

# Ciaran A. J. O'Hare

## Curriculum Vitae

School of Physics, University of Sydney  
Physics Rd, Camperdown NSW 2006, Australia

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📄 [cajoha.re](http://cajoha.re)

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

🌐 [cajohare](https://cajohare)

## Academic history

- 2022 **ARC DECRA Fellow**, *School of Physics*, University of Sydney, Australia.
- 2019–2021 **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](http://cajoha.re/talks)

### Invited seminars

- 2021 **Georg-August-Universität Göttingen**, 'Venturing into the neutrino fog'.
- 2021 **UC San Diego**, 'ALPs to Axions: dark matter in the post-inflationary scenario'.
- 2021 **University of Nottingham**, 'Axions as dark matter'.
- 2021 **Tsung-Dao Lee Institute**, 'Venturing into the neutrino fog'.
- 2021 **Nanjing Normal University**, 'Venturing into the neutrino fog'.
- 2021 **Melbourne University**, 'Venturing into the neutrino fog'.
- 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

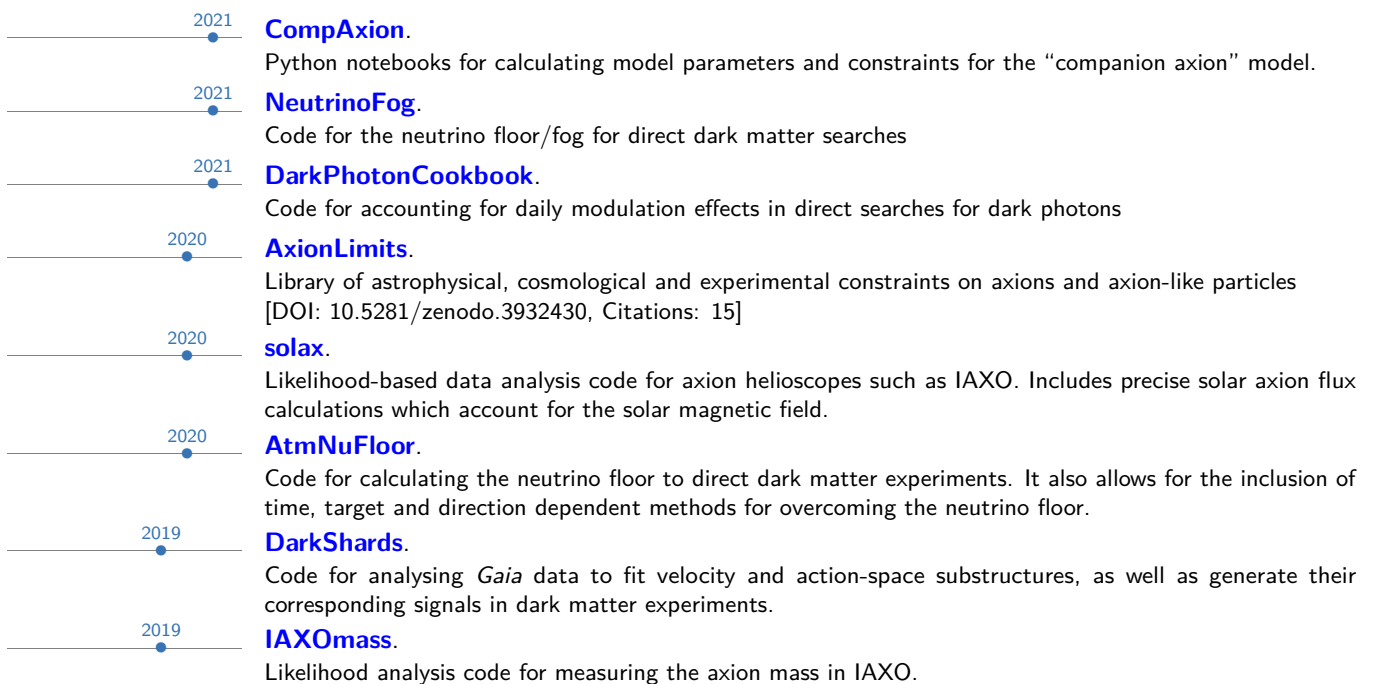
- 2021  
International Joint Workshop on the SM and Beyond 2021, NTHU, Taiwan.  
'Searching for the axions, on Earth and in space'
- 2021  
Theory Workshop, DESY.  
'Directional dark matter detection'
- 2021  
ARC CoE for Dark Matter Fortnightly Meeting, Virtual.  
'Dark photon limits: A cookbook'
- 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

