# Cari Cesarotti, Ph.D.

**CTP Postdoctoral Research Fellow**

Center for Theoretical Physics, MIT Department of Physics,
77 Massachusetts Avenue, Building 6, Cambridge, MA 02139
Email: ccesar@mit.edu; Twitter: @caridoesphysics, @MuonCollider; caricesarotti.com


## RESEARCH FOCUS: THEORY & PHENOMENOLOGY

- Model-agnostic tools, such as event-shape observables, at colliders
- BSM and DM model-building and detection strategies
- Future collider studies (emphasis on muon collider)

## ACADEMIC POSITIONS

**2022-25** **CTP Postdoctoral Fellow**, Center for Theoretical Physics, MIT, Cambridge, MA.
**2025-** **CERN TH Theory Fellow**, CERN, Geneva, CH (Anticipated).

## EDUCATION

**2017-22** **Ph.D. in Physics,** Harvard University.
Ph.D. Advisor: Matthew Reece, Professor.

**2013-17** **B.A. in Physics**, Summa Cum Laude, Cornell University.
Undergraduate Advisor: James Alexander, Professor.

## FELLOWSHIPS & AWARDS

- Leona Woods Distinguished Postdoc Lectureship Award, BNL, 2024.
- Forbes 30 Under 30, Science Category, 2024.
- J.J. and Noriko Sakurai Dissertation Award in Theoretical Physics, APS, 2023.
- Young Scientist Award, 14$^{th}$ International Conference on the Identification of DM, 2022.
- David J. Robbins Prize for Excellence in Teaching, Harvard Physics, 2022.
- NSF Graduate Research Fellow, 2019-22.
- PRISMA Cluster of Excellence Scholarship, Mainz University, 2017.
- Theodore H. Ashford Fellowship for the Sciences, Harvard GSAS, 2017-22.
- Peirce Fellowship, Harvard Physics, 2017-19.
- Kieval Prize in Physics for Outstanding Senior, Cornell Physics, 2017.
- Hunter R. Rawlings III Cornell Presidential Research Scholars, 2015-16.

## PREVIOUS RESEARCH EXPERIENCE

**2017-22** **Graduate Student Research Associate and NSF Graduate Fellow,** Physics Department, Harvard University, Cambridge, MA.
Faculty Advisor: Matthew Reece, Professor.

**2016-17** **Research Assistant,** NA62 Experiment, CERN, Geneva, Switzerland.
Faculty Advisor: Babette Döbrich, Tommaso Spadaro.

**2014-16** **Undergrad Research Assistant,** Physics Department and PADME Experiment, Cornell University, Ithaca, NY. Faculty Advisors: James Alexander and Maxim Perelstein.

## PROFESSIONAL SERVICE

- Contributor to Muon Collider white papers and collaboration, US and Europe-based.
- Contributor to *BSM physics at the LHC* white papers.
- Contributor to several LOIs, white papers, and speaker at Snowmass 2021.
- Participant in 2023 P5 Town halls.
- Reviewer for JHEP, EJPC, and Phys Letters B

## PUBLICATIONS *(Alphabetical Author Ordering)*

**[14]** A. Alenezi, **C. Cesarotti**, S. Gori, J. Shelton
*Discovery Prospects for a Minimal Dark Matter Model at Cosmic and Intensity Frontier Experiments.*
ArXiv: 2504.00077.

**[13] C. Cesarotti**, M. LeBlanc
*A Field Guide to Event-Shape Observables using Optimal Transport*
ArXiv:2409.13150.

**[12] C. Cesarotti,** G. Krnjaic
*Hitting the Thermal Target for Leptophilic Dark Matter*
ArXiv:2404.02906.

**[11] C. Cesarotti**, Y. Kahn, G. Krnjaic, D. Rocha, J. Spitz
*New $\mu$ Forces from $\upsilon_\mu$ Sources*
PRD 110 (2024) 5, 055032, ArXiv:2311.10829.

**[10] C. Cesarotti**, R. Gambhir
*The New Physics Case for Beam-Dump Experiments with Accelerated Muon Beams*
JHEP 05 (2024) 283. ArXiv:2310.16110.

**[9]** ATLAS Collaboration (including **C. Cesarotti** as short-term associate)
*Measurements of multijet event isotropies using optimal transport with the ATLAS detector*
JHEP 10 (2023) 060. ArXiv:2305.16930.

