Michael Vasmer

Curriculum vitae

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Experience

2025–present	**Inria Starting Faculty Position**, *Inria Paris*
2023–2024	**Senior Quantum Architecture Scientist**, *Xanadu Quantum Technologies Inc.*
2022–2024	**Research Scientist**, *Perimeter Institute for Theoretical Physics*
2022–2023	**Quantum Error Correction Researcher**, *Xanadu Quantum Technologies Inc.*
2021–2022	**Independent Contractor**, *Xanadu Quantum Technologies Inc.*
2019–2022	**Postdoctoral Fellow**, *Perimeter Institute & Institute for Quantum Computing*
	Mentors: Raymond Laflamme and Daniel Gottesman

Education

2016–2019	**Ph.D. Quantum Computing**, *University College London*
	Thesis: *Fault-tolerant quantum computing with three-dimensional surface codes.*
	Supervisor: Dan Browne.
2015–2016	**M.Res. Quantum Technologies**, *University College London*, Distinction
	Dissertation: *Swapping between color codes and surface codes.*
	Supervisor: Dan Browne.
2011–2015	**M.Sci. Natural Sciences**, *Durham University*, First Class Honours
	Specialised in Physics and Computer Science.

Funding

2021	**Making noisy quantum processors practical: From theory to applications**, *Natural Sciences and Engineering Research Council of Canada & Innovate UK*, C\$330k + £300k
	Co-principal investigator. I co-authored the grant proposal and I lead the research program on the Canadian side of the grant.
2021–2022	**IonQ Academic Research Credits Program**, \$20k
	I secured funding for running experiments on IonQ's trapped-ion quantum computers.

Publications

[1] H. Aghaee Rad *et al.*, "Scaling and networking a modular photonic quantum computer," *Nature* (Jan., 2025) 1–8.

[2] E. Sabo, L. G. Gunderman, B. Ide, M. Vasmer, and G. Dauphinais, "Weight-Reduced Stabilizer Codes with Lower Overhead," *PRX Quantum* **5** no. 4, (Oct., 2024) 040302, `arXiv:2402.05228`.

[3] D. Honciuc Menendez, A. Ray, and M. Vasmer, "Implementing fault-tolerant non-Clifford gates using the [[8,3,2]] color code," *Phys. Rev. A* **109** no. 6, (June, 2024) 062438, `arXiv:2309.08663`.

[4] J. C. Bridgeman, A. Kubica, and M. Vasmer, "Lifting Topological Codes: Three-Dimensional Subsystem Codes from Two-Dimensional Anyon Models," *PRX Quantum* **5** no. 2, (Apr., 2024) 020310, `arXiv:2305.06365`.

[5] G. Dauphinais, D. W. Kribs, and M. Vasmer, "Stabilizer Formalism for Operator Algebra Quantum Error Correction," *Quantum* **8** (Feb., 2024) 1261, `arXiv:2304.11442`.

[6] A. O. Quintavalle, P. Webster, and M. Vasmer, "Partitioning qubits in hypergraph product codes to implement logical gates," *Quantum* **7** (Oct., 2023) 1153, `arXiv:2204.10812`.

[7] E. Huang, A. Pesah, C. T. Chubb, M. Vasmer, and A. Dua, "Tailoring three-dimensional topological codes for biased noise," *PRX Quantum* **4** (Sep, 2023) 030338, `arXiv:2211.02116`.

[8] J. Huang, S. M. Li, L. Yeh, A. Kissinger, M. Mosca, and M. Vasmer, "Graphical CSS code transformation using ZX calculus," in *Proceedings of the Twentieth International Conference on Quantum Physics and Logic (QPL 2023)*, vol. 384 of *Electronic Proceedings in Theoretical Computer Science*, pp. 1–19. August, 2023. `arxiv:2307.02437`.

[9] A. Kubica and M. Vasmer, "Single-shot quantum error correction with the three-dimensional subsystem toric code," *Nat. Commun.* **13** no. 1, (Oct., 2022) 6272, `arXiv:2106.02621`.

[10] T. R. Scruby, M. Vasmer, and D. E. Browne, "Non-Pauli errors in the three-dimensional surface code," *Phys. Rev. Research* **4** no. 4, (Oct., 2022) 043052, `arXiv:2202.05746`.

[11] H. Chen, M. Vasmer, N. P. Breuckmann, and E. Grant, "Automated discovery of logical gates for quantum error correction," *Quantum Inf. Comput.* no. 11&12, (Sept., 2022) 0947–0964, `arXiv:1912.10063`.

[12] M. Vasmer and A. Kubica, "Morphing quantum codes," *PRX Quantum* **3** no. 3, (Aug., 2022) 030319, `arXiv:2112.01446`.