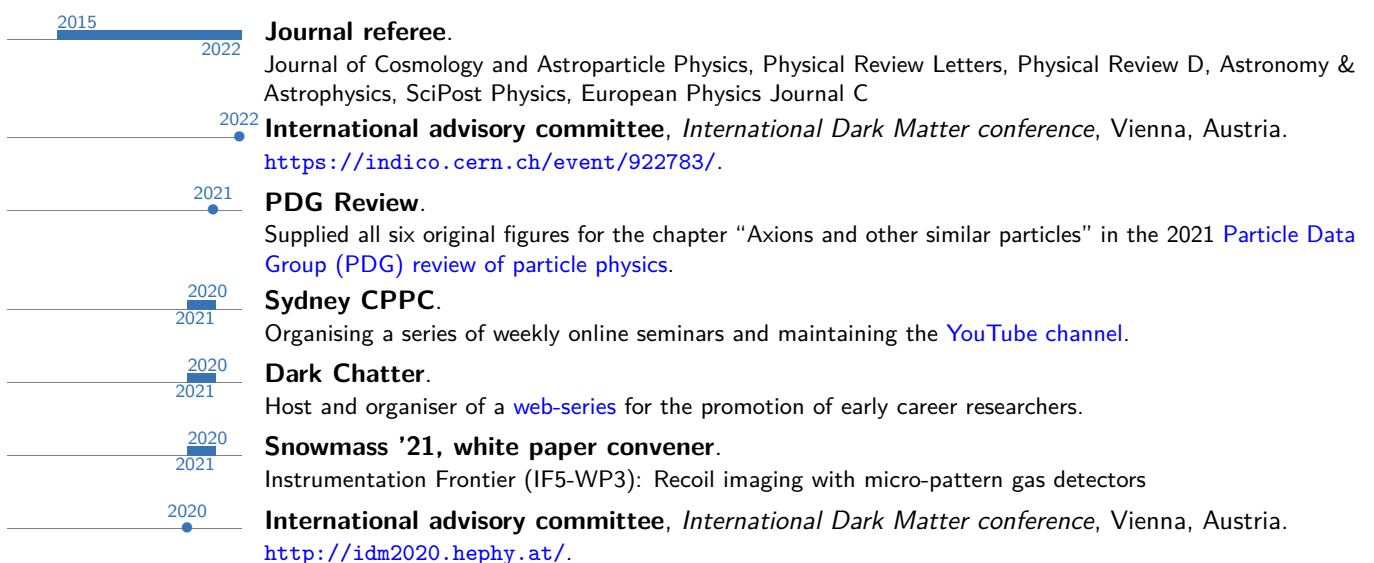
- 2021  
Asia-Pacific Workshop on Particle Physics and Cosmology, Virtual.  
'Searching for dark photons as dark matter'
- 2019  
TeVPA, Sydney, Australia.  
'The Cygnus experiment'
- 2019  
15th Patras workshop on axions, Freiburg, Germany.  
'Direct detection and Gaia'
- 2018  
OAJ-LSC Synergies meeting, Universidad de Zaragoza.  
'Gaia and direct dark matter detection'



## Code



## Other academic service



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

**Special Studies Program**, Solar axions.  
(2 × 2nd year students)

2021

**Special Studies Program**, Informing searches for dark matter with galaxy simulations.  
(2 × 2nd year students)

2021

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

2021

**Physics Honours**, Lattice simulations of axion cosmology.  
(1 × 4th year student)

2021

**Special Studies Program**, Solar chameleons.  
(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

**Centre of Excellence for Dark Matter Particle Physics**, *Meet the researcher*.  
<https://www.centredarkmatter.org/all-posts/meet-the-researcher-ciaran-ohare-htrjn-mjf82>

