CURRICULUM VITÆ – COLE COMFORT

PERSONAL INFORMATION

Full Name: Cole Robert Comfort

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RESEARCH INTERESTS

Categorical semantics for quantum computing and quantum error correction.
Monoidal category theory and graphical languages.
Categorical semantics for linear logic.

SELECTED PUBLICATIONS (LAST 5 YEARS)

Complete equational theories for classical and quantum Gaussian relations
Robert I. Booth, Titouan Carette, Cole Comfort. *Preprint*, 2024.
arXiv:2403.10479.

Graphical Symplectic Algebra
Robert I. Booth, Titouan Carette, Cole Comfort. *Preprint*, 2024.
arXiv:2401.07914.

Denotational semantics for Stabiliser Quantum Programs
Robert I. Booth, Cole Comfort. *Preprint*, 2025.
https://colecomfort.github.io/pdfs/QEC.pdf.

Dagger linear logic for categorical quantum mechanics
J.R.B. Cockett, Cole Comfort, Priyaa Srinivasan. *Logical Methods in Computer Science* 17(4), 2021.
DOI: 10.46298/lmcs-17(4:8)2021.

EMPLOYMENT

Postdoctoral Scholar (joint project)
Équipe QUACS, Université Paris-Saclay *December 2024–November 2026 (expected)*
(CNRS, ENS Paris-Saclay, Inria, LMF, Gif-sur-Yvette, France).

Équipe MOCQUA, Université de Lorraine *October 2023–November 2024*
(CNRS, Inria, LORIA, Nancy, France).

Research focus: categorical semantics of quantum computing and quantum error correction. Diagrammatic methods in quantum computing.

Researcher *September 2021–January 2022*
Tallinn Institute of Technology, Estonia.
Supervisor: Prof. Paweł Sobociński.
Research focus: diagrammatic methods in theoretical computer science.

EDUCATION

Doctor of Philosophy, Computer Science, Clarendon Scholar *October 2019–October 2023*
University of Oxford, United Kingdom.
Supervisors: Prof. Aleks Kissinger and Prof. Bob Coecke.
Thesis Title: *A Diagrammatic Approach to Networks of Spans and Relations*.

Thesis Based Master of Science, Computer Science *September 2017–July 2019*
University of Calgary, Canada.
Supervisor: Prof. J.R.B. Cockett.
Thesis Title: *Classifying reversible logic gates with ancillary bits*.
GPA Received: 4.000/4.000.

Bachelor of Science (Honours) First Class, Computer Science *September 2013–June 2017*
University of Calgary, Canada.
Minor: Pure Mathematics.
Concentration: Algorithms and Complexity Theory.
Supervisor: Prof. J.R.B. Cockett.
Thesis Title: *The Category CNOT*.
GPA Received: 3.735/4.000.

Scholarships

Clarendon Fund Scholarship *October 2019–October 2023*
Prestigious scholarship awarded by Oxford University Press to outstanding prospective doctoral students.
Only two recipients per year in Computer Science.
Wrote a research proposal on diagrammatic methods for infinite-dimensional quantum circuits.

Queen Elizabeth II Graduate (Master's) Research Scholarship *2018*
Government of Alberta, awarded for excellence in graduate research.

Queen Elizabeth II Graduate (Master's) Scholarship *2017*
Government of Alberta, awarded for outstanding academic performance.

Graduate Research Award *2017–2018*
Two units, University of Calgary.

Grants

Mitacs Globalink Research Award *September 2018–December 2018*
Project: *Investigating Infinite Dimensional Models of Quantum Computation*.
Visits: Oxford (supervised by Prof. Bob Coecke) and Edinburgh (supervised by Prof. Chris Heunen).
Wrote a successful grant application to obtain travel funding.
Resulted in the publication of the article "Dagger linear logic for categorical quantum mechanics" [6].

Awards

Best Student Paper Award *July 2023*
The Algebra for Stabilizer Codes
19th International Conference on Quantum Physics and Logic (QPL 2023).

Best Student Paper Award *June 2020*
The ZX&-calculus: A complete graphical calculus for classical circuits using spiders
17th International Conference on Quantum Physics and Logic (QPL 2020).

Distinguished Presentation *July 2021*
A Graphical Calculus for Lagrangian Relations
4th International Conference on Applied Category Theory (ACT 2021).

Publications

Conference Publications

[1] J. Hefford and C. Comfort, "Coend optics for quantum combs," p. 63–76, Aug. 2023. [Online]. Available: http://dx.doi.org/10.4204/EPTCS.380.4

[2] C. Comfort and A. Kissinger, "A graphical calculus for Lagrangian relations," *Electronic Proceedings in Theoretical Computer Science*, vol. 372, pp. 338–351, Nov. 2022. [Online]. Available: https://doi.org/10.4204/eptcs.372.24

[3] C. Comfort, "The ZX&-calculus: A complete graphical calculus for classical circuits using spiders (best student paper)," vol. 340. Open Publishing Association, 2021, pp. 60–90. [Online]. Available: https://doi.org/10.4204/eptcs.340.4

