

# Christopher Cappiello

EDWIN THOMPSON JAYNES POSTDOCTORAL FELLOW

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## PROFESSIONAL EXPERIENCE

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- 2024— **Edwin Thompson Jaynes Postdoctoral Fellow**, Department of Physics, Washington University in St. Louis
- 2021—2024 **Postdoctoral Fellow**, Department of Physics, Engineering Physics, and Astronomy, Queen's University
- 2022—2024: Associate Appointment, Perimeter Institute for Theoretical Physics

## EDUCATION

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### The Ohio State University

Columbus, OH

PHD IN PHYSICS

2015 - 2021

- Thesis: *Constraints on Strongly Interacting Dark Matter*
- Advisor: Professor John Beacom

### Yale University

New Haven, CT

BS IN PHYSICS (INTENSIVE)

2011 - 2015

- Senior Thesis: *Shapes of Galaxy Clusters*
- Undergraduate Research Advisor: Professor Daisuke Nagai
- Distinction in the Major
- Magna Cum Laude

## PUBLICATIONS

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A list of my publications can also be found on [Inspire](#).

## WHITE PAPERS

1. Snowmass2021 Cosmic Frontier White Paper: Ultraheavy particle dark matter  
arXiv:2203.06508, SciPost Phys. Core 6, 075 (2023)

## JOURNAL ARTICLES

20. Boukhtouchen, Y., Bramante, J., **Cappiello, C.**, Diamond, M.  
Deconstructive Composite Dark Matter Detection  
arXiv:2512.16043
19. Alam, Z., **Cappiello, C.**, Ferrer, F.  
Dark Matter Boosted by Terrestrial Collisions  
arXiv:2510.12791
18. **Cappiello, C.**, Daylan, T.  
Can a Dark Inferno Melt Earth's Core?  
arXiv:2505.24070, Physical Review D 112, 075018 (2025)

17. **Cappiello, C.**, Dev, B., Patwardhan, A.  
New Supernova Constraints on Neutrinophilic Dark Sector  
arXiv:2503.09691
16. Acevedo, J., Boukhtouchen, Y., Bramante, J., **Cappiello, C.**, Mohlabeng, G., Sheahan, M., Tyagi, N.  
Loosely Bound Composite Dark Matter  
arXiv:2408.03983, JCAP 03 (2025) 013
15. Balan, S., Balázs, C., Bringmann, T., **Cappiello, C.**, Catena, R., Emken, T., Gonzalo, T., Gray, T., Handley, W., Huynh, Q., Kahlhoefer, F., Vincent, A.  
Resonant or asymmetric: The status of sub-GeV dark matter  
arXiv:2405.17548, JCAP 01 (2025) 053
14. Bramante, J., **Cappiello, C.**, Diamond, M., Kim, L., Liu, Q., Vincent, A.  
Dissipative Dark Cosmology: From Early Matter Dominance to Delayed Compact Objects  
arXiv:2405.04575, Physical Review D 110, 043041 (2024)
13. **Cappiello, C.**, Liu, Q., Mohlabeng, G., Vincent, A.  
Cosmic Ray Boosted Dark Matter at IceCube  
arXiv:2405.00086, Physical Review D 110, 095031 (2024)
12. Bleau, K., Bramante, J., **Cappiello, C.**  
How Effective is  $N_{eff}$  at Discovering Dark Radiation in a Cosmology with Heavy Particle Decay?  
arXiv:2309.06482, JCAP 01 (2024) 021
11. **Cappiello, C.**, Jafs, M., Vincent, A.  
The Morphology of Exciting Dark Matter and the Galactic 511 keV Signal  
arXiv:2307.15114, JCAP 11 (2023) 003
10. Diamond, M., **Cappiello, C.**, Vincent, A., Bramante, J.  
Limiting Light Dark Matter with Luminous Hadronic Loops  
arXiv:2307.13727, Physical Review Letters 132, 051001 (2024)
9. **Cappiello, C.**  
An Analytic Approach to Light Dark Matter Propagation  
arXiv:2301.07728, Physical Review Letters 130, 221001 (2023)
8. **Cappiello, C.**, Avis Kozar, N., Vincent, A.  
Dark Matter from Monogem  
arXiv:2210.09448, Physical Review D 107, 035003 (2023)
7. Dhakal, P., Prohira, S., **Cappiello, C.**, Beacom, J., Palo, S., Marino, J.  
New Constraints on Macroscopic Dark Matter Using Radar Meteor Detectors  
arXiv:2209.07690, Physical Review D 107, 043026 (2023)
6. The Prospect Collaboration and **Cappiello, C.**  
Limits on Sub-GeV Dark Matter from the PROSPECT Reactor Antineutrino Experiment  
arXiv:2104.11219, Physical Review D 104, 012009 (2021)
5. **Cappiello, C.**, Collar, J.I., Beacom, J.  
New Experimental Constraints in a New Landscape for Composite Dark Matter  
arXiv:2008.10646, Physical Review D 103, 023019 (2021)
4. Digman, M., **Cappiello, C.**, Beacom, J., Hirata, C., Peter, A.  
Not as Big as a Barn: Upper Bounds on Dark Matter-Nucleus Cross Sections  
arXiv:1907.10618, Physical Review D 100, 063013 (2019)

