

Chris Heunen – Curriculum Vitae

Personal details

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- Address: Department of Computer Science, Wolfson Building, Parks Road, Oxford, OX1 3QD, United Kingdom
- Children: Tristan (2011), Nora (2014)



Employment history

- 2014–present: EPSRC Early Career Research Fellow at University of Oxford.
- 2014–present: Lecturer at St. Hugh's College Oxford.
- 2013–2014: Senior Research Fellow at University of Oxford.
- 2011–2013: Research Assistant at University of Oxford.
- 2009–2012: Visiting researcher at California Institute of Technology.
- 2009–2011: NWO Rubicon Research Fellow at University of Oxford.
- 2005–2009: Junior Researcher at Radboud University Nijmegen.
- 2000–2008: Various teaching assistantships at Radboud University Nijmegen.

Academic history

- 1/2010: PhD in Mathematics and Computer Science, Radboud University Nijmegen.
- 9/2005: MSc in Mathematics (*cum laude*), Radboud University Nijmegen.
- 9/2005: MSc in Computer Science (*cum laude*), Radboud University Nijmegen.

Funding history

- EPSRC Early Career Fellowship, *Combining Viewpoints in Quantum Theory*, PI, 2013–2018.
- JMH Junior Research Fellowship, Linacre College, Oxford, 2010–2012, re-elected 2013.
- NWO Rubicon Fellowship, *Quantum Theory and Categorical Logic*, PI, 2009–2011.
- British Council and Platform Bèta-Techniek conference grant, *Categorical Flow of Information in Quantum Physics and Linguistics*, co-PI, 2009.
- NWO conference grant, *Sheaves and Geometry in Quantum Theory*, PI, 2008.

Honours

- Birkhoff–von Neumann prize, International Quantum Structures Association, 2012.
- Aia Software award, best BSc thesis in Computer Science, 2003.
- National CIVI award, Royal Holland Society of Sciences and Humanities, 2000.

Administrative activities

- Programme committee: *Foundations of Software Science and Computation Structures (FoSSaCS)* 2016, *Quantum Physics and Logic (QPL)* 2015 (co-chair), 2014.
- Organiser *Quantum Physics and Logic* conference, Oxford, 2015.
- Returned by the University of Oxford for the *Research Excellence Framework* 2014.
- Linacre College governing body JRF representative, 2013.
- Convenor of weekly *OASIS seminar*, Oxford, 2011–present.
- Organiser of weekly *Quantum Lunch seminar*, Oxford, 2012–2014.
- Organiser *Categorical Flow of Information in Quantum Physics and Linguistics* workshop, Oxford, 10/2010.
- Maintainer of *Oxford Quantum Talks* online video archive (≥ 300 talks), 2009–present.
- Organiser *Sheaves and Geometry in Quantum Theory* workshop, Nijmegen, 09/2008.
- Organiser reading group *Homotopy Type Theory*, 2013–2014.
- Organiser reading group on *Quantum Logic and Quantum Information*, 2006–2008.

Teaching

- MSc course *Categorical Quantum Mechanics*, University of Oxford, 2011–2015: Lectures, writing lecture notes/book, creating coursework, creating exam, marking exam.
- BSc course *Logic and Proof*, University of Oxford, 2014–2015: Lectures, creating coursework, creating exam, marking exam.
- MSc course *Toposes in the Foundations of Quantum Mechanics*, University of Zurich, 2011: Lectures, writing lecture notes, creating coursework.
- BSc tutorials, St. Hugh's College Oxford, 2014–2015:
 - Linear algebra.
 - Functional programming.
 - Algorithms.
 - Continuous mathematics.
- Plenary tutorial *Introduction to Monoidal Categories*:
 - Spring school on Quantum Foundations and Categories, Oxford, 2014: Lectures.
 - QICS Spring school, Oxford, 2010: Lectures.
- Twelve teaching assistantships, Radboud University Nijmegen, 2000–2008: Tutorials, marking.
 - Discrete mathematics (1st year course, three times).
 - Functional programming (1st year course).
 - Imperative programming (1st year course).
 - Logic (2nd year course).
 - Introduction to Compilers (3rd year course).
 - Introduction to Complexity Theory (3rd year course, twice).
 - Security (3rd year course, twice).
 - Hilbert spaces and quantum mechanics (4th year course).
- Supervision:
 - O. Cunningham, DPhil 2017.
 - S. Tull, DPhil 2017.
 - V. Patta, DPhil 2016.
 - J. H. M. N. Kopp, DPhil 2015.
 - M. Karvonen, MSc 2014 (distinction).
 - M. Gachechiladze, MSc 2014.
 - A. Coladangelo, BSc 2014.
 - P. Hoorn, MSc 2010 (distinction).
 - K. Cohn–Gordon, MSc 2010 (distinction).

