

Ciaran A. J. O'Hare

Curriculum Vitae

School of Physics, University of Sydney
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📄 cajoha.re

🐦 [cajohare](https://twitter.com/cajohare)

🌐 cajohare

Academic history

- 2019 **Postdoctoral Research Associate**, *School of Physics*, University of Sydney, Australia.
Supervisor: Celine Boehm
- 2017–2019 **Postdoctoral Researcher**, *Departamento de Física Teórica*, Universidad de Zaragoza, España.
Supervisor: Javier Redondo

Education

- 2013–2017 **PhD Physics**, *Particle Cosmology group*, University of Nottingham, United Kingdom.
Supervisor: Anne Green
Thesis: [WIMPs, neutrinos and axions in the next generation of dark matter experiment](#)
- 2009–2013 **Msci Physics**, University of Nottingham, 1st class (average: 92%).
Supervisor: Adam Moss
Thesis: [Dynamics of domain wall systems](#)

Talks

Slides for the majority of my talks are available online at cajoha.re/talks

Invited seminars

- 2021 **SLAC**, 'The status and future of directional recoil detection'.
- 2021 **Fermilab**, 'Directional dark matter detection and the CYGNUS project'.
- 2021 **UCLA**, 'Directional dark matter detection'.
- 2021 **Sydney CPPC**, 'Dark matter detection off the beaten path'.
- 2020 **Australian National University**, 'Directional dark matter detection'.
- 2020 **University of New South Wales**, 'Axions and their detection'.
- 2019 **University of Barcelona**, 'Axtronomy'.
- 2019 **University of Sydney**, 'Dark matter detection'.
- 2019 **IFT, Madrid**, 'Gaia and direct dark matter detection'.
- 2019 **Laboratori Nazionali di Frascati**, 'Introduction to directional detection'.
- 2018 **Texas A&M University**, 'How to build an axion observatory'.
- 2018 **Max Planck Institute, Munich**, 'Axiostronomy'.
- 2017 **King's College London**, 'Directly detecting the Milky Way halo'.

Invited presentations

- 2021 **Theory Workshop, DESY**.
'Directional dark matter detection'
- 2021 **ARC CoE for Dark Matter Fortnightly Meeting, Virtual**.
'Dark photon limits: A cookbook'
- 2021 **Asian Forum for Accelerators and Detectors, Novosibirsk (Virtual)**.
'Directional dark matter detection and the Cygnus experiment'
- 2021 **ARC CoE for Dark Matter ECR Workshop, Virtual**.
'The Cygnus experiment'

- 2021 **Axions beyond Gen-2**, *University of Washington (Virtual)*.
'Axion haloscopes and the local dark matter distribution'
- 2020 **Light Dark World workshop**, *Virtual*.
'Axion constraints 2020'
- 2020 **Magnificent CEvNS workshop**, *Virtual*.
'Neutrino floors'
- 2020 **IAXO Collaboration Meeting**, *Virtual*.
'Axion helioscopes as solar magnetometers'
- 2020 **MIAPP Workshop on axion cosmology**, *Technical University of Munich*.
'Axion haloscopes and the local dark matter distribution'
- 2019 **Dark Matter Searches in the 2020s**, *Institute for Cosmic Ray Research, Tokyo*.
'Breaking through the neutrino floor'
- 2019 **Cygnus directional detection workshop**, *Sapienza University of Rome*.
'Physics case for the Cygnus experiment'
- 2019 **DMUK Meeting**, *Kings' College London*.
'*Gaia* and direct dark matter detection'
- 2019 **Saturnalia Workshop**, *Universidad de Zaragoza*.
'Dark Matter Hurricane'
- 2019 **CYGNUS workshop**, *University of Hawaii (Virtual)*.
'Physics reach for the Cygnus experiment'
- 2018 **MADMAX Collaboration Meeting**, *Max Planck Institute, Munich*.
'The axion velocity distribution'
- 2018 **Workshop on ultralight dark matter and axions**, *University of Michigan*.
'Directional axion detection'
- 2017 **Theoretical Physics Seminar**, *Universidad de Zaragoza*.
'Directly detecting the Milky Way halo'
- 2016 **IDM**, *University of Sheffield*.
'Dark matter detection and the neutrino floor'
- 2015 **11th Patras workshop on axions, WIMPs and WISPs**, *Universidad de Zaragoza*.
'Theoretical prospects for directional WIMP detection'