3. **Cappiello, C.**, and Beacom, J.  
Strong New Limits on Light Dark Matter from Neutrino Experiments  
arXiv:1906.11283, Physical Review D 100, 103011 (2019)
2. **Cappiello, C.**, Ng, K., Beacom, J.  
Reverse Direct Detection: Cosmic Ray Scattering With Light Dark Matter  
arXiv:1810.07705, Physical Review D 99, 063004 (2019) (*Featured as Editor's Suggestion*)
1. **Cappiello, C.**  
A Closer Look at Function Transformations  
Mathematics Teacher. 106 (8): 630-34. (2013)

## SOFTWARE

- DarkInferno (2025) — Code for modeling heat flow in the Earth's core due to dark matter annihilation. (Code, v0.1.0, Available on [GitHub](#) and [zenodo](#))
- DMprop (2023) — Publicly available code for modeling the propagation of sub-GeV dark matter in the Earth's crust and atmosphere. (Code, v0.1.0, Available on [GitHub](#))

## MENTORING/SUPERVISING

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- 2025-2026 Icarus Scoville, High School Student. Helped supervise research on neutrino interactions in direct detection experiments
- 2024-2026 Jose Padron, MSc Candidate, Washington University. Helped supervise Master's thesis research on interactions between GZK neutrinos and the cosmic neutrino background.
- 2024-2025 Zamiul Alam, Graduate Student, Washington University. Supervised research on inelastic dark matter scattering in the Earth.
- 2023 Katarina Bleau, MSc Candidate, Queen's University. Helped supervise Master's thesis research on  $N_{eff}$  constraints on light dark matter, which was published in JCAP.
- 2023 Ivanna Boras, Summer Research and Outreach Fellow, Queen's University. Supervised an undergraduate summer research project on scattering of sub-GeV dark matter in the Earth's crust, which was presented at the Canadian Conference for Undergraduate Women in Physics.
- 2021–2023 Neal Avis Kozar, PhD Candidate, Queen's University. Supervised a research project on boosted dark matter in the framework of nonrelativistic effective field theory, which was published in Physical Review D.
- 2019–2023 Pawan Dhakal, MSc, The Ohio State University. Helped supervise Master's thesis research on macroscopic dark matter, which was published in Physical Review D.

