074 (2013). arXiv:1302.0314 [hep-ph]. MCTP-13-01.
4. Eric Kuflik, SDM, and Kathryn M. Zurek. *Neutrino Phenomenology in a 3+1+1 Framework*. Phys. Rev. D **86**, 033015 (2012). arXiv:1205.1791 [hep-ph]. MCTP-12-11.
3. SDM, Hai-Bo Yu, and Kathryn M. Zurek. *The Dark Matter Inverse Problem: Extracting Particle Physics from Scattering Events*. Phys. Rev. D **85**, 123507 (2012). arXiv:1110.4281 [hep-ph]. MCTP-11-34.
2. SDM, Hai-Bo Yu, and Kathryn M. Zurek. *Constraints on Scalar Asymmetric Dark Matter from Black Hole Formation in Neutron Stars*. Phys. Rev. D **85**, 023519 (2012). arXiv:1103.5472 [hep-ph]. MCTP-11-16.
1. SDM, Hai-Bo Yu, and Kathryn M. Zurek. *Turning off the Lights: How Dark is Dark Matter?* Phys. Rev. D **83**, 063509 (2011). arXiv:1011.2907 [hep-ph]. MCTP-10-52.

CODE

`dmdd`, ascl:1506.002

- `dmdd` is a python package that enables simple simulation and Bayesian posterior analysis of nuclear-recoil data from dark matter direct detection experiments for a wide variety of theories of dark matter-nucleon interactions. `dmdd` was developed in collaboration with Vera Gluscevic for use in arXiv:1506.04454, additionally with Moira Gresham, Annika H. G. Peter, and Kathryn M. Zurek.
- `dmdd` was used by the PICO collaboration to set official limits in arXiv:1510.07754 [hep-ex]

INVITED TALKS

Dark Radiation and Superheavy Dark Matter from Black Hole Domination

- AAS Dark Matter “Meeting within a Meeting” **June 11, 2019**
- Current Trends in Particle Theory, UIC **June 16, 2019**

The Dark Matter Mass and The Dark Matter Cross Section

- “String Theory and the Hidden Universe” and “Progress After Impasse”, Aspen Center for Physics **May 27 & 28, 2019**

Core Collapse Supernovae and Hidden Sectors

- Theory Seminar, Argonne National Lab **April 9, 2019**

Dark Matter and Fusion

- Particle Theory Seminar, Perimeter Institute **Dec 1, 2017**
- Theoretical Physics Seminar, Brandeis University **Feb 15, 2018**
- Brown Bag Seminar, University of Michigan **Oct 31, 2018**
- CCPP Seminar, New York University **Feb 9, 2019**

A Particle Physicist’s Perspective on EDGES

- Theoretical Astrophysics Seminar, Fermilab **May 21, 2018**
- CIPANP XIII **May 30, 2018**
- Twelfth Conference on the Identification of Dark Matter **July 23, 2018**
- Seventh PIMKIO meeting, University of Michigan **March 29, 2019**

Supernova 1987A Bounds on Hidden Sectors

- Dark Interactions Workshop, Brookhaven **Sep 7, 2016**
- HEP Seminar, Johns Hopkins University **Oct 25, 2016**
- High Energy Theory Seminar, University of Minnesota **Mar 10, 2017**
- Nuclear Theory Seminar, University of Kentucky **Apr 6, 2017**
- CFP Seminar, University of Maryland **Apr 10, 2017**
- Particle Theory Seminar, Boston University **Oct 11, 2017**
- 4D Seminar, Berkeley **Oct 18, 2017**
- Theory Seminar, SLAC **Oct 20, 2017**
- ITS Seminar, University of Oregon **Oct 23, 2017**
- Particle Physics Seminar, University of Washington **Oct 24, 2017**
- HPS Collaboration Telecon **Nov 15, 2017**
- Theoretical Astrophysics Seminar, Fermilab **Feb 5, 2018**
- *New Probes for Physics Beyond the Standard Model* Conference, KITP **Apr 10, 2018**
- CIPANP XIII **May 31, 2018**