**[8]** P. Asadi, **C. Cesarotti**, K. Fraser, S. Homiller, A. Parikh
*Oblique Lessons from the W Mass Measurement at CDF II*
PRD 108 (2023) 5, 055026. ArXiv: 2204.05283.

**[7] C. Cesarotti**, S. Homiller, R. Mishra, M. Reece
*Probing New Gauge Forces with a High-Energy Muon Beam Dump*
PRL 130.071803. ArXiv: 2202.12302

**[6]** P. Asadi, R. Capdevilla, **C. Cesarotti**, S. Homiller
*Searching for Leptoquarks at Future Muon Colliders*
JHEP 10 (2021) 182. ArXiv: 2104.05720.

**[5] C. Cesarotti,** M. Reece, M. Strassler
*The Efficacy of Event Isotropy as an Event Shape Observable*.
JHEP 07 (2021) 215. ArXiv: 2011.06599.

**[4] C. Cesarotti,** M. Reece, M. Strassler
*Spheres to Jets: Tuning Event Shapes with 5d Simplified Models.*
JHEP 05 (2021) 096. ArXiv: 2009.08981

**[3] C. Cesarotti,** J. Thaler
*A Robust Measure of Event Isotropy at Colliders.*
JHEP 08 (2020) 084. ArXiv:2004.06125

**[2] C. Cesarotti,** Y. Soreq, M. Strassler, J. Thaler, W. Xue
*Searching in CMS Open Data for Dimuon Resonance with Substantial Transverse Momentum.*
Phys Rev D 100 (2019) 1, 015021. ArXiv:1902.04222

**[1] C. Cesarotti,** Q. Lu, Y. Nakai, A. Parikh, M. Reece
*Interpreting the Electron EDM Constraint*.
JHEP 05 (2019) 059. ArXiv:1810.07736

## SELECT COMMUNITY PUBLICATIONS

**[3]** ***Towards a muon collider***. Eur. Phys. J.C 83 (2023) 9, 864. ArXiv: 2303.08533.

**[2]** ***Muon Collider Physics Summary***. Snowmass 2021. ArXiv:2203.07256.

**[1]** Warped Compactifications in Particle Physics, Cosmology, and Quantum Gravity. Snowmass 2021. ArXiv:2203.07533.

## TALKS AND CONFERENCES

**Invited Talks (*** indicates colloquium or plenary**)**

**[84]** ***Physics Potential of Future Colliders****
Invisibles25 Workshop, CERN.

**[83]** ***Theory at Muon Colliders****
The Frontier of Particle Physics: Exploring Muons, Quantum Science, and the Cosmos, YITP, 6/15/25

**[82]** ***Theory at Future Muon Colliders: Cross-Pollination Talk****
IMCC & MuCol Collaboration Meeting, DESY, 5/12/25

**[81]** ***BSM At Future Colliders***
LHCP 2025, Taipei, Future Projects, 5/9/25

**[76-80]** ***No Stone Unturned: A Comprehensive Approach to New Physics Searches at Colliders****
UB Physics Colloquium, UB 2/13/25 – SITP Colloquium, Stanford 2/24/25 – SLAC Colloquium, SLAC 2/26/25 – IAS Theory Seminar, IAS 3/14/25

**[76] Leona Woods Colloquium:** ***Physics Potential at a Future Muon Collider****
BNL Physics Colloquium, BNL 10/17/24

**[72-75]** ***Hitting the Leptophilic Dark Matter Target with Future Colliders***
Brown University Theory Seminar 10/23/24 – Boston University Theory Seminar 11/08/24 – BNL Theory Seminar, BNL 12/05/24

**[71]** ***Physics Potential at a Future Muon Collider****
University of California Physics Colloquium, Irvine 10/17/24

**[70]** ***Hitting the Leptophilic Dark Matter Target***
ECFA3 10/9/24

**[69]** ***Physics Vision for Linear ee Colliders****
Cool Copper Collider Workshop 10/7/24

**[68]** ***Dark Matter at Future Colliders****
LFC24 9/20/24

**[57-67]** ***Physics Potential at a Future Muon Collider (Seminar)***
Scuola Normale Superiore Seminar 1/16/24 – University of Minnesota Theory Seminar 2/2/24 – Aspen Center for Physics 3/28/24 – University of Michigan 4/10/24 – University of Chicago Particle Colloquium 4/15/24 – Argonne 4/16/24 – Fermilab 4/18/24 – Northwestern 4/22/24 – University of Illinois Urbana-Champaign 4/26/24 – University of Wisconsin 4/29/24 – Princeton University 5/05/24

