

Matthew Evans

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materials discovery • ab initio calculations
data management and APIs • open science & software

EDUCATION

- 2016– **PhD Physics**, Theory of Condensed Matter Group, University of Cambridge
2015–2016 **MPhil Scientific Computing**, University of Cambridge, *Pass with distinction*
2011–2015 **MPhys Physics with Theoretical Physics**, University of Manchester, *First Class (Hons)*

EXPERIENCE

- 2020– **Researcher then BEWARE Research Fellow** (jointly at **Matgenix**, 2022 onwards)
with Prof Gian-Marco Rignanese (*Université catholique de Louvain*)
– Machine learning for small materials datasets (MODNet).
– High-throughput workflows for computational materials discovery and molecular dynamics.
– Continued development of the **OPTIMADE** API specification and associated software.
- 2021– **Visiting Researcher**
in the group of Prof Clare Grey (*University of Cambridge*)
– Data management, analysis software and open APIs for materials chemistry research.
– Funded by BIG-MAP External Stakeholder Initiative to develop **data^{lab}**, a data management API and web UI for samples and associated characterisation via electrochemical cycling, NMR and XRD.
– Founder and co-leader of a **MaRDA** working group on interoperable **metadata extractors** in materials science and chemistry.
- 2022 **Postdoctoral Research Associate**
Cambrige Crystallographic Data Centre
2-month contract to implement a recommender system for the Cambridge Structural Database.
- 2016–2020 **PhD student: Crystal structure prediction for next-generation energy storage**
with Dr Andrew Morris (*University of Cambridge/University of Birmingham*)
– Computational materials discovery for conversion anodes for Li, Na and K-ion batteries.
– Author of two open-source Python packages: database approaches for high-throughput calculations and materials design with **matador** and crystal structure prediction with **ilustrado**.
– Active member of the **OPTIMADE consortium** for materials database interoperability and author of the **optimade-python-tools** package (used in production by The Materials Project, NOMAD, Materials Cloud and others) and **odbx** implementation.
- 2019 **Visiting Researcher**
Department of Applied Physics, Aalto University
Received HPC-Europa funding to visit the group of Prof Adam Foster for 7 weeks, with computational resources provided by the Finnish IT center for science (CSC).
- 2019 **Scientific Software Developer (Intern)**
Enthought Inc., Cambridge
Worked on the open source, Horizon 2020 **FORCE project**, adding functionality to a workflow manager for multi-criteria optimisations. Helped develop Cython bindings for the ACADO toolkit.
- 2014, 2015 **UG research: Interactions of quantised vortices in superfluid helium**
with Dr Paul Walmsley & Prof Andrei Golov (*University of Manchester*)
- 2014–2015 **MPhys project: Electronic structure of defects in graphene superlattices**
with Prof Francisco Guinea (*University of Manchester*)
- 2013 **UG research: Hard sphere packing of nanotube-encapsulated fullerenes**
with Dr Ho-Kei Chan & Prof Elena Besley (*University of Nottingham*)

COMPUTING

- Exposure: **Daily**, Intermittent, *Occasional*.
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|-----------|--|-----------|--|
| Languages | Python , Javascript, Vue.js, Fortran, Cython, C++ | Expertise | Web APIs & databases, HT workflows, ML |
| DFT | CASTEP , Quantum Espresso, <i>GPAW</i> | Stack | FastAPI, pydantic, Flask, Tensorflow |
| Tools | git , vim , Docker | Practices | Test-driven development , CI |

(TEACHING + SERVICE)

