

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](https://cajohare.github.io)

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 talks

2021 **Lecture**, *Sydney*.

'Dark matter detection off the beaten path'

2021 **Axions beyond Gen-2**, *University of Washington (Virtual)*.

'Axion haloscopes and the local dark matter distribution'

2020 **Light Dark World**, *Virtual*.

'Axion constraints 2020'

2020 **Magnificent CEvNS**, *Virtual*.

'Neutrino floors'

2020 **Seminar**, *Australian National University*.

'Directional dark matter detection'

2020 **IAXO Collaboration Meeting**, *Virtual*.

'Axion helioscopes as solar magnetometers'

2020 **MIAPP Workshop on axion cosmology**, *Technical University of Munich, Germany*.

'Axion haloscopes and the local dark matter distribution'

2020 **Review lecture**, *UNSW, Sydney*.

'Axions and their detection'

2019 **Dark Matter Searches in the 2020s**, *Institute for Cosmic Ray Research, Tokyo*.

'Breaking through the neutrino floor'

2019 **Seminar**, *University of Sydney*.

'Dark matter detection'

2019 **Workshop on directional sub-GeV dark matter detection**, *Laboratori Nazionali di Frascati*.

'Introduction to directional detection'

2019 **Cygnus directional detection workshop**, *Sapienza University of Rome*.

'Physics case for the Cygnus experiment'

2019 **Seminar**, *University of Barcelona*.

'Axtronomy'

2019 **DMUK Meeting**, *Kings' College London*.

'Gaia and direct dark matter detection'

- 2019 **Theoretical Physics Seminar**, *Instituto de Física Teórica, Madrid*.
'*Gaia* and direct dark matter detection'
- 2019 **Saturnalia Workshop**, *Universidad de Zaragoza*.
'Dark Matter Hurricane'
- 2019 **Cygnus workshop**, *University of Hawaii (remote)*.
'Physics reach for the Cygnus experiment'
- 2018 **MADMAX Collaboration Meeting**, *Max Planck Institute, Munich*.
'The axion velocity distribution'
- 2018 **Mitchell Institute Seminar**, *Texas A&M University*.
'How to build an axion observatory'
- 2018 **Workshop on ultralight dark matter and axions**, *University of Michigan*.
'Directional axion detection'
- 2018 **Astroparticle Seminar**, *Max Planck Institute, Munich*.
'Axioastronomy'
- 2017 **Theoretical Physics Seminar**, *Universidad de Zaragoza*.
'Directly detecting the Milky Way halo'
- 2017 **Theoretical Physics Seminar**, *Kings' College London*.
'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'

Conferences & Workshops

- 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 HEP 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

I have been releasing code for all my papers since 2019 publicly via [github](#), in addition to several other tools which may be useful to the wider community such as:

2020

AxionLimits.

Library of astrophysical, cosmological and experimental constraints on axions and axion-like particles
DOI: [10.5281/zenodo.3932430](https://doi.org/10.5281/zenodo.3932430) [Citations: 2]

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.

DOI: [10.5281/zenodo.3997250](https://doi.org/10.5281/zenodo.3997250)

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.

DOI: [10.5281/zenodo.3997254](https://doi.org/10.5281/zenodo.3997254)

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.

DOI: [10.5281/zenodo.3372394](https://doi.org/10.5281/zenodo.3372394)

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

Sydney CPPC.

Running online seminars and maintaining the [YouTube channel](#).

2020

Dark Chatter.

Host and organiser of PhD research discussion series.

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

2020

2021

High School intership project, *University of Sydney*, 'Supernova neutrinos'.

2020

2021

International Masters Student, *University of Sydney*, 'Axion miniclusters'.

2020

2021

SSP Undergraduate Project Supervision, *University of Sydney*, 'Particle detection with DNA'.

2020

2021

Honours Project Supervision, *University of Sydney*, 'Probing dark matter with *Gaia*'.

2016

2017

MSci Project Supervision, *University of Nottingham*, 'Simulating the direct detection of dark matter'.

2015

2016

MSci Project Supervision, *University of Nottingham*, 'Distinguishing neutrino and WIMP signals in dark matter detection'.

2013

2016

2nd year Msci physics workshops, *University of Nottingham*,

Approximately three hours a week of workshop instruction in four 2nd year core modules.

- 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

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

2020

Sydney Physics Dialogues, *University of Sydney, Australia*.

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.

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>

Languages

English (native), Spanish (C1)

Publications

Total citations: 916. Collected from the [inspireHEP](#) database

- Vahsen et al. 2021 **22.** [‘Directional recoil detection’](#)
S. Vahsen, C. A. J. O’Hare, D. Loomba
Annual Reviews of Nuclear and Particle Science
[in press for 2021 issue]
- 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 6 records]
- Boehm et al. 2020 **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 (Submitted to JCAP)
[Cited by 13 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 3 records]
- 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 9 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 11 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 19 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 13 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 60 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 35 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 30 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 13 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 12 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 378 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 37 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 19 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 43 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, N. S. Phan, S. E. Vahsen
Physics Reports **627** (2016) 1
[Cited by 125 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 52 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 36 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](#)