Michael Vasmer

Curriculum vitae

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mikevasmer

Experience

2025–present **Inria Starting Faculty Position**, *Inria Paris*

2024–present **Associate Member**, *Institute for Quantum Computing*

2025 **Visiting Fellow**, *Perimeter Institute for Theoretical Physics*

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 E. Browne.

2015–2016 **M.Res. Quantum Technologies**, *University College London*, Distinction
Dissertation: *Swapping between color codes and surface codes*.
Supervisor: Dan E. Browne.

2011–2015 **M.Sci. Natural Sciences**, *Durham University*, First Class Honours

Funding

2025–2026 **Discovering fault-tolerant circuits with generative models**, *IVADO Exploratory Projects Program*, C$100k
Project partners: Inria Paris, Perimeter Institute, Université de Montréal, and University of Waterloo.

2021–2024 **Making noisy quantum processors practical: From theory to applications**, *Natural Sciences and Engineering Research Council of Canada & Innovate UK*, C$330k + £300k
Project partners: Perimeter Institute, Phasecraft Ltd., Quantum Benchmark Inc., University College London, and University of Waterloo.

2021–2022 **IonQ Academic Research Credits Program**, $20k

Publications

[1] T. Hillmann, G. Dauphinais, I. Tzitrin, and M. Vasmer, "Single-shot and measurement-based quantum error correction via fault complexes," *Phys. Rev. A* **112** (Oct, 2025) L040401,

arXiv:2410.12963. Contributed talk at QIP 2025.

[2] B. W. Walshe, B. Q. Baragiola, H. Ferretti, J. Gefaell, M. Vasmer, R. Weil, T. Matsuura, T. Jaeken, G. Pantaleoni, Z. Han, T. Hillmann, N. C. Menicucci, I. Tzitrin, and R. N. Alexander, "Linear-optical quantum computation with arbitrary error-correcting codes," *Phys. Rev. Lett.* **134** (Mar, 2025) 100602, arXiv:2408.04126.

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

[4] 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.

[5] 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.

[6] 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.

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

[8] 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.

[9] 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.

[10] 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.

[11] 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. Contributed talk at TQC 2021.

[12] 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.

[13] 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.

[14] M. Vasmer and A. Kubica, "Morphing quantum codes," *PRX Quantum* **3** no. 3, (Aug., 2022) 030319, arXiv:2112.01446. Contributed talk at TQC 2021.

[15] 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.

[16] 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. Contributed talk at TQC 2021.

[17] 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. Contributed talk at TQC 2021.

[18] 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.

[19] 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.

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

[21] 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] A. Pesah, A. K. Daniel, I. Tzitrin, and M. Vasmer, "Fault-tolerant transformations of spacetime codes," arXiv:2509.09603. Contributed talk at QEC 2025.

[2] E. Dyrenkova, R. Laflamme, and M. Vasmer, "Scalable simulation of fermionic encoding performance on noisy quantum computers," arXiv:2506.06425.

[3] A. Ray, E. Swaroop, N. Cao, M. Vasmer, and A. Chowdhury, "Quasiprobabilistic imaginary-time evolution on quantum computers," arXiv:2505.06343.

[4] 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.

Invited talks

Oct 2025 **Fault-tolerant photonic quantum computing by stitching together resource states**
International Conference on Quantum Photonics, Wenzhou, China

Sep 2025 **Quantum Error Correction and Fault-Tolerant Quantum Computation in the MBQC model**
Graphix workshop, Inria Paris, France

Jun 2025 **Benchmarking quantum error-correcting codes using Monte Carlo sampling**
Teratec Quantum Computing Initative: Quantum Benchmark, Palaiseau, France

May 2025 **Fault-tolerant transformations of spacetime codes**
Quandela x Inria Workshop, Massy, France

Mar 2025 **Teleporting quantum errors: Knill error correction in the era of modern quantum processors**
University of Guelph Department of Mathematics & Statistics Colloquium, Guelph ON, Canada

Jan 2025 **Single-shot and measurement-based quantum error correction via fault complexes**
NISQ2LSQ Workshop, L'université d'Aix-Marseille, Marseille, France

Jul 2024 **Implementing fault-tolerant non-Clifford gates using color codes**
International Conference on Atomic Physics Satellite Workshop, University of Sussex, Brighton, UK

May 2024 **Weight Reduced Stabilizer Codes with Lower Overhead**
Canadian Association of Phyicists Congress, London ON, Canada

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

Mar 2024 **Weight Reduced Stabilizer Codes with Lower Overhead**
Yukawa Institute for Theoretical Physics Error Correction Workshop, Kyoto, Japan

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

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**, *a*, b, c
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, Recording: `https://youtu.be/G24Foy64GEM`

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

Mar 2019 **Cellular automaton decoder for topological codes with boundaries**
Quantum Code Design and Architecture Kick-Off Meeting, Paris, France

