

Michael John Hutcheon, PhD

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URLS: [Google scholar](#)¹ [Github](#)² [Gitlab](#)³



Current positions

- 2024- **Intellectual Ventures** *Research consultant*
Machine-learning accelerated superconductor discovery
- 2020- Author of the [open source](#)⁴ procedurally-generated multiplayer video game [Don't get lost](#)⁵
 - More than 128,000 copies shipped

Previous positions

- 2021-2024 **University of Nottingham** *Research Fellow*
Computational chemistry, [Teale group](#)⁶
Research: Quantum mechanics, numerical optimization, Density functional theory (DFT), orbital-free DFT
 - Core developer of the [QUEST](#)⁷ quantum chemistry code (~ 1400 commits)
 - Author of the [TOPGRID](#)⁸ topological analysis library ([paper](#)⁹)
 - Winner of best talk, *Orbitals aren't real*, Dan Ely symposium 2023
- 2018-2021 **University of Cambridge** *PhD, Theoretical physics*
Thesis: [Novel methods to predict solid-state material properties](#)¹⁰
Group: Theoretical condensed matter physics ([TCM](#)¹¹, [my homepage there](#)¹²)
Research: Superconductors, crystal structure prediction, machine learning, quantum Monte Carlo, phonons
 - Co-investigator in 3 million CPU-hour grant for superconductor discovery¹³
 - Published seven academic papers during my PhD (achieving *editors suggestion* in [PRL](#)¹⁴ and [PRB](#)¹⁵)
 - Four years teaching mathematics for the physical sciences tripos
 - Author of the [XDMC](#)¹⁶ quantum Monte Carlo code, based on a technique [of my own design](#)¹⁷
- 2017-2018 **University of Cambridge** *MPhil, Scientific Computing (distinction)*
Dissertation: *The energetics of crystals using density-functional theory and diffusion quantum Monte Carlo*
- 2016-2017 **University of Oxford** *MPhys, Masters in Physics (1st class)*
Dissertation: *Photon induced decoherence of a Transmon superconducting charge qubit*
- 2013-2016 **University of Oxford** *BSc, Physics (1st class)*
 - Placed 6th in cohort
 - 2017 Mary Somerville prize
 - 2016 Brazell Scholarship in Physics
 - 2015 Maria and Tina Bentivoglio Scholarship in Physics
 - Departmental commendations for laboratory work
- 2016 **Rutherford Appleton labs, Internship**
8 week placement. Designed vertex reconstruction algorithms for the 2025 upgrade of the CMS detector at CERN

Publications

Please see my [Google scholar](#) page for my academic publications

My music can be found on [Spotify](#)¹⁸ and [SoundCloud](#)¹⁹

Grants

Resource Allocation Panel (RAP): Open access to Tier-2 (Spring 2019) *Predicting the crystal structure and superconducting properties of hydrides under high pressure*; 3 million CPU hours, Co-investigator.

Talks

- *Orbitals aren't real*, Winner of best talk, Dan Eley symposium, Nottingham, 2023.
- *Direct approaches to the SCF problem in quantum chemistry*, Nottingham, 2023.
- *Occupation numbers in quantum chemistry*, Nottingham, 2022.

- *Topological analysis of electronic properties on arbitrary grids*, MAGIC conference, Cambridge, 2022.
- *Topological analysis of functions on DFT grids*, Nottingham, 2022.
- *High-throughput discovery of superconductors*, Invited talk, Oxford, 2021.
- *Exchange-diffusion Monte Carlo*, Total energy and force methods conference, San Sebastián, 2020.
- *Exchange-diffusion Monte Carlo: asymptotically exact solutions to the sign problem*, Cambridge, October 2019.
- *Run DMC: diffusion Monte Carlo theory and practice*, Cambridge, Nov 2018.

Computing experience

7 years of research focused on computational physics/chemistry and high-performance computing. Extensive experience programming in python, C++ and C# both for scientific and non-scientific purposes. I am the author of **XDMC**, a C++ quantum Monte Carlo code based on a novel technique [of my own design](#)²⁰, and **TOPGRID**, which is the topological analysis python library (see [paper](#)²¹) used in the QUEST quantum chemistry package, of which I am also a core developer (~1300 commits). I build video games in my spare time, mostly using C# and C++ and am the author of the open-source procedurally-generated multiplayer video game [Don't get lost](#), which has shipped over 128,000 copies on steam. Along the way I've used a lot of 3D modelling software, game engines, photoshop etc. I have also done a reasonable amount of FORTRAN (in particular, optimizations to the [Quantum Espresso](#)²² software) and web development; Javascript, HTML and CSS. I am a native linux user, and an experienced user of supercomputers. I also built [a robot called Doug](#)²³, who draws pictures.

Peer Review

I have reviewed papers for the following journals

- Nature, npj Computational Materials
- APS, Physical Review B
- Wiley, The Journal of Computational chemistry
- Elsevier, Physics Letters A

Other experience

Graduate of the *Make every comma count* communications course.

2009-2013

Wootton upper school

A-Levels: Maths A*, Physics A*, Perspectives on Science A*, Further Maths A, Chemistry A
AS-Levels: Applied Science A, Biology A
GCSEs: 4A*, 10A

2012

Cranfield University, Internship

6 week placement. Created a computer model of a Siemens SGT-8000H industrial gas turbine engine.

2013-2019

Colben Ltd., Farm worker

Worked during the harvest at my family farm over each summer. Transporting and monitoring moisture levels of grain, maintaining and repairing farm equipment.

Rowing

Captain of Somerville men's boatclub in my 2nd year at Oxford, president in my 3rd and social sec in my 4th. Rowed for Somerville men's 1st boat at Oxford and Hughes Hall men's 1st boat in Cambridge. Organised and taken part in dozens of regattas and training camps.

Music

Countless hours spend recording and producing music of many genres; playing guitar, piano and drums. Examples can be found on my webpages.

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¹<https://scholar.google.com/citations?user=UYEycjEAAAAJ>

²<https://github.com/miicck>

³<https://gitlab.com/miicck>

⁴<https://github.com/miicck/dont-get-lost>

⁵https://store.steampowered.com/app/1442360/Dont_get_lost/

⁶<https://quest.codes/>

⁷<https://quest.codes/the-code/>

⁸<https://github.com/miicck/topgrid>

⁹<https://pubs.acs.org/doi/10.1021/acs.jctc.2c00649>

¹⁰<https://www.repository.cam.ac.uk/items/2811d589-ae22-4d08-a265-111efa7af5be>

¹¹<https://www.tcm.phy.cam.ac.uk/>

¹²<http://www.tcm.phy.cam.ac.uk/~mjh261/>

¹³See 'grants' section

¹⁴<https://link.aps.org/doi/10.1103/PhysRevLett.128.047001>

¹⁵<https://link.aps.org/doi/10.1103/PhysRevB.104.054501>

¹⁶<https://github.com/miicck/xdmc>

¹⁷<https://journals.aps.org/pre/abstract/10.1103/PhysRevE.102.042105>

¹⁸<https://open.spotify.com/artist/4ghErFI3mXNdb2UM7EQQzJ?si=mmJe0h5cT1ikoQ57KhKoYw>

¹⁹<https://soundcloud.com/michael-hutcheon>

²⁰<https://journals.aps.org/pre/abstract/10.1103/PhysRevE.102.042105>

²¹<https://pubs.acs.org/doi/10.1021/acs.jctc.2c00649>

²²<https://gitlab.com/miicck/q-e>

²³https://github.com/miicck/spider_printer