Inflatable Dark Matter and the 750 GeV Resonance

- Pheno & Vino, Princeton **Feb 2, 2016**
- Astro Coffee, IAS **Feb 3, 2016**
- High Energy Physics Seminar, Caltech **Apr 25, 2016**
- Joint Particle Seminar, UC Irvine **Apr 27, 2016**

Probing Theories of Dark Matter with Direct Detection

- APS DPF meeting, Ann Arbor **Aug 5, 2015**

Ratcheting up the Search for Dark Matter

- URA Thesis Award Presentation, Fermilab Users Meeting **June 10, 2015**

Beyond Templates for the Galactic Center GeV Gamma-ray Excess

- MIT CTP **Oct 1, 2014**
- IAS Astro Coffee **Oct 8, 2014**
- UT Austin Theory Group Seminar **Nov 4, 2014**
- Brookhaven National Lab **Mar 4, 2015**
- Maryland CFP **Mar 9, 2015**
- Cornell Particle Theory Seminar **Apr 10, 2015**

The Galactic Center GeV Gamma-ray Excess: Have We Started to See Dark Matter?

- Université de Montréal and McGill dark matter workshop **July 24, 2014**
- Galileo Galilei Institute workshop **Sep 30, 2015**

Thoughts on the keV Line

	University of Chicago Dark Matter Hub meeting	Apr 15, 2014
	<i>Constraining Dark Matter with Background Light</i>	
	• Los Alamos T2 Seminar	Dec 5, 2013
	• Wisconsin Theory Seminar	Nov 8, 2013
	• SLAC Theoretical Physics Seminar	Oct 30, 2013
	• Fermilab Theory Seminar	Oct 17, 2013
PARALLEL AND OTHER TALKS	FNAL New Directions in the Search for Light Dark Matter	June 2019
	Aspen Center for Physics	2015, 2016, 2017, 2019
	Brookhaven Forum	Oct 2015
	YITP Wine and Cheese	Sep 2014
	COSMO2014 Parallel Session	Aug 2014
	TeVPA/IDM 2014 Parallel Session	June 2014
	Phenomenology Parallel Session	2012, 2013
	University of Michigan Undergraduate Poster Session	Mar 2012
	19th SUSY (2011)	Sep 2011
	University of Michigan Graduate Student Symposium	June 2011
	MCTP Student Journal Club	2009 - 2013
PROGRAMMING LANGUAGES	Proficient: Mathematica, Python, HTML	
	Familiar: Cython, CSS	
PROFESSIONAL SERVICE	Referee: Phys. Rev. Letters , MNRAS Letters , JHEP , Phys. Rev. D , and Phys. Letters B .	
	New Directions in the Search for Light Dark Matter Particles	June 4-7, 2019
	• Workshop at Fermilab and KICP	
	• Co-organized with Dan Bauer, Dan Baxter, Yoni Kahn, Gordan Krnjaic, and Noah Kurinsky	
	• awarded \$24,525 grant from the Gordon and Betty Moore Foundation	
	Next Frontiers in the Search for Dark Matter	Aug, 26 2019 - Oct, 11 2019
	• Workshop at Galileo Galilei Institute in Arcetri, Italy	
	• inclusive of a five-day conference	
	• Co-organized with Marco Battaglieri, Laura Baudis, Francesco D'Eramo, Claudia Frugieule, Eric Kuflik, Tongyan Lin, Hitoshi Murayama, and Ste- fano Profumo	
	Beyond WIMPs: from Theory to Detection	March 27-29, 2017
	• Workshop at Simons Center for Geometry and Physics	
	• Co-organized with Rouven Essig, Peter Sorensen, Tomer Volansky, and Tien-Tien Yu	

MCTP Light Dark Matter: Asymmetric, thermal and non-thermal dark matter
and its detection **April, 2013**

PUBLICITY

Conover, Emily. "If real, dark fusion could help demystify this physics puzzle."
Science News, 6 June 2018.