

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 **Msc 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

2020

IAXO Collaboration Meeting, *DESY (virtually)*.

'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'
- 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 **IDM**, *University of Sheffield*.
'Dark matter detection and the neutrino floor'
- 2016 **LINK'16 Interdisciplinary conference**, *East Midlands Conference Centre*.
'Detecting Dark Matter'
- 2015 **11th Patras workshop on axions, WIMPs and WISPs**, *Universidad de Zaragoza*.
'Theoretical prospects for directional WIMP detection'
- 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**.
Widely used 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 webinar series.

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

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 internship 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

Awards

2017

DESY.

1st place science slam prize

2015

Tessella.

University of Nottingham Postgraduate Poster Competition

2013

University of Nottingham.

Salmon prize for top performance

2013

University of Nottingham.

Project prize for best final year research project thesis

Media

Articles written

2020

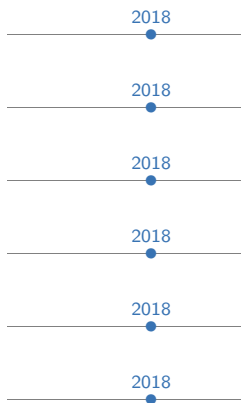
CERN Courier, *Astroparticle physicists head down under* .

<https://cerncourier.com/a/astroparticle-physicists-head-down-under/>

Media coverage

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>



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>

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>

Cosmos magazine, *Researchers brace for dark matter 'hurricane'* .

<https://cosmosmagazine.com/space/researchers-brace-for-dark-matter-hurricane>

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/>

Discover Magazine, *A 'Dark Matter Hurricane'* .

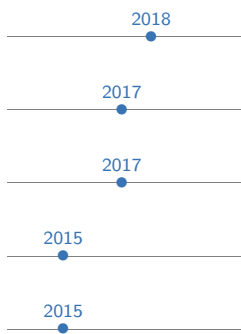
<http://blogs.discovermagazine.com/d-brief/2018/11/12/dark-matter-hurricane/>

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



Science Slam, *DESY, Hamburg*.

'On safari in the Milky Way'

Pint of Science festival, *Bunkers Hill pub, Nottingham*.

'The Cosmic Pint'

Guest lecture, *Manchester Astronomy Society*.

'The Dark Side'

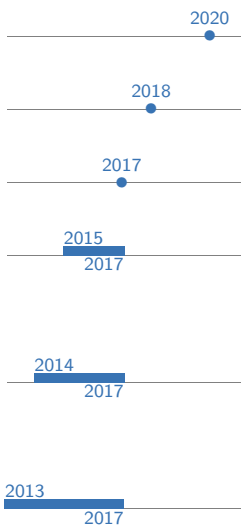
TEDxUoN talk, *Portland Building, Nottingham*.

'Detecting Dark Matter'

Pub.hD talk, *Vat and Fiddle pub, Nottingham*.

'Detecting Dark Matter'

Aimed at students



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

Lecture on 'Dark matter' aimed at international undergraduates

School visit, *Colegio Nuestra Señora del Pilar, Zaragoza*.

Aimed at 14-16 year old science and english students.

School visit, *Chilwell school, Nottinghamshire*.

Aimed at students thinking of studying physics at university.

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.

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 (working proficiency)

Publications

Total citations: 784. Collected from the [inspireHEP](#) database

- Vahsen et al. 2020 **20.** '[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)
- Bøehm et al. 2020 **19.** '[Eliminating the LIGO bounds on primordial black hole dark matter](#)'
C. Bøehm, A. Kobakhidze, C. A. J. O'Hare, Z. S. C. Picker, M. Sakellariadou (Submitted to PRL)
- O'Hare 2020 **18.** '[Can we overcome the neutrino floor at high masses?](#)'
C. A. J. O'Hare (Submitted to PRD)
[Cited by 5 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 8 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 15 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 9 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 50 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 29 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 26 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 12 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 9 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 334 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 33 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 18 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 42 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 113 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 45 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 33 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](#)