- 2023 Invited tutorial on OPTIMADE at the Actively Learning Materials Science (AL4MS2023) workshop, Aalto University, Finland.
- 2022– Founded and co-lead a **MaRDA** working group on **metadata extractors** for materials science and chemistry
- 2020– Co-chair of the Research Data Alliance (RDA) IG *Materials Data, Infrastructure & Interoperability*
- 2018– Reviewed manuscripts and data for *npj. Computational Materials*, *J. Phys.: Cond. Mat.*, *Scientific Reports*, *Digital Discovery* and *Journal of Open Source Software*
- 2022 Organiser for the CECAM Virtual Workshop *Machine-actionable Data Interoperability for Chemical Sciences* (**MADICES**)
- 2021 Lecturer for “Working with Materials Databases” at the ICTP-East African Institute for Fundamental Research Training School *Machine Learning for Electronic Structure and Molecular Dynamics*
- 2021 Mentor at Acceleration Consortium Hackathon on Scientific Databases
- 2021 Developed and delivered a **2-day OPTIMADE tutorial** for the NOMAD Virtual Tutorial Series.
- 2016–2020 Active member of TCM sysadmin team, Cavendish Laboratory
- 2019-2021 Demonstrator: Part II Computational Physics, Cavendish Laboratory
– Demonstrated scientific Python to beginners in weekly labs (2019 only).
– Conceptualised and delivered a tutorial on the basics of **version control with Git** (2019-2021).
- 2016–2018 Supervisor: 2x Part IB Electromagnetism, Dynamics and Thermodynamics, Selwyn College
– Small group teaching, providing detailed feedback on assigned problems.
- 2016–2019 Demonstrator: 3x Part IB Introduction to Computing (C++), Cavendish Laboratory
- 2016–2019 Demonstrator: 4x at annual CASTEP workshop, University of Oxford
- 2017 Volunteer: 2nd Conference of Research Software Engineers, University of Manchester
- 2016–2017 Volunteer: Key Stage 2 Code Club, Ridgefield Primary School, Cambridge
- 2012–2015 Tutor: GCSE Maths & Key Stage 2 Programming for **The Tutor Trust**, Manchester
– Provided tuition to small groups and ‘looked after children’ across 15 schools.
– Helped lead a successful pilot to teach primary school children programming using Scratch.

(AWARDS + HONOURS)

- 2022 BEWARE2 Fellowship from the Wallonia-Brussels Federation to fund 3 years of postdoctoral work (approx. €300,000).
- 2021 PI for “Interoperable data management for fundamental battery research”, BIG-MAP External Stakeholder Initiative, total funding €150,000 (personal allocation €50,000).
- 2019 HPC-Europa 3 funding to visit Aalto University for 7 weeks and associated computing time.
- 2018 Tier-2 HPC Resource Allocation: PI on project awarded 2 MCPUh, *Crystal structure prediction for next-generation solar absorbers*, **M. L. Evans**, D. O. Scanlon and A. J. Morris.
HPC Midlands+ Substantial Project: awarded 1.3 MCPUh for *High-throughput materials discovery for energy applications*, **M. L. Evans** and A. J. Morris.
- 2017 Tier-2 HPC Resource Allocation: Co-investigator on project awarded 4 MCPUh, *Ab initio structure prediction for next-generation battery materials*, B. Karasulu, **M. L. Evans** and A. J. Morris.
- 2015 Tesella Prize for Software, University of Manchester, for the most effective use of software in a final year physics project.
- 2013, 2014 Undergraduate research bursary for two summers as an undergraduate, totalling £4200.
- 2011–2015 Means-tested and merit based scholarship to study at the University of Manchester, worth £12,000.

SELECTED PRESENTATIONS

- 2023 Invited talk: *Open Databases Integration for Materials Design* at the Actively Learning Materials Science (AL4MS2023) workshop, Aalto University, Finland.
Invited talk: *Metadata extractors for interoperable ETL*, MaRDA Alliance Annual Meeting
Invited talk: *Interoperable data management for fundamental battery research*, Laboratory of Materials Simulation, Paul Scherrer Institut, Switzerland.
- 2021 Invited panel discussions: *International Materials Data: Joint Meeting* and *Metadata for Data Indexing and Discovery in Materials Science*, Research Data Alliance (RDA) 18th Virtual Plenary Meeting
Invited talk: *The OPTIMADE Ecosystem*, DoE Battery Genome Initiative
Invited panel discussion: *Delivery platforms for open marketplaces*, Research Data Alliance (RDA) 17th Virtual Plenary Meeting
- 2020 Invited talk: *The OPTIMADE Specification*, Research Data Alliance (RDA) 16th Virtual Plenary Meeting: Data Infrastructure for Collaborations in Materials Research
Invited talk and workshop demonstration: *odbx & OPTIMADE* and *optimade-python-tools*, CECAM Workshop, Open Databases Integration for Materials Design 2020
- 2019 Contributed talk: *Phosphorus anodes for potassium-ion batteries: insights from crystal structure prediction*, EMRS Spring 2019, Nice, France
Invited talk: *matador & OPTIMADE*, CECAM Workshop, Open Databases Integration for Materials Design 2019, EPFL, Switzerland
- 2018 Contributed talk: *Sn-P anodes for potassium-ion batteries: insights from crystal structure prediction*, SMARTER6 Conference, Ljubljana, Slovenia
Invited talk: *matador: databases and crystal structure prediction (slides)*, CECAM Workshop, Open Databases Integration for Materials Design 2018, EPFL, Switzerland
- 2017 Invited talk: *Crystal structure prediction for next-generation battery anodes (slides)*, Solid State Seminar Series, University of Cambridge
Poster Presentation: 13th RSC Conference in Materials Chemistry (**poster**), University of Liverpool
- 2016 Poster Presentation: SMARTER5 Conference, University of Bayreuth, Germany

PUBLICATIONS

Underline indicates (joint) first authorship.

