Adam Coogan

Curriculum vitae

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Work experience

GRAPPA, University of Amsterdam, Amsterdam, The Netherlands
Postdoctoral Researcher, October 2018 — present
eTEC-BIG postdoc (DarkGenerators project, PI: Christoph Weniger), 2021 — present
Supervisors: Gianfranco Bertone and Christoph Weniger

Education

University of California Santa Cruz, Santa Cruz, CA, USA
Ph.D., Physics, September 2012 —August 2018
M.S., Physics, March 2014
Advisor: Stefano Profumo

Brown University, Providence, RI, USA
Sc. B. *magna cum laude* with honors, Mathematical Physics, May 2012

Research interests

I currently focus on testing basic assumptions about dark matter using astrophysical data and developing machine learning-based tools to solve the associated high-dimensional statistical problems. My broad research interests include dark matter, theoretical astrophysics and cosmology, gravitational waves, strong gravitational lensing and machine learning.

Publications (list online)

12 publications (nine peer-reviewed), one conference publication and one non-physics peer-reviewed publication. *See publication list for details.*

Presentations

European Physical Society conference on high energy physics, July 2021
Measuring the dark matter environments of black hole binaries with gravitational waves (talk

UK National Astronomy Meeting: *Holding a Lens to Dark Matter Substructure* parallel session, July 2021
Precision searches for subhalos in strong lensing images with targeted inference networks (poster)

GRAPPA Colloquium, University of Amsterdam, June 2021
New inference techniques for unveiling dark matter substructure in strong gravitational lenses (invited talk)

American Physical Society April Meeting, April 2021
Targeted Likelihood-Free Inference of Dark Matter Substructure in Strongly-Lensed Galaxies (talk)

NeurIPS *Machine Learning and the Physical Sciences* workshop, December 2020
Targeted Likelihood-Free Inference of Dark Matter Substructure in Strongly-Lensed Galaxies (poster)

TeV Particle Astrophysics (TeVPA), University of Sydney, December 2019
Primordial Black Holes as Silver Bullets for New Physics at the Weak Scale (talk)

TeV Particle Astrophysics (TeVPA), University of Sydney, December 2019
Differentiable Strong Lensing: Uniting Gravity and Neural Nets through Differentiable Probabilistic Programming (poster)

Light Antinuclei as a Probe for New Physics, Lorentz Center, October 2019
Primordial black holes as a probe for new physics (invited talk)

Paris–Amsterdam–London–Stockholm meeting, Sorbonne University, September 2019
Primordial Black Holes as Silver Bullets for New Physics at the Weak Scale (talk)

Matera Oscura, Matera, September 2019
Deep Lensing: Uniting Gravity and Neural Nets through Differentiable Programming (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 superviser 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, LaTeX, 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)

13. *Measuring the dark matter environments of black hole binaries with gravitational waves*
A. Coogan, G. Bertone, D. Gaggero, B. J. Kavanagh, D. A. Nichols
Submitted, arXiv:2108.04154

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, JCAP **01** (2020) no.01, 56, 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