Contributed talks

May 2025 **Teleporting quantum errors: Knill error correction in the era of modern quantum processors**
International Conference on Quantum Computing, Paris, France

Feb 2025 **Single-shot and measurement-based quantum error correction via fault complexes**
28th Annual Conference on Quantum Information Processing, Raleigh NC, USA
Recording: `https://youtu.be/7-yhw_JZ1Zg`

Mar 2022 **Morphing quantum codes**
APS March Meeting, Chigaco IL, USA

Jul 2021 **Locally unencoding the color code**
16th Annual Conference of the Theory of Quantum Computation, Communication, and Cryptography (online), Recording: `https://youtu.be/jUYOjC9Z68g`

Mar 2019 **Cellular automaton decoder for topological codes with boundaries**
APS March Meeting, Boston MA, USA

Jul 2018 **Quantum computing with 3D surface codes**
Quantum Roundabout Conference, Nottingham, UK

Seminars

Sep 2025 **qLDPC codes: What are they good for?**
Tutorial at Kavli Institute for Theoretical Physics, Santa Barbara CA, USA, Recording: `https://online.kitp.ucsb.edu/online/stablephases25/vasmer/`

2025 **Fault-tolerant transformations of spacetime codes**
Quobly, Grenoble, France
ENS Lyon, France

Apr 2025 **Review of recent progress in constructing codes with transversal non-Clifford gates**
Perimeter Institute Quantum Information Seminar, Waterloo ON, Canada, Recording: `https://doi.org/10.48660/25040104`

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

Dec 2023 **Decoding the 3D subsystem toric code**
Working Group on Quantum Codes, Inria Paris, France

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

Apr 2022 **Morphing quantum codes**
Riverlane, Cambridge, UK

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`

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

2018 **Quantum computing with 3D surface codes**
Perimeter Institute Quantum Discussions, Waterloo ON, Canada, Recording: `https://doi.org/10.48660/18110080`

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

2026–present Miya Dridi, PhD student at Inria Paris and Télécom Paris (with Patrick Cheinet and Paul Hilaire).

2025–present Etienne Stock, master's student at Inria Paris and TU Munich (with Lucas Berent and Robert Wille).

2025–present Ewan Murphy, PhD student at Inria Paris and Quandela (with Boris Bourdoncle and Anthony Leverrier).

2023-2025 Emiliia Dyrenkova, master's student at the University of Waterloo, supervised for ther thesis on fermionic encodings (with Raymond Laflamme, resulted in preprint [2]).

Summer 2024 Praveen Jayakumar, summer resident at Xanadu Quantum Technologies Inc., supervised for a project on improving decoder performance (with Priya Nadkarni). Applied for and received funding for the position from Mitacs.

Summer 2024 S. Siddardha Chelluri, summer resident at Xanadu Quantum Technologies Inc., supervised for a project on fault-tolerant measurement-based quantum computing (with Ilan Tzitrin).

2021–2024 Annie Ray, PhD student at the University of Waterloo, supervised for a project on quantum error mitigation (with Ningping Cao and Anirban Chowdhury, resulted in preprint [3]).

Summer 2022 Emiliia Dyrenkova, undergraduate student at the University of California, Berkeley, supervised for her USEQIP research project at the Institute for Quantum Computing (with Raymond Laflamme).

Summer 2022 Daniel Honciuc Menendez, undergraduate student at the University of Toronto, supervised for his PSI Start research internship at Perimeter Institute (resulted in publication [5]).

Summer 2021 Eric Huang, Perimeter Scholars International master's student, supervised for his thesis (with Beni Yoshida, resulted in publication [9]).

Teaching

Autumn 2025	Master's (M2) course on quantum information theory for the Master Quantum Engineering at Université Paris Science et Lettres. 32 hours of lectures, assessment of problem sets and final exam.
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.

Community contributions

2025–present	Editor: Quantum – the open journal for quantum science.
2025–present	Organiser: QASAR (Quantum Architectures, Small And Reliable) online seminar series.
2025	Program committee member: 29th Annual Conference on Quantum Information Processing (QIP).
Sep 2025	Organiser: Quantum error correction meets ZX-calculus workshop (Dagstuhl, Germany).
Apr 2025	PhD Thesis examiner: The locality of quantum codes by Nouédyn Baspin, University of Sydney, Australia.
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)
- Journal of Mathematical Physics (1)
- Nature (3)
- Nature Physics (2)
- npj Quantum Information (1)
- Physical Review Letters (3)
- Physical Review X (2)
- PRX Quantum (7)
- Quantum (7)

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)

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.

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 [5].

High-performance computing: Experience with multiple supercomputing clusters, including the Digital Research Alliance of Canada systems, see publications [4, 6, 11, 12, 15, 17, 18, 19].

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.