## AWARDS, FELLOWSHIPS, & GRANTS

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### GRANT PROPOSALS SUBMITTED AS CO-I

- 2026 **ADAP**, NASA
- 2026 **XRISM General Observer**, NASA

### AWARDS, FELLOWSHIPS AND GRANTS AWARDED

- 2024 **Edwin Thompson Jaynes Postdoctoral Fellowship**, Washington University
- 2023 **Postdoctoral Scholar Award**, Arthur B. McDonald Canadian Astroparticle Physics Research Institute

- 2019 **Student Travel Award**, Division of Particles and Fields, American Physical Society
- 2016 **Student Travel Grant**, Division of Astrophysics, American Physical Society
- 2015 **DeForest Pioneers Prize for Distinguished Creative Achievement in Physics**, Yale University
- 2015 **University Fellowship**, The Ohio State University
- 2013 **Yale College Dean’s Research Fellowship**, Yale University
- 2013 **Richter Summer Fellowship**, Yale University
- 2011 **Brown Fellows Award**, Centre College
- 2010 **National Merit Scholar**, National Merit Scholarship Corporation
- 2009 **American Invitational Mathematics Examination Qualifier**, Mathematical Association of America

## SERVICE & OUTREACH

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### PUBLIC TALKS

- Nov 21, 2025 “From Variable Stars to Dark Matter: The Expanding Legacy of Henrietta Leavitt”, Departments of Physics and Performing Arts Colloquium, Washington University
- Mar 29, 2025 “Searching for Dark Matter with Cosmic Rays”, Society of Physics Students Zone 12 Meeting, Washington University
- Nov 4, 2023 “Theory and Future of Dark Matter Physics”, Dark Matter Day, Queen’s University

### WASHINGTON UNIVERSITY

- Fall 2025 TeVPA 2025, Indirect Detection Session Convener
- Fall 2025– Postdoc Peer Mentorship Program, Mentor
- Spring 2025– Particle Physics Journal Club, Organizer
- March 2025 APS Global Physics Summit, Dark Matter Session Chair
- 2024–2025 Jaynes Fellowship Search Committee, Member
- Fall 2024 Astromusers Journal Club, Organizer

### QUEEN’S UNIVERSITY

- May 2024 APS DPF Meeting/Phenomenology Symposium 2024, Beyond-Standard-Model-Physics Session Convener
- 2022 & 2024 Departmental Research Support Committee, Postdoc Representative
- 2022–2024 Science Rendezvous Kingston, Planning and Demo Station Volunteer
- Summer 2023 Summer Research and Outreach Fellow Program, Undergraduate Research Project Supervisor
- June 2023 1st Workshop on Boosted Dark Matter, Session Convener
- June 2023 XVI International Conference on Interconnections between Particle Physics and Cosmology (PPC 2023), Dark Matter Session Convener
- August 2022 TeVPA 2022, Dark Matter Session Convener and Organizing Volunteer

### THE OHIO STATE UNIVERSITY

- 2017–2021 CCAPP Astroparticle Lunch, Weekly Journal Club Organizer
- 2016–2019 Breakfast of Science Champions (Annual Event), Assistant Instructor
- April 2018 Global Star Party, Volunteer
- August 2017 TeVPA 2017, Organizing Volunteer

Summer 2016 Ohio Supercomputer Center Summer Institute, Instructor  
Summer 2016 OSU Young Scholars Program, Assistant Instructor

### PEER REVIEW

2024– Physical Review D  
2023– Journal of Cosmology and Astroparticle Physics  
2021– Physical Review Letters  
2021– Physics Letters B

### GRANT REVIEW

2025 Agencia Nacional de Investigación y Desarrollo (ANID), Chile

### PRESENTATIONS

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#### INVITED TALKS

*Can a Dark Inferno Melt the Earth's Core?* Astro/Pheno Seminar, University of Victoria. Victoria, BC, Canada. February 24, 2026. (Virtual)

*Can a Dark Inferno Melt the Earth's Core?* Nature of Dark Matter Seminar, Yale University. New Haven, CT. January 29, 2026. (Virtual)

*Dark Matter Scattering in the Earth: The Good, the Bad, and the Melting of the Planet's Core.* Jaynes Fellowship Symposium, Washington University. December 3, 2025.

*Can a Dark Inferno Melt the Earth's Core?* Structure and Evolution of Astronomical Objects Workshop. December 3, 2025. (Virtual)

*Producing and Accelerating Light Dark Matter with Supernovae.* University of Melbourne, Melbourne, Victoria, Australia. August 13, 2025. (Virtual)

*Can a Dark Inferno Melt Earth's Core?* CETUP\*, Lead, SD. June 18, 2025.

