

Christopher Cappiello

EDWIN THOMPSON JAYNES POSTDOCTORAL FELLOW

*Department of Physics, Washington University in St. Louis
1 Brookings Drive, St. Louis, MO, 63130*

✉ cappiello@wustl.edu | 🌐 www.mcdonaldinstitute.ca/chris-cappiello/

PROFESSIONAL EXPERIENCE

- 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

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

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

MANUSCRIPTS IN PREP

1. Acevedo, J., Boukhtouchen, Y., Bramante, J., **Cappiello, C.**, Mohlabeng, G., Sheahan, M., Tyagi, N.
Weakly Bound Composite Dark Matter Phenomenology

JOURNAL ARTICLES

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
14. Bramante, J., **Cappiello, C.**, Diamond, M., Kim, L., Liu, Q., Vincent, A.
A Dissipative Dark Cosmology: From Early Matter Dominance to Delayed Compact Objects
arXiv:2405.04575

13. **Cappiello, C.**, Liu, Q., Mohlabeng, G., Vincent, A.
Cosmic Ray Boosted Dark Matter at IceCube
arXiv:2405.00086
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, Accepted for publication in Physical Review Letters
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

- 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

- 2023 Katarina Bleau, MSc Candidate, Queen's University
- 2023 Ivanna Boras, Summer Research and Outreach Fellow, Queen's University
- 2021–2023 Neal Avis Kozar, PhD Candidate, Queen's University
- 2019–2023 Pawan Dhakal, MSc, The Ohio State University
- 2019 Maria Scaccia, Undergraduate Instructional Assistant, Astronomy 1101,
The Ohio State University

AWARDS, FELLOWSHIPS, & GRANTS

- 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

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

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

PRESENTATIONS

INVITED TALKS

- 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.* TPPC 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. *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

SUMMER SCHOOL LECTURES AND PUBLIC TALKS

- Nov 4, 2023 “Theory and Future of Dark Matter Physics”, Dark Matter Day, Queen’s University
- May 4, 2023 “Direct and Indirect Detection of Dark Matter”, Summer Particle Astrophysics Workshop, Queen’s University

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

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 Physical Society (APS)

PRESS

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

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

REFERENCES

Prof. John Beacom (PhD Advisor)

Director of the Center for Cosmology and Astroparticle Physics
Department of Physics
Department of Astronomy
The Ohio State University
Columbus, OH 43210, USA
beacom.7@osu.edu

Prof. Joe Bramante

Department of Physics, Engineering Physics, & Astronomy
Arthur B. McDonald Canadian Astroparticle Physics Research Institute
Queen's University
Kingston, ON K7L 3N6, Canada
joseph.bramante@queensu.ca

Prof. Juan Collar

Department of Physics
Enrico Fermi Institute
Kavli Institute for Cosmological Physics
University of Chicago
Chicago, IL 60637, USA
collar@uchicago.edu

Prof. Annika Peter

Department of Physics
Department of Astronomy
The Ohio State University
Columbus, OH 43210, USA
peter.33@osu.edu

Prof. Aaron Vincent

Department of Physics, Engineering Physics, & Astronomy
Arthur B. McDonald Canadian Astroparticle Physics Research Institute
Queen's University
Kingston, ON K7L 3N6, Canada
aaron.vincent@queensu.ca