Other conference & workshop presentations

- 2019 **TeVPA**, *Sydney, Australia*.
'The Cygnus experiment'
- 2019 **15th Patras workshop on axions**, *Freiburg, Germany*.
'Direct detection and *Gaia*'
- 2018 **OAJ-LSC Synergies meeting**, *Universidad de Zaragoza*.
'*Gaia* and direct dark matter detection'
- 2018 **14th Patras workshop on axions**, *DESY, Germany*.
'Directional axion detection'
- 2017 **13th Patras workshop on axions**, *Thessaloniki, Greece*.
'Axion/WIMP astronomy in dark matter experiments'
- 2017 **IOP Joint APP and HEPP Conference**, *University of Sheffield*.
'Measuring the dark matter velocity distribution with WIMPs and axions'
- 2016 **TeVPA**, *CERN*.
'Dark matter detection and the neutrino floor'
- 2016 **LINK'16 Interdisciplinary conference**, *East Midlands Conference Centre*.
'Detecting Dark Matter'
- 2015 **DMUK**, *University of Liverpool*.
'Directional dark matter detection and the neutrino background'
- 2014 **BUSSTEPP**, *University of Southampton*.
'Directional detection of dark matter substructure'

Software

2021

DarkPhotonCookbook.

Code for accounting for daily modulation effects in direct searches for dark photons

2020

AxionLimits.

Library of astrophysical, cosmological and experimental constraints on axions and axion-like particles [Citations: 7]

2020

solax.

Likelihood-based data analysis code for axion helioscopes such as IAXO. Includes precise solar axion flux calculations which account for the solar magnetic field.

2020

AtmNuFloor.

Code for calculating the neutrino floor to direct dark matter experiments. It also allows for the inclusion of time, target and direction dependent methods for overcoming the neutrino floor.

2019

DarkShards.

Code for analysing *Gaia* data to fit velocity and action-space substructures, as well as generate their corresponding signals in dark matter experiments.

2019

IAXOmass.

Likelihood analysis code for measuring the axion mass in IAXO.

Other academic duties

2015

2021

Journal referee.

Journal of Cosmology and Astroparticle Physics (JCAP)
Physical Review Letters (PRL)
Physical Review D (PRD)
Astronomy & Astrophysics (A&A)

2020

2021

Sydney CPPC.

Organising a series of weekly online seminars and maintaining the [YouTube channel](#).

2020

2021

Dark Chatter.

Host and organiser of a [web-series](#) for the promotion of early career researchers.

2020

Snowmass 2021 Letter of Interest, *CYGNUS: A nuclear recoil observatory with directional sensitivity to dark matter and neutrinos.*

https://www.snowmass21.org/docs/files/summaries/CF/SNOWMASS21-CF1_CF0-NF10_NF4-IF5_IF4_Vahsen-189.pdf.

2020

Snowmass 2021 Letter of Interest, *Astrophysical signatures of the QCD axion and axion-like particles.*

https://www.snowmass21.org/docs/files/summaries/CF/SNOWMASS21-CF2_CF3-TF9_TF0-165.pdf.

2020

International advisory committee, *International Dark Matter conference*, Vienna, Austria.

<http://idm2020.hephy.at/>.

2018

Local organising committee, *4th MADMAX Collaboration Meeting*, Zaragoza, Spain.

<https://indico.mpp.mpg.de/event/6018/overview>.

2018

Local organising committee, *Probing the dark universe synergies workshop*, Zaragoza, Spain.

<https://riastronomia.es/en/probing-the-dark-universe-oaj-lsc-synergies/>.

Teaching and Supervision

The University of Sydney

2021

Physics Honours, Lattice simulations of axion cosmology.

(1 × 4th year student)

2021

Special Studies Program, Solar axions and their detection.