*Upscattering Inelastic Dark Matter in the Earth.* Mitchell Conference on Collider, Dark Matter, and Neutrino Physics, Texas A&M University, College Station, TX. May 14, 2025.

*Dark Matter Phenomenology: From MeV to Meteors.* Jaynes Fellowship Symposium, Washington University, St. Louis, MO. November 13, 2024.

*Cosmic Ray-Boosted Dark Matter at IceCube.* Theory Seminar, Washington University, St. Louis, MO. September 19, 2024.

*Cosmic Ray-Boosted Dark Matter at IceCube.* CNP Seminar, Virginia Tech, Blacksburg, VA. May 22, 2024.

*An Analytic Approach to Light Dark Matter Propagation.* Washington University, St. Louis, MO. December 14, 2023. (Virtual)

*The Morphology of Exciting Dark Matter and the Galactic 511 keV Signal.* TEPAPP Seminar, UCLA, Los Angeles, CA. October 4, 2023. (Virtual)

*An Analytic Approach to Light Dark Matter Propagation.* GUINEAPIG Workshop, Université de Montréal, Montreal, QC. July 13, 2023.

*An Analytic Approach to Light Dark Matter Propagation.* CETUP\*, Lead, SD. June 22, 2023.

*Boosting Light Dark Matter with Cosmic Rays and Supernovae.* 1st Workshop on Boosted Dark Matter, Institute for Basic Science, Daejeon, South Korea. June 16, 2023.

*An Analytic Approach to Light Dark Matter Propagation.* LSSU Seminar, Jeonbuk National University, Jeonju, South Korea. June 8, 2023.

*Boosting Light Dark Matter with Cosmic Rays and Supernovae.* Dark Matter Beyond the Weak Scale, University of Liverpool, Liverpool, UK. March 30, 2023.

*An Analytic Approach to Light Dark Matter Propagation.* TTPC Seminar, King's College London, London, UK. March 24, 2023.

*An Analytic Approach to Light Dark Matter Propagation.* IPPP Seminar, Durham University, Durham, UK. March 23, 2023.

*An Analytic Approach to Light Dark Matter Propagation.* PandaX DM + nu Forum, Tsung-Dao Lee Institute, Shanghai Jiao Tong University, Shanghai, China. February 15, 2023. (Virtual)

*Boosting Light Dark Matter with Cosmic Rays and Supernovae.* Particle Physics Seminar, Carleton University, Ottawa, ON. November 21, 2022.

*Boosting Light Dark Matter with Cosmic Rays and Supernovae.* Mitchell Institute Seminar, Texas A&M University, College Station, TX. October 12, 2022.

*Probing the Landscape of Heavy, Strongly Interacting, and Composite Dark Matter.* Mega Dark Matter: Theory and Detection. Mainz Institute for Theoretical Physics, Mainz, Germany. May 2, 2022.

*Probing the Landscape of Heavy, Strongly Interacting, and Composite Dark Matter.* Particle Physics Seminar, Perimeter Institute for Theoretical Physics, Waterloo, ON. April 19, 2022.

*Probing the Landscape of Heavy, Strongly Interacting, and Composite Dark Matter.* McDonald Institute Seminar, Queen's University, Kingston, ON. October 14, 2021.

*Probing the Landscape of Heavy, Strongly Interacting, and Composite Dark Matter.* TEPAPP Seminar, UCLA, Los Angeles, CA. February 2, 2021. (Virtual)

*New Experimental Constraints in a New Landscape for Composite Dark Matter.* TRIUMF, Vancouver, BC. December 16, 2020. (Virtual)

## PANELS

*Dark Matter Detection: Status and Prospects.* New Horizons in Astro and Particle Theory. Queen's University, Kingston, ON. August 6–7, 2022.

## CONTRIBUTED TALKS

**Cappiello, C.,** Alam, Z., Ferrer, F. *Inelastic Dark Matter Boosted by Terrestrial Collisions.* TeVPA 2025. Valencia, Spain. November 4, 2025.