[13] T. R. Scruby, D. E. Browne, P. Webster, and M. Vasmer, "Numerical implementation of just-in-time decoding in novel lattice slices through the three-dimensional surface code," *Quantum* **6** (May, 2022) 721, `arXiv:2012.08536`.

[14] P. Webster, M. Vasmer, T. R. Scruby, and S. D. Bartlett, "Universal fault-tolerant quantum computing with stabilizer codes," *Phys. Rev. Research* **4** no. 1, (Feb., 2022) 013092, `arXiv:2012.05260`.

[15] A. O. Quintavalle, M. Vasmer, J. Roffe, and E. T. Campbell, "Single-shot error correction of three-dimensional homological product codes," *PRX Quantum* **2** no. 2, (June, 2021) 020340, `arXiv:2009.11790`. Editors' suggestion.

[16] J. E. Bourassa, R. N. Alexander, M. Vasmer, A. Patil, I. Tzitrin, T. Matsuura, D. Su, B. Q. Baragiola, S. Guha, G. Dauphinais, K. K. Sabapathy, N. C. Menicucci, and I. Dhand, "Blueprint

for a scalable photonic fault-tolerant quantum computer," *Quantum* **5** (Feb., 2021) 392, `arXiv:2010.02905`.

[17] M. Vasmer, D. E. Browne, and A. Kubica, "Cellular automaton decoders for topological quantum codes with noisy measurements and beyond," *Sci. Rep.* **11** no. 1, (Jan., 2021) 2027, `arXiv:2004.07247`.

[18] M. Vasmer, *Fault-tolerant quantum computing with three-dimensional surface codes*. PhD thesis, University College London, Dec., 2019.

[19] M. Vasmer and D. E. Browne, "Three-dimensional surface codes: Transversal gates and fault-tolerant architectures," *Phys. Rev. A* **100** no. 1, (July, 2019) 012312, `arXiv:1801.04255`.

▬▬▬ Preprints

[1] P. J. Nadkarni, S. Adonsou, G. Dauphinais, D. W. Kribs, and M. Vasmer, "Unified and Generalized Approach to Entanglement-Assisted Quantum Error Correction," `arXiv:2411.14389`.

[2] T. Hillmann, G. Dauphinais, I. Tzitrin, and M. Vasmer, "Single-shot and measurement-based quantum error correction via fault complexes," `arXiv:2410.12963`.

[3] B. W. Walshe, B. Q. Baragiola, H. Ferretti, J. Gefaell, M. Vasmer, R. Weil, T. Matsuura, T. Jaeken, G. Pantaleoni, Z. Han, N. C. Menicucci, I. Tzitrin, and R. N. Alexander, "Linear-optical quantum computation with arbitrary error-correcting codes," `arXiv:2408.04126`.

▬▬▬ Invited talks

Jul 2024	**Implementing fault-tolerant non-Clifford gates using color codes** International Conference on Atomic Physics 2024 Satellite Workshop, University of Sussex, Brighton, UK
May 2024	**Weight Reduced Stabilizer Codes with Lower Overhead** Canadian Association of Phyicists Congress, London ON, Canada
Mar 2024	**Weight Reduced Stabilizer Codes with Lower Overhead** Yukawa Institute for Theoretical Physics Error Correction Workshop, Kyoto, Japan
Nov 2023	**Fault-tolerant quantum computation beyond the surface code** Quantum Innovators Workshop, Waterloo ON, Canada
Jun 2023	**Fault-tolerant quantum computation with topological subsystem codes** International Workshop on General-Purpose Quantum Computing and Information Theory, Institute of Theoretical Physics, Chinese Academy of Sciences (online)
Mar 2023	**3D subsystem codes from 2D topological codes** APS March Meeting, Las Vegas NV, USA
Oct 2022	**Fault-tolerant quantum computing in the age of "good codes"** Q-SITE Conference, Toronto ON, Canada

Jul 2022 **Single-shot quantum error correction: Part II**
IBM Quantum Error Correction Summer School, Tarrytown NY, USA

▬▬▬▬ Contributed talks & seminars

2025 **Single-shot and measurement-based quantum error correction via fault complexes**
NISQ2LSQ workshop, L'université d'Aix-Marseille, Marseille, France
QIP 2025, Raleigh NC, USA

May 2024 **Overview of quantum error correction with a view on machine learning opportunities**
Future Horizons: Bridging AI, Quantum and New Materials workshop, Montréal QC, Canada

May 2024 **Quantum error correction with constant time overhead**
Quantum Spain seminar (online), Recoding: `https://youtu.be/HXuIFxHMmZg`

Apr 2024 **Weight Reduced Stabilizer Codes with Lower Overhead**
Quandela, Massy, France

2024 **Implementing fault-tolerant non-Clifford gates using the [[8,3,2]] color code**
IBM Quantum Information Technical Exchange colloquium (online)
Alice & Bob (online)