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	<p><b>CNN</b>, <i>A dark matter hurricane is headed our way [sic]</i>.  <a href="https://edition.cnn.com/2018/11/19/opinions/dark-matter-hurricane-headed-our-way-lincoln-opinion/index.html">https://edition.cnn.com/2018/11/19/opinions/dark-matter-hurricane-headed-our-way-lincoln-opinion/index.html</a></p>
2018	<p><b>Astronomy magazine</b>, <i>A 'dark matter hurricane' is storming past Earth</i> .  <a href="http://www.astronomy.com/news/2018/11/a-dark-matter-hurricane-is-storming-past-earth">http://www.astronomy.com/news/2018/11/a-dark-matter-hurricane-is-storming-past-earth</a></p>
2018	<p><b>Cosmos magazine</b>, <i>Researchers brace for dark matter 'hurricane'</i> .  <a href="https://cosmosmagazine.com/space/researchers-brace-for-dark-matter-hurricane">https://cosmosmagazine.com/space/researchers-brace-for-dark-matter-hurricane</a></p>
2018	<p><b>CNET</b>, <i>Scientists predict a 'dark matter hurricane' will collide [sic] with the Earth</i> .  <a href="https://www.cnet.com/news/scientists-predict-a-dark-matter-hurricane-will-collide-with-the-earth/">https://www.cnet.com/news/scientists-predict-a-dark-matter-hurricane-will-collide-with-the-earth/</a></p>
2018	<p><b>Discover Magazine</b>, <i>A 'Dark Matter Hurricane'</i> .  <a href="http://blogs.discovermagazine.com/d-brief/2018/11/12/dark-matter-hurricane/">http://blogs.discovermagazine.com/d-brief/2018/11/12/dark-matter-hurricane/</a></p>
2018	<p><b>Gizmodo Magazine</b>, <i>So What's Going on With That 'Hurricane of Dark Matter?'</i> .  <a href="https://gizmodo.com/so-whats-going-on-with-that-hurricane-of-dark-matter-1830420899">https://gizmodo.com/so-whats-going-on-with-that-hurricane-of-dark-matter-1830420899</a></p>

## Outreach

### Aimed at the public

2020 2021	<p><b>Dark Matter Day</b>, <i>Virtual</i>.          Speaker and panel member for an annual series of events organised as part of the worldwide Dark Matter Day (31st October)</p>
2018	<p><b>Science Slam</b>, <i>DESY, Hamburg</i>.          'On safari in the Milky Way'</p>
2017	<p><b>Pint of Science Festival</b>, <i>Bunkers Hill pub, Nottingham</i>.          'The Cosmic Pint'</p>
2017	<p><b>Guest lecture</b>, <i>Manchester Astronomy Society</i>.          'The Dark Side'</p>
2015	<p><b>TEDxUoN talk</b>, <i>Portland Building, Nottingham</i>.          'Detecting Dark Matter'</p>
2015	<p><b>Pub.hD talk</b>, <i>Vat and Fiddle pub, Nottingham</i>.          'Detecting Dark Matter'</p>

### Aimed at students

2021	<p><b>PhySoc guest lecture</b>, <i>University of Sydney</i>.          Lecture on 'Dark matter' aimed at Sydney undergraduates</p>
2020	<p><b>Sydney Physics Dialogues</b>, <i>University of Sydney</i>.          Lecture on 'Dark matter' aimed at international undergraduates</p>
2018	<p><b>School visit</b>, <i>Colegio Nuestra Señora del Pilar, Zaragoza</i>.          Aimed at 14-16 year old science and english students.</p>
2017	<p><b>School visit</b>, <i>Chilwell school, Nottinghamshire</i>.          Aimed at students thinking of studying physics at university.</p>
2014 2017	<p><b>Ambition Nottingham</b>.          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.</p>
2013 2017	<p><b>University of Nottingham open days</b>.          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.</p>