[4] J. R. B. Cockett and C. Comfort, "The category TOF," vol. 287. Open Publishing Association, Jan. 2019, pp. 67–84. [Online]. Available: https://doi.org/10.4204/eptcs.287.4

[5] J. R. B. Cockett, C. Comfort, and P. Srinivasan, "The category CNOT," vol. 266. Open Publishing Association, Feb. 2018, pp. 258–293. [Online]. Available: https://doi.org/10.4204/eptcs.266.18

Journal Articles

[6] J. R. B. Cockett, C. Comfort, and P. Srinivasan, "Dagger linear logic for categorical quantum mechanics," *Logical Methods in Computer Science*, vol. Volume 17, Issue 4, Nov. 2021. [Online]. Available: https://doi.org/10.46298/lmcs-17(4:8)2021

Preprints

[7] R. I. Booth and C. Comfort, "Denotational semantics for stabiliser quantum programs," 2025. [Online]. Available: https://colecomfort.github.io/pdfs/QEC.pdf

[8] C. Comfort, "Gaussian probability theory is completely positive," 2025. [Online]. Available: https://colecomfort.github.io/pdfs/SVD.pdf

[9] R. I. Booth, T. Carette, and C. Comfort, "Complete equational theories for classical and quantum Gaussian relations," 2024. [Online]. Available: https://arxiv.org/abs/2403.10479

[10] ——, "Graphical symplectic algebra," 2024. [Online]. Available: https://arxiv.org/abs/2401.07914

[11] C. Comfort, "The algebra for stabilizer codes (best student paper, QPL 2023)," 2023. [Online]. Available: https://arxiv.org/abs/2304.10584

[12] C. Comfort, A. Delpeuch, and J. Hedges, "Sheet diagrams for bimonoidal categories," 2020. [Online]. Available: https://arxiv.org/abs/2010.13361

SERVICE

Program committee member

8th International Conference on Applied Category Theory (ACT 2025).

Journal reviewer

Logical Methods in Computer Science.
Polynesian Journal of Mathematics.
Bulletin of the London Mathematical Society.
ACM Transactions on Quantum Computing.
Journal of Physics A: Mathematical and Theoretical.
Compositionality.

Conference reviewer

53rd ACM SIGPLAN Symposium on Principles of Programming Languages (POPL 2026).
21st International Conference on Quantum Physics and Logic (QPL 2024).
39th Annual ACM/IEEE Symposium on Logic in Computer Science (LICS 2024).
20th International Conference on Quantum Physics and Logic (QPL 2023).
18th Theory of Quantum Computation, Communication and Cryptography (TQC 2023).
19th International Conference on Quantum Physics and Logic (QPL 2022).
47th International Symposium on Mathematical Foundations of Computer Science (MFCS 2022).
25th International Conference on Foundations of Software Science and Computation Structures (FOSSACS 2022).
4th International Conference on Applied Category Theory (ACT 2021).

Organizer

QUACS informal seminar series. *November 2024–ongoing*
ZX-calculus seminar series. *October 2019–July 2021*

TEACHING

Tutor *July 2023*

Quantinuum, Oxford, United Kingdom.
Teaching categorical quantum mechanics to high-school students.
Organized as part of quantum education research project.

Tutor *Michaelmas 2020*

Department of Computer Science, University of Oxford, Oxford, United Kingdom.
Course: Categories, Proofs and Processes.

Tutor *Michaelmas 2020*

Department of Computer Science, University of Oxford, Oxford, United Kingdom.
Course: Quantum Processes and Computation.

Teaching Assistant *Winter Term 2019*

Department of Computer Science, University of Calgary, Calgary, Canada.
Course: CPSC 313, Introduction to Computability.

Teaching Assistant *Winter Term 2018*

Department of Computer Science, University of Calgary, Calgary, Canada.
Course: CPSC 411, Compiler Construction.

Teaching Assistant *Fall Term 2017*

Department of Computer Science, University of Calgary, Calgary, Canada.
Course: CPSC 521, Foundations of Functional Programming.

RESEARCH VISITS

Macquarie University, Sydney, Australia *September 2025*

Invited by Prof. J.S. Lemay in the Centre of Australian Category Theory group in the Department of Mathematics.

Quantinuum, Oxford, United Kingdom *February 2025*

Visited the group of Prof. Bob Coecke at the quantum computing company Quantinuum.
Collaborated with Dr. Giovanni de Felice.

Centre INRIA Saclay, Gif-sur-Yvette, France *May 2024*

Visited the QUACS group in the Laboratoire de Méthodes Formelles.

Technische Universität Dresden, Dresden, Germany *December 2023*
Invited by the geometric methods in mathematics group of Prof. Ulrich Krähmer.

University of Edinburgh, Edinburgh, United Kingdom *November 2023*
Visited Dr. Robert Booth in the Quantum Software group, in the School of Informatics.

Centre Inria Saclay, Gif-sur-Yvette, France *July 2023*
Visited the QUACS group in the Laboratoire de Methodes Formelles.

Centre Inria Nancy – Grand Est, Nancy, France *June 2023*
Visited the MOCQUA group in LORIA.

