

# Adam Coogan

## Curriculum vitae

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<b>Work experience</b>	<b>GRAPPA, University of Amsterdam</b> , Amsterdam, The Netherlands Postdoctoral Researcher, October 2018 — present eTEC-BIG postdoc ( <a href="#">DarkGenerators project</a> , PI: Christoph Weniger), 2021 — present Supervisors: Gianfranco Bertone and Christoph Weniger
<b>Education</b>	<b>University of California Santa Cruz</b> , Santa Cruz, CA, USA Ph.D., Physics, September 2012 — August 2018 M.S., Physics, March 2014 Advisor: Stefano Profumo  <b>Brown University</b> , Providence, RI, USA Sc. B. <i>magna cum laude</i> with honors, Mathematical Physics, May 2012
<b>Research interests</b>	Dark matter, theoretical astrophysics and cosmology, gravitational waves, strong gravitational lensing, machine learning
<b>Publications</b> ( <a href="#">list online</a> )	Ten publications (eight peer-reviewed), one conference contribution (accepted) and one non-physics peer-reviewed publication. <i>See publication list for details.</i>
<b>Presentations</b>	GRAPPA Colloquium, University of Amsterdam, June 2021 <i>New inference techniques for unveiling dark matter substructure in strong gravitational lenses</i> (invited talk)  American Physical Society April Meeting, April 2021 <a href="#">Targeted Likelihood-Free Inference of Dark Matter Substructure in Strongly-Lensed Galaxies</a> (talk)  NeurIPS <i>Machine Learning and the Physical Sciences</i> workshop, December 2020 <a href="#">Targeted Likelihood-Free Inference of Dark Matter Substructure in Strongly-Lensed Galaxies</a> (poster)  TeV Particle Astrophysics (TeVPA), University of Sydney, December 2019 <a href="#">Primordial Black Holes as Silver Bullets for New Physics at the Weak Scale</a> (talk)  TeV Particle Astrophysics (TeVPA), University of Sydney, December 2019 <a href="#">Differentiable Strong Lensing: Uniting Gravity and Neural Nets through Differentiable Probabilistic Programming</a> (poster)  Light Antinuclei as a Probe for New Physics, Lorentz Center, October 2019 <a href="#">Primordial black holes as a probe for new physics</a> (invited talk)  Paris–Amsterdam–London–Stockholm meeting, Sorbonne University, September 2019 <a href="#">Primordial Black Holes as Silver Bullets for New Physics at the Weak Scale</a> (talk)  Matera Oscura, Matera, September 2019 <a href="#">Deep Lensing: Uniting Gravity and Neural Nets through Differentiable Programming</a> (poster)

Accelerating the Search for Dark Matter with Machine Learning, Trieste, April 2019  
[Strong Gravitational Lensing and ML: Generative Models for Galaxies](#) (talk)

[American Geophysical Union Fall Meeting](#), December 2017

*A Gap-Filling Procedure for Hydrologic Data Based on Kalman Filtering and Expectation Maximization: Application to Data from the Wireless Sensor Networks of the Sierra Nevada* (poster)

Supersymmetry and Unification of Fundamental Interactions (SUSY), University of Melbourne, July 2016

[Indirect Detection of Sub-GeV Dark Matter](#) (talk)

Supersymmetry and Unification of Fundamental Interactions (SUSY), Lake Tahoe, August 2015

[Monochromatic Gamma Rays from Dark Matter Annihilation to Leptons](#) (talk)

## Supervision

Daily supervision of GRAPPA Ph.D. student Noemi Anau Montel (strong lensing, machine learning, dark matter substructure)

Daily supervision of GRAPPA bachelors student Jesse Franzua (strong lensing, machine learning, dark matter substructure)

Capstone project supervisor for Amsterdam University College bachelor's student Pieter Parlevliet (microlensing constraints on clustered primordial black holes)

Worked closely with UC Santa Cruz Ph.D. students [Benjamin V. Lehmann](#) and [Logan Morrison](#) and GRAPPA masters student/SISSA Ph.D. student [Konstantin Karchev](#)

## Teaching

[GRAPPA Student Seminar](#) for first-year masters students (four weeks; literature overview lectures; University of Amsterdam, 2020)

[GRAPPA Student Seminar](#) for first-year masters students (one week; introductory dark matter lecture & programming project supervision; [course materials](#); University of Amsterdam, 2019)

Teaching assistant for 13 undergraduate courses, including Introduction to Physics, Mathematical Methods in Physics and General Relativity (UC Santa Cruz, 2012 —2016)

## Organization experience

[Weekly journal club](#), GRAPPA, fall 2019 —summer 2020

Head of organizing committee for [Gravitational Wave Probes of Fundamental Physics \(GW4FP\)](#), Amsterdam, November 2019

Graduate student organizer for particle theory faculty search, UC Santa Cruz, 2017