(2 × 2nd year students)

2021

Dalyell Showcase, Studying the structure with the stellar halo with *Gaia*.

(8 × 1st year students)

2020

Summer internship, Calculating event rates of supernova neutrinos in DUNE.

(1 × high school student)

2020

Physics Honours, Globular cluster dynamics with *Gaia*.

(1 × 4th year student)

2020

Special Studies Program, Geant4 simulations of a DNA-based particle detector.
(3 × 2nd year students)

University of Nottingham

2016
2017

MSci Project, Developing Monte Carlo simulations for dark matter detectors.
(2 × 4th year students)

2015
2016

MSci Project, Distinguishing neutrino and WIMP signals in dark matter detectors.
(2 × 4th year students)

2013
2016

2nd year Msci physics workshops, *University of Nottingham*,
Approximately 3 hr/wk of workshop instruction in four 2nd year Physics courses.

- Quantum mechanics
- Thermal Physics and Statistical Mechanics
- Vector calculus and electromagnetism
- Optics and Fourier analysis

Media

Articles written

2020

CERN Courier, *Astroparticle physicists head down under* .
<https://cerncourier.com/a/astroparticle-physicists-head-down-under/>

Media coverage

2021

Discover magazine, *How DNA can help in the search for dark matter* .
<https://www.discovermagazine.com/the-sciences/how-dna-can-help-the-search-for-dark-matter>

2020

AstroBites, *MACHOs Find a New Weight Class to Compete In* .
<https://astrobites.org/2020/09/08/machos-weight-class/>

My publication *O'Hare et al. 2018* was covered by 49 media outlets in 2018.

Altmetric score of 495 (top 5% of all research outputs): <https://aps.altmetric.com/details/45496963>

2018

CNN, *A dark matter hurricane is headed our way [sic]*.
<https://edition.cnn.com/2018/11/19/opinions/dark-matter-hurricane-headed-our-way-lincoln-opinion/index.html>

2018

Astronomy magazine, *A 'dark matter hurricane' is storming past Earth* .
<http://www.astronomy.com/news/2018/11/a-dark-matter-hurricane-is-storming-past-earth>

2018

Cosmos magazine, *Researchers brace for dark matter 'hurricane'* .
<https://cosmosmagazine.com/space/researchers-brace-for-dark-matter-hurricane>

2018

CNET, *Scientists predict a 'dark matter hurricane' will collide [sic] with the Earth* .
<https://www.cnet.com/news/scientists-predict-a-dark-matter-hurricane-will-collide-with-the-earth/>

2018

Discover Magazine, *A 'Dark Matter Hurricane'* .
<http://blogs.discovermagazine.com/d-brief/2018/11/12/dark-matter-hurricane/>

2018

Gizmodo Magazine, *So What's Going on With That 'Hurricane of Dark Matter?'* .
<https://gizmodo.com/so-whats-going-on-with-that-hurricane-of-dark-matter-1830420899>

Outreach

Aimed at the public

2020

Dark Matter Day, *Virtual*.
'The evidence for dark matter'

2018

Science Slam, *DESY, Hamburg*.
'On safari in the Milky Way'

2017

Pint of Science Festival, *Bunkers Hill pub, Nottingham*.
'The Cosmic Pint'

2017

Guest lecture, *Manchester Astronomy Society*.
'The Dark Side'

2015

TEDxUoN talk, *Portland Building, Nottingham*.
'Detecting Dark Matter'

2015

Pub.hD talk, *Vat and Fiddle pub, Nottingham*.
'Detecting Dark Matter'

Aimed at students

2021

PhySoc guest lecture, *University of Sydney*.
Lecture on 'Dark matter' aimed at Sydney undergraduates

2020

Sydney Physics Dialogues, *University of Sydney*.
Lecture on 'Dark matter' aimed at international undergraduates

2018

School visit, *Colegio Nuestra Señora del Pilar, Zaragoza*.
Aimed at 14-16 year old science and english students.

2017

School visit, *Chilwell school, Nottinghamshire*.
Aimed at students thinking of studying physics at university.