**Cappiello, C.,** Alam, Z., Ferrer, F. *Upscattering Inelastic Dark Matter in the Earth.* PPC 2025. Deadwood, SD. June 24, 2025.

**Cappiello, C.,** Daylan, T. *Can a Dark Inferno Melt Earth's Core?.* 246th Meeting of the American Astronomical Society. Anchorage, AK. June 11, 2025.

**Cappiello, C.,** Dev, B., Patwardhan, A. *A New Supernova Bound on Neutrinophilic Dark Matter.* APS Global Physics Summit 2025. Anaheim, CA. March 19, 2025.

**Cappiello, C.,** Liu, Q., Mohlabeng, G., Vincent, A. *Cosmic Ray-Boosted Dark Matter at IceCube.* Particle Physics on the Plains 2024. Lawrence, KS. November 2, 2024.

**Cappiello, C.,** Liu, Q., Mohlabeng, G., Vincent, A. *Cosmic Ray-Boosted Dark Matter at IceCube.* TeVPA 2024. Chicago, IL. August 27, 2024.

- Cappiello, C., Liu, Q., Mohlabeng, G., Vincent, A.** *Cosmic Ray-Boosted Dark Matter at IceCube*. DPF-Pheno 2024. Pittsburgh, PA. May 13, 2024.
- Cappiello, C.** *An Analytic Approach to Dark Matter Propagation*. PPC 2023. Daejeon, South Korea. June 13, 2023.
- Cappiello, C.** *An Analytic Approach to Dark Matter Propagation*. Phenomenology Symposium 2023. Pittsburgh, PA. May 8, 2023.
- Cappiello, C.** *An Analytic Approach to Dark Matter Propagation*. APS April Meeting 2023. Minneapolis, MN. April 17, 2023.
- Cappiello, C., Avis Kozar, N., Vincent, A.** *Dark Matter from Monogem: Constraints on Velocity-Dependent Dark Matter-Nucleus Scattering*. TeVPA 2022. Kingston, ON. August 9, 2022.
- Cappiello, C., Andriamirado, M., Littlejohn, B.** *Cosmic ray boosted dark matter at PROSPECT—theory and propagation*. APS April Meeting 2021. Virtual. April 20, 2021.
- Cappiello, C., Collar, J.I., Beacom, J.** *New Experimental Constraints in a New Landscape for Composite Dark Matter*. APS April Meeting 2020. Virtual. April 20, 2020.
- Cappiello, C., Beacom, J.** *Strong New Limits on Light Dark Matter from Neutrino Experiments*. 8th PIKIMO Meeting. Cincinnati, OH. November 2, 2019.
- Cappiello, C., Beacom, J.** *Strong New Limits on Light Dark Matter from Neutrino Experiments*. 2019 Meeting of the Division of Particles and Fields (DPF) of the American Physical Society. Boston, MA. August 1, 2019.
- Cappiello, C., Beacom, J.** *Strong New Limits on Light Dark Matter from Neutrino Experiments*. 2019 Phenomenology Symposium. Pittsburgh, PA. May 6, 2019.
- Cappiello, C., Beacom, J.** *Constraining Dark Matter with Cosmic Ray Interactions*. APS April Meeting 2019. Denver, CO. April 14, 2019.
- Cappiello, C., Ng, K., Beacom, J.** *Reverse Direct Detection: Cosmic Ray Tests of Light Dark Matter Elastic Scattering*. 2018 Phenomenology Symposium. Pittsburgh, PA. May 7, 2018.
- Cappiello, C., Ng, K., Beacom, J.** *Reverse Direct Detection: Cosmic Ray Tests of Light Dark Matter Elastic Scattering*. APS April Meeting 2018. Columbus, OH. April 14, 2018.
- Cappiello, C., Ng, K., Beacom, J.** *Reverse Direct Detection: Cosmic Ray Tests of Light Dark Matter Elastic Scattering*. TeVPA 2017. Columbus, OH. August 10, 2017.
- Cappiello, C., Ng, K., Beacom, J.** *Constraining Proton-Dark Matter Scattering Using Cosmic Ray Measurements*. APS April Meeting 2017. Washington, DC. January 29, 2017.