- Jablonka, K. M., Ai, Q., Al-Feghali, A., Badhwar, S., Bocarsly, J. D., M., A., Bringuier, S., Brinson, L. C., Choudhary, K., Circi, D., *et al.* *14 Examples of How LLMs Can Transform Materials Science and Chemistry: A Reflection on a Large Language Model Hackathon* 2023. DOI:[10.48550/arXiv.2306.06283](https://doi.org/10.48550/arXiv.2306.06283). arXiv: 2306 . 06283. (2023).
- Ells, A. W., **Evans, M. L.**, Groh, M., Morris, A. J. & Marbella, L. E. Phase transformations and phase segregation during potassiation of Sn_xP_y anodes. *Chemistry of Materials*, (2022). DOI:[10/h69d](https://doi.org/10.1039/d1mh00000a).
- Evans, M. L.**, Andersen, C. W., Dwaraknath, S., Scheidgen, M., Fekete, Á. & Winston, D. optimade-python-tools: a Python library for serving and consuming materials data via OPTIMADE APIs. *Journal of Open Source Software* **6**, 3458, (2021). DOI:[10/gn3w9f](https://doi.org/10.1038/s41586-021-03919-1).
- Andersen, C. W., Armiento, R., Blokhin, E., Conduit, G. J., Dwaraknath, S., **Evans, M. L.**, Fekete, Á., Gopakumar, A., Gražulis, S., Merkys, A., *et al.* OPTIMADE, an API for exchanging materials data. *Scientific Data* **8**, 217, (2021). DOI:[10/gmnrxj](https://doi.org/10.1038/s41598-021-01111-1).
- Breuck, P.-P. D., **Evans, M. L.** & Rignanese, G.-M. Robust model benchmarking and bias-imbalance in data-driven materials science: a case study on MODNet. *Journal of Physics: Condensed Matter* **33**, 404002, (2021). DOI:[10/gpw93d](https://doi.org/10.1038/s41524-021-00931-1).
- Evans, M. L.** & Morris, A. J. matador: a Python library for analysing, curating and performing high-throughput density-functional theory calculations. *Journal of Open Source Software* **5**, 2563, (2020). DOI:[10/gmf4mv](https://doi.org/10.1038/s41586-020-02000-0).
- Harper, A. F., **Evans, M. L.** & Morris, A. J. Computational Investigation of Copper Phosphides as Conversion Anodes for Lithium-Ion Batteries. *Chemistry of Materials*, (2020). DOI:[10/gg5sx3](https://doi.org/10.1039/c9cc05533a).
- Harper, A. F., **Evans, M. L.**, Darby, J. P., Karasulu, B., Koçer, C. P., Nelson, J. R. & Morris, A. J. Ab initio Structure Prediction Methods for Battery Materials : A review of recent computational efforts to predict the atomic level structure and bonding in materials for rechargeable batteries. *Johnson Matthey Technology Review* **64**, 103–118, (2020). DOI:[10/ggrmgf](https://doi.org/10.1039/c9cc05533a).
- Mayo, M., Darby, J. P., **Evans, M. L.**, Nelson, J. R. & Morris, A. J. Correction to Structure Prediction of Li–Sn and Li–Sb Intermetallics for Lithium-Ion Batteries Anodes. *Chemistry of Materials*, (2018). DOI:[10/gf25zc](https://doi.org/10.1039/c8cc05533a).
- Marbella, L. E., **Evans, M. L.**, Groh, M. F., Nelson, J., Griffith, K. J., Morris, A. J. & Grey, C. P. Sodiation and Desodiation via Helical Phosphorus Intermediates in High-Capacity Anodes for Sodium-Ion Batteries. *Journal of the American Chemical Society* **140**, 7994–8004, (2018). DOI:[10/gdq6h4](https://doi.org/10.1021/jacs.8b06444).
- Zhu, T., **Evans, M. L.**, Brown, R. A., Walmsley, P. M. & Golov, A. I. Interactions between unidirectional quantized vortex rings. *Physical Review Fluids* **1**, 044502, (2016). DOI:[10/gf2529](https://doi.org/10.1103/PhysRevFluids.1.044502).