2015

2017

Sutton Trust Summer School.

An annual series of masterclasses and workshops for high school students. I was involved in the organisation of the physics branch of the school. I also lectured and led computer-based workshops on particle physics and astronomy.

2014

2017

Ambition Nottingham.

A series of programs at UoN aimed at local students from backgrounds under-represented at universities in the UK. I was heavily involved in the physics and astronomy 'course tasters' for the scheme as both an organiser and a lecturer.

2013

2017

University of Nottingham open days.

My roles involved guiding visitors around the School of Physics and giving information on research programs, undergraduate and postgraduate courses. I also ran drop-in sessions and demonstrations for the Particle Cosmology group.

I upload slides and other material related to my outreach at <https://cajoha.re/outreach>

Publications

Total citations: 1,090. Collected from the [inspireHEP](#) database

- O'Hare et al. 2021 **24.** '[Particle detection and tracking with DNA](#)'
C. A. J. O'Hare, Vassili G. Matsos, Joseph Newton, Karl Smith, Joel Hochstetter, Ravi Jaiswar, Wunna Kyaw, Aimee McNamara, Zdenka Kuncic, Sushma Nagaraja Grellscheid, and Céline Boehm
- Caputo et al. 2021 **23.** '[Dark photon limits: a cookbook](#)'
A. Caputo, C. A. J. O'Hare, A. Millar, E. Vitagliano
[Cited by 4 records, github page: <http://cajohare.github.io/DarkPhotonCookbook>]
- Vahsen et al. 2021 **22.** '[Directional recoil detection](#)'
S. Vahsen, C. A. J. O'Hare, D. Loomba
Annu. Rev. Nucl. Part. Sci. 2021. **71** 189–224
[Cited by 9 records]
- Boehm et al. 2021 **20.** '[Eliminating the LIGO bounds on primordial black hole dark matter](#)'
C. Boehm, A. Kobakhidze, C. A. J. O'Hare, Z. S. C. Picker, M. Sakellariadou
JCAP **03** 078 (2021)
[Cited by 23 records]
- Vahsen et al. 2020 **21.** '[CYGNUS: Feasibility of a nuclear recoil observatory with directional sensitivity to dark matter and neutrinos](#)'
S. Vahsen, C. A. J. O'Hare et al. (Submitted to PRD)
[Cited by 24 records]
- O'Hare & Vitagliano 2020 **19.** '[Cornering the axion with CP-violating interactions](#)'
C. A. J. O'Hare, E. Vitagliano
Phys. Rev. D **102**, 115026 (2020)
[Cited by 8 records, github page: <http://cajohare.github.io/AxionLimits>]
- O'Hare 2020 **18.** '[Can we overcome the neutrino floor at high masses?](#)'
C. A. J. O'Hare
Phys. Rev. D **102**, 063024 (2020)
[Cited by 14 records, github page: <http://github.com/cajohare/AtmNuFloor>]