#### POSTER PRESENTATIONS

- 225th Meeting of the American Astronomical Society. Seattle, WA. January 4–8, 2015.
- 2014 Northeast Regional Sigma Xi Conference. Old Westbury, NY. April 26, 2014. Second Place Poster Presentation Award.
- Annual Northeast Undergraduate Research and Development Symposium. Biddeford, ME. March 9, 2014.

## TEACHING EXPERIENCE

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### WASHINGTON UNIVERSITY

Oct 9, 2025 Guest Lecture, PHYSICS 3330/5330 (Planets and Life in the Universe)  
Sept 30, 2025 Guest Lecture, PHYSICS 5820 (Research Seminar)

### INVITED SUMMER SCHOOL LECTURER, QUEEN'S UNIVERSITY

May 4, 2023 “Direct and Indirect Detection of Dark Matter”, Summer Particle Astrophysics Workshop

### TEACHING ASSISTANT, THE OHIO STATE UNIVERSITY

Spring 2020 Astronomy 1141: Life in the Universe  
Fall 2019 Astronomy 1101: From Planets to the Cosmos  
Fall 2019 Astronomy 1141: Life in the Universe  
Spring 2017 Astronomy 1101: From Planets to the Cosmos  
Spring 2017 Astronomy 1144: Stars, Galaxies, & the Universe  
Fall 2016 Physics 1250: Mechanics, Work and Energy, Thermal Physics

## PROFESSIONAL DEVELOPMENT

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### SUMMER SCHOOLS

**University of Michigan Cosmology Summer School 2020.** Cosmology summer school. Topics included 21 cm cosmology, the CMB, galaxy clusters, numerical simulations, and weak lensing. University of Michigan. June 2020. Virtual.

**Erdős Institute 2020 Data Science Bootcamp.** Summer school on data manipulation and analysis. Topics focused on Python-based data analysis and machine learning, particularly the pandas and scikit-learn libraries. The Ohio State University. May 2020. Virtual.

**Neutron Star Mergers for Non Experts.** Summer school covering a variety of physics related to GW170817. Topics included gravitational waves, kilonova observations, neutron star equation-of-state, numerical simulations of neutron star mergers, and r-process nucleosynthesis. Michigan State University. May 2018. East Lansing, MI, USA.

**Tri-Institute Summer School on Elementary Particles (TRISEP).** Summer school on particle physics. Topics included accelerator physics, dark matter models and detection, running simulations with Geant4, neutrino oscillations, neutrinoless double beta decay, and statistics in particle physics. SNO-LAB. July 2017. Sudbury, ON, Canada.

### OTHER RESEARCH APPOINTMENTS

2014 **REU Intern**, Smithsonian Astrophysical Observatory, Harvard University  
2011-2012 **Summer Research Intern**, Brown Cancer Center, University of Louisville

### PROFESSIONAL MEMBERSHIPS

American Astronomical Society (AAS)  
American Physical Society (APS)

## PRESS

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**Trouw**, “Donkere materie, waar moet je het zoeken?” (“Dark matter, where should you look?”), [Link to Article](#). Press Piece. November 1, 2025.

**Astrobites**, “A dark matter journey to the centre of the Earth,” [Link to Article](#). Press Piece. June 15, 2025.

**Cosmology Talks (YouTube Channel)**, “Melissa Diamond - If Dark Matter Interacts with Protons We Could See It Scatter Electrons,” [Link to Video](#). Interview. October 3, 2023.

**WOSU Public Media**, “Ohio State researchers use radar in the search for dark matter,” [Link to Article](#). Interview. December 13, 2022.

## REFERENCES

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**Prof. John Beacom** (PhD Advisor)

Director of the Center for Cosmology and Astroparticle Physics  
Department of Physics  
Department of Astronomy  
The Ohio State University  
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**Prof. Joe Bramante**

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**Prof. Aaron Vincent**

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