Dec 2023 **Decoding the 3D subsystem toric code**
Inria Paris, France

Dec 2023 **Photonic quantum computation beyond the surface code**
Télécom Paris, France

May 2022 **Fault-tolerant quantum computation beyond the surface code**
QuEra Computing (online)

2022 **Morphing quantum codes**
Riverlane, Cambridge, UK
APS March Meeting, Chigaco IL, USA

2021 **Single-shot quantum error correction with the 3D subsystem toric code**
Cambridge Quantum Computing, UK
University College London, UK
Freie Universität Berlin (online), Recording: `https://youtu.be/idmrNQy09Aw`

2021 **Locally unencoding the color code**
TQC 2021 (online), Recording: `https://youtu.be/jUYOjC9Z68g`
1QB Information Technologies (online)

2020 **Cellular automaton decoders for toplogical codes with noisy measurements and beyond**
Quantum Code Design and Architecture seminar (online)
Université de Sherbrooke, Sherbrooke QC, Canada

Mar 2019 **Cellular automaton decoder for topological codes with boundaries**
APS March Meeting, Boston MA, USA
Quantum Code Design and Architecture kick-off meeting, Paris, France

2018	**Quantum computing with 3D surface codes**

Perimeter Institute, Waterloo ON, Recording: `https://doi.org/10.48660/18110080`
Quantum Roundabout 2018, Nottingham, UK
Northern Quantum meeting, Durham, UK

Awards

Aug 2019	**Poster Prize**, *5th International Conference on Quantum Error Correction, London UK*
Sep 2017	**Prize for outstanding performance in the MRes in Quantum Technologies**, *University College London*
Jun 2012	**Outstanding Achievement Prize**, *Durham University Physics Department*

Supervision

2021–2024	Supervised one PhD student and two master's students at the University of Waterloo for projects on quantum error correction and mitigation.
Summer 2022	Supervised two undergraduate students for projects on quantum error correction and mitigation (resulted in publication [3]).
Summer 2021	Supervised a Perimeter Scholars International master's student for his thesis (resulted in publication [7]).

Teaching

Winter 2024	Graduate course at the University of Waterloo on quantum error correction and fault tolerance. Five (three-hour) lectures on quantum LDPC codes and fault-tolerant quantum computation and assessment of students' final projects. Course website: `https://www.math.uwaterloo.ca/~wcleung/qic890-w2024.html`.
Winter 2022	Graduate course at the University of Waterloo on quantum error correction and fault tolerance. Six (one-hour) lectures on fault-tolerant quantum computation and assessment of students' final projects. Course website: `https://www.math.uwaterloo.ca/~wcleung/co781-w2022.html`.
2017–2019	Delivered tutorials on quantum technologies to master's students at University College London. Total: 12 hours.

Equity, diversity and inclusion (EDI)

2022–2023	Member: Institute for Quantum Computing EDI committee.
2017–2019	PhD tutor, The Brilliant Club (`https://thebrilliantclub.org`). Delivered university-style tutorials about quantum computing to students at low-participation schools. Designed my own course over multiple placements.

Community contributions

Sep 2025	Organiser: Quantum error correction meets ZX-calculus workshop (Dagstuhl, Germany).
2025–present	Organiser: QASAR (Quantum Architectures, Small And Reliable) online seminar series.

2024, 2026	Organiser: Fault-tolerant quantum technologies workshop (Benasque, Spain).
2022, 2024	Program committee member: Quantum Computing Theory in Practice workshop.
2022	Organiser: Workshop on industrial quantum error mitigation (London, UK).
2020–2022	Organiser: Perimeter Institute quantum information seminar.
2017	Organiser: QCumber 2017 student conference (Windsor, UK).
2020–present	Reviewer for scientific journals (number of reviewed articles in brackets):

- ACM Transactions on Quantum Computing (1)
- Nature (3)
- Nature Physics (2)
- Physical Review Letters (3)
- Physical Review X (2)
- PRX Quantum (7)
- Quantum (6)

2021–present	Reviewer for academic conferences:

- Conference on Quantum Information Processing (QIP)
- Conference on the Theory of Quantum Computation, Communication and Cryptography (TQC)
- IEEE International Symposium on Information Theory (ISIT)
- IEEE Information Theory Workshop (ITW)

Computer skills

Software development	Programming languages: Python, C++, Julia, GAP, Mathematica. Source control: Git, GitHub.
Quantum computers	Experience running quantum circuits on superconducting and trapped-ion quantum comptuers over the cloud, see publication [3].
High-performance computing	Experience with multiple supercomputing clusters, including the Digital Research Alliance of Canada systems, see publications [2, 4, 9, 10, 13, 15, 16, 17].

Personal details

Date of birth	January 19th 1993
Citizenship	United Kingdom, Canada
Languages	English (native), Welsh (native), French (B1), German (A2).

References

Available on request