Università degli Studi di Pisa, Pisa, Italy *May 2023*
Visited Prof. Filippo Bonchi in the Dipartimento di Informatica.

University College London, London, United Kingdom *March 2022*
Visited Prof. Fabio Zanasi in the Programming Principles, Logic and Verification Group in the Department of Computer Science.

University of Edinburgh, Edinburgh, United Kingdom *November-December 2018*
Visited Prof. Chris Heunen in the Quantum Software group in the School of Informatics.

University of Oxford, Oxford, United Kingdom *September-November 2018*
Visited Prof. Bob Coecke in the Quantum Group in the Department of Computer Science.

INVITED TALKS AT INTERNATIONAL COLLOQUIA

TBA *October 2025*
Topos Institute Colloquium (online).
Invited by Dr. David Spivak.

INVITED SEMINAR TALKS

Categorical semantics for discrete time dynamics *September 2025*
Australian Category Seminar, Macquarie University. Sydney, Australia.
Invited by Prof. J.S. Lemay.

String diagrams for classical mechanics *September 2025*
Maths & Stats Seminar, Western Sydney University. Sydney, Australia.
Invited by Prof. Colin Reid.

Syntax and semantics for mechanical processes *September 2025*
Australian Category Seminar, Macquarie University. Sydney, Australia.
Invited by Prof. J.S. Lemay.

A ZX-calculus for continuous-variable Gaussian quantum circuits *May 2024*
QUACS seminar. Centre Inria Paris-Saclay. Gif-sur-Yvette, France.

Graphical algebra and quantum circuits *December 2023*
Technische Universität Dresden. Dresden, Germany.
Invited by the geometric methods in mathematics group of Prof. Ulrich Krähmer.

Graphical Calculi for Phase-Space Representations in Quantum Mechanics *March 2023*
Prague Mathematical Physics Seminar. Charles University. Prague, Czech Republic (online).
Invited by Prof. Branislav Jurčo.

Graphical Symplectic Algebra *May 2023*
Università degli Studi di Pisa. Pisa, Italy.

Graphical Symplectic Algebra *May 2023*
QUACS seminar (online). Centre Inria Paris-Saclay. Gif-sur-Yvette, France.
Invited by Prof. Renaud Vilmart.

Graphical Symplectic Algebra *March 2022*
Programming Principles, Logic, and Verification Group seminar. University College London. London, United Kingdom.

CONFERENCE TALKS

Graphical Symplectic Algebra, *June 2024*
Complete equational theories for classical and quantum Gaussian relations
7th International Conference on Applied Category Theory (ACT 2024).
University of Oxford. Oxford, United Kingdom.
Two consecutive talks.

The Algebra of Stabilizer Codes *July 2023*
19th International Conference on Quantum Physics and Logic (QPL 2023).
Paris, France.

Coend Optics for Quantum Combs *July 2022*
5th International Conference on Applied Category Theory (ACT 2022).
University of Strathclyde. Glasgow, United Kingdom.

A Graphical Calculus for Lagrangian Relations *July 2021*
4th International Conference on Applied Category Theory (ACT 2021).
University of Cambridge. Cambridge, United Kingdom.
Distinguished presentation.

The ZX&-calculus: A complete graphical calculus for classical circuits using spiders *June 2020*
17th International Conference on Quantum Physics and Logic (QPL 2020).
Paris, France (online).

The Category TOF *June 2018*
15th International Conference on Quantum Physics and Logic (QPL 2018).
Dalhousie University. Halifax, Canada.

The Category CNOT *July 2017*
14th International Conference on Quantum Physics and Logic (QPL 2017).
Radboud University. Nijmegen, Netherlands.

WORKSHOP TALKS

A complete equational theory for Gaussian quantum circuits *July 2024*
31st Foundational Methods in Computer Science Workshop (FMCS 2024).
University of Calgary. Kananaskis, Canada.

A phase-space approach to rewriting infinite-dimensional quantum circuits *July 2024*
LHC Days 2024.
Nantes, France.

Graphical Symplectic Algebra *July 2022*
29th Foundational Methods in Computer Science Workshop (FMCS 2022).
University of Calgary. Kananaskis, Canada.

A Graphical Calculus for Lagrangian Relations *June 2021*
Tangent Categories and their Applications.
University of Calgary. Kananaskis, Canada (online).

Circuit Relations for Real Stabilizers: Towards TOF+H *May 2019*
27th Foundational Methods in Computer Science Workshop (FMCS 2019).
University of Calgary. Kananaskis, Canada.

Circuit Relations for Real Stabilizers: Towards TOF+H *May 2019*
4th Symposium on Compositional Structures (SYCO 2019).
Chapman University. Orange, United States.

The Category TOF *May 2018*
26th Foundational Methods in Computer Science Workshop (FMCS 2018).
Mount Allison University. Sackville, Canada.

The Category CNOT *June 2017*
25th Foundational Methods in Computer Science Workshop (FMCS 2017).
University of Ottawa. Ottawa, Canada.

The Category CNOT *May 2017*
Calgary Applied and Industrial Mathematical Sciences Conference.
University of Calgary. Calgary, Canada.