- O'Hare et al. 2020b **17.** 'Axion helioscopes as solar magnetometers'
C. A. J. O'Hare, A. Caputo, A. J. Millar, E. Vitagliano
Phys. Rev. D **102**, 043019 (2020)
[Cited by 15 records, github page: <http://cajohare.github.io/solax>]
- O'Hare et al. 2020a **16.** 'Dark Shards: velocity substructure from *Gaia* and direct searches for dark matter'
C. A. J. O'Hare, N. W. Evans, C. McCabe, G. Myeong, V. Belokurov
Phys. Rev. D **101** (2020) no.2, 023006
[Cited by 27 records, github page: <http://cajohare.github.io/DarkShards>]
- Dafni et al. 2019 **15.** 'Weighing the Solar Axion'
T. Dafni, C. A. J. O'Hare, J. Galán, I. G. Irastorza, F. J. Iguaz, K. Jakovčić, B. Lakić, G. Luzón, J. Redondo, E. Ruiz Chóliz
Phys. Rev. D **99** 035037 (2019)
[Cited by 15 records, github page: <http://cajohare.github.io/IAXOmass>]
- Evans et al. 2019 **14.** 'SHM⁺⁺: A refinement of the Standard Halo Model for dark matter searches'
N. W. Evans, C. A. J. O'Hare, C. McCabe
Phys. Rev. D **99**, 023012 (2019)
[Cited by 73 records]
- O'Hare et al. 2018 **13.** 'A dark matter hurricane: measuring the S1 stream with dark matter detectors'¹
C. A. J. O'Hare, C. McCabe, N. W. Evans, G. Myeong, V. Belokurov
Phys. Rev. D **98**, 103006 (2018)
[Cited by 45 records]
- Knirck et al. 2018 **12.** 'Directional axion detection'
S. Knirck, A. Millar, C. A. J. O'Hare, J. Redondo, F. Steffen
JCAP **11** 051 (2018)
[Cited by 33 records]
- O'Hare & Burrage 2018 **11.** 'The symmetron field profile in the galactic disk'
C. A. J. O'Hare & C. Burrage
Phys. Rev. D **98** 064019 (2018)
[Cited by 14 records]
- O'Hare et al. 2017 **10.** 'Time-integrated directional detection of dark matter'
C. A. J. O'Hare, B. J. Kavanagh, A. M. Green
Phys. Rev. D **96**, 083011 (2017)
[Cited by 14 records]
- Battaglieri et al. 2017 **9.** 'US Cosmic Visions: New Ideas in Dark Matter 2017: Community Report'²
M. Battaglieri et al., FERMILAB-CONF-17-282-AE-PPD-T (2017)
[Cited by 420 records]
- O'Hare 2017 **8.** 'Terrestrial WIMP/Axion astronomy'
C. A. J. O'Hare
Contributed to the 13th Patras Workshop on Axions, WIMPs and WISPs, Thessaloniki
[Cited by 1 record]
- O'Hare & Green 2017 **7.** 'Axion astronomy with microwave cavity experiments'
C. A. J. O'Hare & A. M. Green
Phys. Rev. D **95** 063017 (2017)
[Cited by 41 records]
- Kavanagh & O'Hare 2017 **6.** 'Reconstructing the three-dimensional local dark matter velocity distribution'
B. J. Kavanagh & C. A. J. O'Hare
Phys. Rev. D **94**, 123009 (2016)
[Cited by 22 records]
- O'Hare 2016 **5.** 'Dark matter astrophysical uncertainties and the neutrino floor'
C. A. J. O'Hare
Phys. Rev. D **94**, 063527 (2016)
[Cited by 45 records]

- Mayet et al. 2016 **4.** ['A review of the discovery reach of directional Dark Matter detection'](#)³
F. Mayet, A. M. Green, J. B. R. Battat, J. Billard, N. Bozorgnia, G. B. Gelmini, P. Gondolo, B. J. Kavanagh, S. K. Lee, D. Loomba, J. Monroe, B. Morgan, C. A. J. O'Hare, A. H. G. Peter
Physics Reports **627** (2016) 1
[Cited by 142 records]
- O'Hare 2017 **3.** ['Theoretical prospects for directional WIMP detection'](#)
C. A. J. O'Hare
Contributed to the 11th Patras Workshop on Axions, WIMPs and WISPs, Zaragoza
- O'Hare et al. 2015 **2.** ['Readout strategies for directional detection beyond the neutrino background'](#)⁴
C. A. J. O'Hare, A. M. Green, J. Billard, E. Figueroa-Feliciano, L. E. Strigari
Phys. Rev. D **92**, 063518 (2015)
[Cited by 59 records]
- O'Hare & Green 2014 **1.** ['Directional detection of dark matter streams'](#)⁵
C. A. J. O'Hare & A. M. Green
Phys Rev. D **90**, 123511 (2014)
[Cited by 37 records]

¹ Selected as a highlighted article in [American Physical Society news](#)

² Contributed to as part of the CYGNUS collaboration

³ Selected as a highlighted article in [Physics Reports](#)

⁴ Contains figure selected for [PRD Kaleidoscope Sep 2015](#)

⁵ Contains figure selected for [PRD Kaleidoscope Dec 2014](#)