**[55, 56]** ***Wishlist from the Physics Side****
MDI IMCC Workshop 3/11/24 – IMCC Annual Meeting Highlight Talk 3/15/24

**[52-54]** ***A Field Guide for Event Isotropy***
University of Pisa 1/18/24 –MIT Theory Seminar 02/26/24 -- Harvard University Theory Seminar 02/29/24

**[51]** ***Physics Prospects of High-Energy Future Colliders****
Higgs 2023 Conference 12/1/23

**[50]** ***Physics with Low Energy Muon Beams***
PITT PACC Muon Collider Workshop 11/17/23

**[44-49]** ***The Case for a Future Muon Collider***
IPNS Workshop on Muon Acceleration and Future Colliders 11/2/23 – KEK-PH2023 Workshop 11/7/23 – Cornell Theory Seminar 10/18/23 – Boston University Seminar 9/14/23 – CERN Special Seminar 6/30/23

**[43]** ***KITP Muon Collider Rapid Response Summary****
IMCC Meeting 6/22/23

**[37 -42]** ***Physics Potential at Future Muon Colliders & Demonstrator Facilities***
IMCC Meeting 6/20/23 – IAS Amplitudes Seminar 3/28/23 – Simons Center Workshop 3/22/23 – KITP Rapid Response 3/1/23 – IMCC Meeting 10/12/22 –
Snowmass Summer Study 7/21/22

**[26-36]** ***Probing New Gauge Forces at Muon Collider Beam Dumps***
Yale Seminar 11/8/22 – YITP Seminar 10/20/22 – UC Irvine Seminar 4/20/22 – UMD 3/7/22 – McGill Seminar 2/14/22 – University of Washington 12/7/21 – BSM PANDEMIC 12/7/21 – Caltech Seminar 11/15/21 – UC Berkeley 11/10/21 – MIT Seminar 10/1/21 – Perimeter Institute 7/6/21

**[24-25]** ***Oblique Lessons from the W Mass Measurement at CDFII***
NYU CCPP Seminar 9/28/22 – Harvard CMSA Seminar 5/12/22

**[18-23]** ***Searching for New Physics at Colliders with Event Shape Observables***
FCC Physics Workshop 2/9/22 – Harvard LPPC Seminar 12/14/21 – University of Tennessee 9/22/21 – FCC Physics Workshop 11/10/20 – MIT Seminar 11/6/20 – FCCee Webinar 7/27/20

**[16-17]** ***Leptoquarks at Future Muon Colliders***
Snowmass Workshop (EF08-EF09) 9/1/21 – MIT Seminar 4/2/21

**[15] Panelist:** ***Future Directions***
BOOST 2021 Workshop 8/5/21

**[14]** ***Global Searches for New Physics Based on Novel Event Characteristics***
9th Large Hadron Collider Physics Conference 6/7/21

**[13] Discussion leader:** ***Dark Showers***
Searches for long-lived particles at the LHC: 9th LLP workshop 5/27/21

**[12]** ***Interpreting the Electron EDM Constraint***
Harvard ATLAS Group Meeting 2/18/21

**[11]** ***The Efficacy of Event Isotropy at Colliders***
MIT Seminar 5/1/20

**[8-10]** ***A New Measure of Event Isotropy at Colliders***
LLP at LHC Workshop 11/17/20 – LLP at LHC Workshop 5/26/20 – MIT Seminar 12/6/19

**[7] 24/7 Lecturer:** ***The LHC***
The 29th First Annual Ig Nobel Prize Ceremony (Outreach) 9/13/19

**[6]** ***Symmetry in Art and Nature***
Science in the News: DayCon 2019, The Art of Science (Outreach) 6/15/19

**[3-5]** ***Searching in CMS Open Data for Dimuon Resonances with Transverse Momentum***
Cornell University Seminar 5/3/19 – MIT Seminar 12/7/18 – Snowmass Computational Frontier Workshop 8/11/20

**[2]** ***Dark QCD: Jets vs. SUEPs***
Searches for long-lived particles at the LHC: 2nd LLP workshop 8/20/17

**[1]** ***The MMAPS proposal at Cornell***
Light Dark Matter Conference 2017 5/27/17

**Submitted Talks**

**[15]** ***Event Shapes of High Multiplicity Jets***
BOOST 2024 Conference 8/01/24

**[14]** ***A Field Guide for Event Isotropy***
BOOST 2023 Conference 8/02/23

**[13]** ***Physics on the Way to 10 TeV***
P5 BNL Town Hall 4/13/23

**[12]** ***Oblique Lessons from the W Mass Measurement at CDFII***
14th International Conference on the Identification of Dark Matter 7/21/22

