

# Michael John Hutcheon, PhD

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URLS: [Google scholar](#)<sup>1</sup> [Github](#)<sup>2</sup> [Gitlab](#)<sup>3</sup>



## Current positions

- 2021- **University of Nottingham Research Fellow**  
Computational chemistry, [Teale group](#)<sup>4</sup>  
Research: Quantum mechanics, numerical optimization, Density functional theory (DFT), orbital-free DFT
- Core developer of the [QUEST](#)<sup>5</sup> quantum chemistry code (~ 1400 commits)
  - Author of the [TOPGRID](#)<sup>6</sup> topological analysis library ([paper](#)<sup>7</sup>)
  - Winner of best talk, *Orbitals aren't real*, Dan Ely symposium 2023
- 2020- Author of the [open source](#)<sup>8</sup> procedurally-generated multiplayer video game [Don't get lost](#)<sup>9</sup>
- More than 90,000 copies shipped

## Previous positions

- 2018-2021 **University of Cambridge PhD, Theoretical physics**  
Thesis: [Novel methods to predict solid-state material properties](#)<sup>10</sup>  
Group: Theoretical condensed matter physics ([TCM](#)<sup>11</sup>, [my homepage there](#)<sup>12</sup>)  
Research: Superconductors, crystal structure prediction, machine learning, quantum Monte Carlo, phonons
- Co-investigator in 3 million CPU-hour grant for superconductor discovery<sup>13</sup>
  - Published seven academic papers during the PhD (achieving *editors suggestion* in [PRL](#)<sup>14</sup> and [PRB](#)<sup>15</sup>)
  - Four years teaching mathematics for the physical sciences tripos
  - Author of the [XDMC](#)<sup>16</sup> quantum Monte Carlo code, based on a technique [of my own design](#)<sup>17</sup>
- 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 (1<sup>st</sup> class)**  
Dissertation: *Photon induced decoherence of a Transmon superconducting charge qubit*
- 2013-2016 **University of Oxford BSc, Physics (1<sup>st</sup> class)**
- Placed 8<sup>th</sup>/88 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](#)<sup>18</sup> and [SoundCloud](#)<sup>19</sup>

## 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](#)<sup>20</sup>, and **TOPGRID**, which is the topological analysis python library (see [paper](#)<sup>21</sup>) 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 90,000 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](#)<sup>22</sup> 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](#)<sup>23</sup>, 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

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 2<sup>nd</sup> year at Oxford, president in my 3<sup>rd</sup> and social sec in my 4<sup>th</sup>. Rowed for Somerville men's 1<sup>st</sup> boat at Oxford and Hughes Hall men's 1<sup>st</sup> 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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<sup>1</sup><https://scholar.google.com/citations?user=UYEycjEAAAAJ>

<sup>2</sup><https://github.com/miicck>

<sup>3</sup><https://gitlab.com/miicck>

<sup>4</sup><https://quest.codes/>

<sup>5</sup><https://quest.codes/the-code/>

<sup>6</sup><https://github.com/miicck/topgrid>

<sup>7</sup><https://pubs.acs.org/doi/10.1021/acs.jctc.2c00649>

<sup>8</sup><https://github.com/miicck/dont-get-lost>

<sup>9</sup>[https://store.steampowered.com/app/1442360/Dont\\_get\\_lost/](https://store.steampowered.com/app/1442360/Dont_get_lost/)

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

<sup>11</sup><https://www.tcm.phy.cam.ac.uk/>

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

<sup>13</sup>See 'grants' section

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

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

<sup>16</sup><https://github.com/miicck/xdmc>

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

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

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

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

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

<sup>22</sup><https://gitlab.com/miicck/q-e>

<sup>23</sup>[https://github.com/miicck/spider\\_printer](https://github.com/miicck/spider_printer)