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

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## Publications

Total citations: 1,298. Collected from the [inspireHEP](#) database

- O'Hare et al. 2021b **29.** 'Simulations of axion-like particles in the post-inflationary scenario'  
C.A.J. O'Hare, G. Pierobon, J. Redondo, Y.Y.Y. Wong  
[Animations: <https://www.youtube.com/channel/UCqosWwo0KrdmNKbBwVUuGg/videos>]
- Chen et al. 2021b **28.** 'Cosmology of the companion-axion model: dark matter, gravitational waves, and primordial black holes'  
Z. Chen, A. Kobakhidze, C.A.J. O'Hare, Z.S.C. Picker, G. Pierobon  
arXiv:2110.11014  
[Cited by 1 record, github page: <https://github.com/cajohare/CompAxion>]
- Chen et al. 2021a **27.** 'The companion-axion model: photon interactions and constraints'  
Z. Chen, A. Kobakhidze, C.A.J. O'Hare, Z.S.C. Picker, G. Pierobon  
[Cited by 2 records, github page: <https://github.com/cajohare/CompAxion>]
- O'Hare 2021 **26.** 'Fog on the horizon: a new definition of the neutrino floor for direct dark matter searches'<sup>1</sup>  
C. A. J. O'Hare  
Phys. Rev. Lett. **127**, 251802 (2021)  
[Cited by 2 records, github page: <https://github.com/cajohare/NeutrinoFog>]
- O'Hare et al. 2021a **25.** '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  
arXiv:[2105.11949]
- Boehm et al. 2021b **24.** 'Comment on: Cosmological black holes are not described by the Thakurta metric'  
C. Boehm, A. Kobakhidze, C. A. J. O'Hare, Z. S. C. Picker, M. Sakellariadou  
arXiv:[2105.14908]  
[Cited by 4 records]
- Caputo et al. 2021 **23.** 'Dark photon limits: a cookbook'  
A. Caputo, A. Millar, C. A. J. O'Hare, E. Vitagliano  
Phys. Rev. D **104**, 095029 (2021)  
[Cited by 19 records, github page: <https://github.com/cajohare/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 15 records]
- Boehm et al. 2021a **21.** '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 29 records]
- 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)  
[Cited by 30 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 17 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 20 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 21 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 33 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 22 records, github page: <http://cajohare.github.io/IAXOmass>]
- Evans et al. 2019 **14.** 'SHM<sup>++</sup>: 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 87 records]
- O'Hare et al. 2018 **13.** 'A dark matter hurricane: measuring the S1 stream with dark matter detectors'<sup>2</sup>  
C. A. J. O'Hare, C. McCabe, N. W. Evans, G. Myeong, V. Belokurov  
Phys. Rev. D **98**, 103006 (2018)  
[Cited by 49 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 42 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 15 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 16 records]
- Battaglieri et al. 2017 **9.** 'US Cosmic Visions: New Ideas in Dark Matter 2017: Community Report'<sup>3</sup>  
M. Battaglieri et al., FERMILAB-CONF-17-282-AE-PPD-T (2017)  
[Cited by 486 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 48 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 51 records]
- Mayet et al. 2016 **4.** 'A review of the discovery reach of directional Dark Matter detection'<sup>4</sup>  
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 157 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](#)'<sup>5</sup>  
C. A. J. O'Hare, A. M. Green, J. Billard, E. Figueroa-Feliciano, L. E. Strigari  
Phys. Rev. D **92**, 063518 (2015)  
[Cited by 68 records]
- O'Hare & Green 2014 **1.** '[Directional detection of dark matter streams](#)'<sup>6</sup>  
C. A. J. O'Hare & A. M. Green  
Phys Rev. D **90**, 123511 (2014)  
[Cited by 40 records]

**1** PRL [Editor's suggestion](#) and featured in *APS Physics*

**2** Featured in *APS Physics*

**3** Contributed projections for the CYGNUS experiment

**4** Selected as a highlighted article in *Physics Reports*

**5** Contains figure selected for *PRD Kaleidoscope Sep 2015*

**6** Contains figure selected for *PRD Kaleidoscope Dec 2014*