## Technologies

*Languages & software:* python (including [numpy](#), [scipy](#), [pytorch](#), [pyro](#), [keops](#), [matplotlib](#)), [Julia](#), Mathematica, C++, Java, L<sup>A</sup>T<sub>E</sub>X, Git, Javascript (including [React](#) with hooks), HTML & CSS, [Firebase](#), [Figma](#)

## Awards

Koret Scholar Mentor, UC Santa Cruz, 2018

ARCS Foundation Scholar Award, ARCS Northern California Chapter, 2015—2016

Elmer A. Fridley Scholarship in the Physical Sciences, UC Santa Cruz, 2015

Outstanding Teaching Assistant Award, UC Santa Cruz, 2015

Elmer A. Fridley Scholarship in the Physical Sciences, UC Santa Cruz, 2014 Regents Fellowship, UC Santa Cruz, 2012—2013

Undergraduate Teaching and Research Award, Brown University, 2011

Rhode Island Space Grant, Brown University, 2010

Undergraduate Teaching and Research Award, Brown University, 2009

**Press**

[New possibilities for detecting Hawking radiation emitted by primordial black holes](#)

Ingrid Fadelli, Phys.org

Based on [Coogan, Morrison & Profumo, PRL 126, 171101 \(2021\)](#)



**Other**

Member of the GRAPPA Diversity, Equity and Inclusion Committee

Member of the Laser Interferometer Space Antenna (LISA) consortium

Co-creator of [Tasty Base](#), a recipe-sharing web application

Physics  
publications  
([online list](#))

12. *Strong-lensing source reconstruction with variationally optimised Gaussian processes*  
K. Karchev, **A. Coogan**, C. Weniger  
Submitted, [arXiv:2105.09465](#)
11. *Precision Gamma-Ray Constraints for Sub-GeV Dark Matter Models*  
**A. Coogan**, L. Morrison, S. Profumo  
Submitted, [arXiv:2104.06168](#)
10. *Hunting for Dark Matter and New Physics with (a) GECCO*  
**A. Coogan**, A. Moiseev, L. Morrison, S. Profumo  
Submitted, [arXiv:2101.10370](#)
9. *Direct Detection of Hawking Radiation from Asteroid-Mass Primordial Black Holes*  
**A. Coogan**, L. Morrison, S. Profumo  
Phys. Rev. Lett. **126**, 171101 (2021), [arXiv:2010.04797](#)
8. *Targeted Likelihood-Free Inference of Dark Matter Substructure in Strongly-Lensed Galaxies*  
**A. Coogan**, K. Karchev, C. Weniger  
Machine Learning and the Physical Sciences workshop at NeurIPS 2020,  
[arXiv:2010.07032](#)
7. *Differentiable Strong Lensing: Uniting Gravity and Neural Nets through Differentiable Probabilistic Programming*  
M. Chianese, **A. Coogan**, P. Hofma, S. Otten, C. Weniger  
MNRAS **496** (2020) 1, 381-393, [arXiv:1910.06157](#)
6. *Hazma: A Python Toolkit for Studying Indirect Detection of Sub-GeV Dark Matter*  
**A. Coogan**, L. Morrison, S. Profumo  
JCAP **01** (2020) no.01, 56, [arXiv:1907.11846 \[hep-ph\]](#). Code: 
5. *Primordial Black Holes as Silver Bullets for New Physics at the Weak Scale*  
G. Bertone, **A. Coogan**, D. Gaggero, B. J. Kavanagh, C. Weniger  
Phys. Rev. D **100**, 123013 (2019), [arXiv:1905.01238 \[hep-ph\]](#). Code: 
4. *Connecting direct and indirect detection with a dark spike in the cosmic-ray electron spectrum*  
**A. Coogan**, B. Lehmann, S. Profumo  
JCAP **10** (2019) 063, [arXiv:1903.07177 \[astro-ph.HE\]](#)
3. *Origin of the tentative AMS antihelium events*  
**A. Coogan**, S. Profumo  
Phys. Rev. D **96**, 083020 (2017), [arXiv:1705.09664 \[astro-ph.HE\]](#)
2. *Monochromatic Gamma Rays from Dark Matter Annihilation to Leptons*  
**A. Coogan**, S. Profumo, W. Shepherd  
JHEP **1508** (2015) 074, [arXiv:1504.05187 \[hep-ph\]](#)
1. *Antihelium from Dark Matter*  
E. Carlson, **A. Coogan**, S. Profumo, A. Ibarra, S. Wild  
Phys. Rev. D **89** 076005 (2014), [arXiv:1401.2461 \[hep-ph\]](#)

Non-physics  
publications

1. *Gap-filling snow-depth time-series with Kalman Filtering-Smoothing and Expectation Maximization: Proof of concept using spatially dense wireless-sensor-network data*  
F. Avanzi, Z. Zheng, **A. Coogan**, R. Rice, R. Akella, M. H. Conklin  
Cold Regions Science and Technology, volume 175, July 2020, 103066,  
<https://doi.org/10.1016/j.coldregions.2020.103066>