**[10-11]** ***Searching for New Physics at Muon Colliders***
Harvard Particle Physics Lunch Seminar (Internal) 10/20/21 –
Phenomenology 2021 Symposium 5/26/21

**[9]** ***Searching for Vector Leptoquarks***
Harvard Lunch Seminar (Internal) 7/31/21

**[7-8]** ***A Robust Measure of Event Isotropy at Colliders***
BOOST Workshop Virtual Poster 7/24/20 – Phenomenology 2020 Symposium 5/4/20

**[5-6]** ***The Efficacy of Event Isotropy at Colliders***
Harvard Particle Physics Lunch Seminar (Internal) 7/14/20 –
Harvard Lunch Seminar (Internal) 4/15/20

**[4]** ***A New Measure of Event Isotropy at Colliders***
Harvard Lunch Seminar (Internal) 11/13/19

**[2-3]** ***Searching in CMS Open Data for Dimuon Resonances with Transverse Momentum***
Phenomenology 2019 Symposium 5/7/29 – GGI Winter School Seminar 1/23/19 –
Harvard Lunch Seminar (Internal) 10/10/18

**[1]** ***SUEPs to Jets: A Toy Model for New Physics at the LHC***
Harvard Particle Physics Lunch Seminar (Internal) 3/21/18

## MENTORSHIP & TEACHING

**MIT Research Science Institute (RSI) Summer Program Advisor**
Co-advised rising college student Damian Musk during a month-long research program with Prof. Mike Williams on study of sensitivity to invisible Higgs decays at muon colliders.

**Research Group Responsibilities**
- Co-advisor of graduate students Rikab Gambhir, Sam Alipour-Fard, and Sean Benevedes (MIT)
- Organizer of the pheno group meeting and journal club at MIT (2022-23)

**Teaching Assistant**

Responsibilities included writing homework solutions, grading, and holding office hours.

- *Graduate Standard Model*. Spring 2019 (taught by Matthew Reece), Harvard University.
- *Physics Foundations.* Summer 2021 and Winter 2022, Harvard University. Course responsibilities shared.

**Harvard Summer School Instructor**

Responsibilities included writing and delivering 30 hours of lectures per class, developing and grading homework, writing student assessments.

- *Fundamentals of Particle Physics*. Summer 2018-21, Harvard University.
- *F=ma*: *Fundamentals of Physics*. Summer 2019 and 2021, Harvard University.

**Lumiere Education Mentor**

Responsibilities include mentoring high school students on a short term research-like project. Students produce literature review or small-scale publication over 12-week timeline.

## OUTREACH

- ***Mindscape*** Podcast with Sean Carroll. *Next Generation of Particle Experiments.* 2024.
- ***Waves in an Impossible Sea*****:** Illustrator of science novel by Matthew Strassler. 2024.
- ***Starts with a Bang*** Podcast with Ethan Siegel. Episode 108–*A Future Particle Collider*. 2024.
- ***Why This Universe?*** Podcast with Dan Hooper. Episode 65 – *Should we build a muon collider?* 2023.
- **Muon Collider Twitter (@MuonCollider)**: Manager & owner, science communication regarding a future muon collider through twitter, 2022-
- **IAIFI Twitter (@IAIFI_news)**: Manager, science communication and information platform for IAIFI related events, 2023-, MIT
- **MIT Link K-12**: Volunteer with program at MIT where researchers visit local K-12 schools to discuss research and science, 2023-, MIT
- **Harvard College Women in STEM Mentorship Program:** Mentored undergraduate women in physics, 2017-2020, Harvard University.
- **Women in Physics at Harvard Co-President:** Organized events for the WiP and physics department in general, 2018-2019, Harvard University.
- **Equity and Inclusion Committee:** Served as co-chair with Prof. Jenny Hoffman on Retention & Recruitment, 2017-2019, Harvard University.
- **Science in the News:** Wrote monthly articles and delivered public colloquia about science topics, 2017-19, Harvard University.
- **March for Science Geneva:** Organizer for the March for Science, April 2017, Geneva, Switzerland.
- **Expand Your Horizons:** Performed physics demonstrations for young women interested in STEM, 2014-16, Cornell University, Ithaca, NY.
- **GIAC After School Program:** Created physics lectures and hands-on activities for weekly 2 hour afterschool program of underrepresented minority students, Fall 2015, Ithaca, NY.