Reviewing services

- EPSRC
- Journals: *Journal of Algebra*, *Journal of Pure and Applied Algebra*, *Theory and Applications of Categories*, *Applied Categorical Structures*, *Order*, *Annals of Pure and Applied Logic*, *Communications in Mathematical Physics*, *Journal of Mathematical Physics*, *Proceedings of the Royal Society A*, *Journal of Physics A*, *Foundations of Physics*, *Semigroup Forum*, *Synthese*, *Studia Logica*, *Logical Methods in Computer Science*, *Mathematical Structures in Computer Science*, *Journal of Logic and Computation*, *Mathematical Logic Quarterly*, *Information Processing Letters*, *International Journal of Theoretical Physics*, *Studies in the History and Philosophy of Modern Physics*, *Journal of Applied Non-Classical Logic*, *Quantum Studies: Mathematics and Foundations*, *Axioms*, *SIGMA*
- Conferences: LiCS, CSL, ICALP, FoSSaCS, CONCUR, MFPS, CALCO, QPL, Calculemus
- Mathematical Reviews, Computing Reviews

Professional Organisations

- American Mathematical Society
- Royal Dutch Mathematical Society
- International Quantum Structures Association
- European Association for Theoretical Computer Science
- Association for Computing Machinery, Special Interest Group on Logic and Computation

Selected invited presentations

- Higher TQFT and categorical QM workshop, ESI Institute Vienna, 10/2015.
- Domains XII conference, University College Cork, 9/2015
- CALCO conference, Radboud University Nijmegen, 6/2015.
- Second Amsterdam Quantum Logic workshop, University of Amsterdam, 5/2015.
- Departmental Computer and Information Sciences seminar, University of Strathclyde Glasgow, 3/2015
- Algebra seminar, Heriot–Watt University Edinburgh, 3/2015
- Laboratory for Foundations of Computer Science seminar, University of Edinburgh, 3/2015
- Quantum Structures conference, University of Olomouc, 6/2014.
- Departmental Computer Science seminar, University of Southampton, 6/2014.
- Departmental Computer Science seminar, University of Oxford, 4/2014.
- Mathematics colloquium, Bowdoin College, 4/2014.
- Amsterdam Quantum Logic Workshop, University of Amsterdam, 3/2014.
- Philosophy of Mechanics workshop, Université Paris Diderot, 2/2014.
- World Congress of Paraconsistent Logic, Indian Statistical Institute Calcutta, 2/2014.
- Theory seminar, Queen Mary University of London, 1/2014.
- Whither quantum structures workshop, Vrije Universiteit Brussel, 11/2013.
- LogIC seminar, Imperial College London, 10/2013.
- Quantum Information & Foundations conference, University of British Columbia, 7/2013.
- Functional Analysis seminar, University of Oxford, 1/2013.
- Quantum Structures conference, University of Cagliari, 7/2012.
- Quantum geometry seminar, University of California at Berkeley, 3/2012.
- Category theory seminar, University of Cambridge, 1/2012.
- Mathematical Physics seminar, Institute of Technology Zurich, 5/2011.
- Classical and Quantum Information Flow workshop, Bellairs Institute Barbados, 4/2011.
- Institute for Quantum Information seminar, Caltech Institute of Technology, 4/2011.
- Mathematical Physics seminar, University of California at San Diego, 3/2011.
- Algebra seminar, Free University Brussels, 1/2011.
- Mathematical aspects of foundations of physics seminar, University of Oxford, 1/2011.
- Noncommutative geometry seminar, California Institute of Technology, 12/2010.
- Algebra seminar, Masaryk University Brno, 9/2010.
- Quantum Field Theory seminar, University of Oxford, 5/2010.
- Theory seminar, University of Birmingham, 1/2010.
- Institute for Quantum Information seminar, California Institute of Technology, 11/2009.
- Analytic topology seminar, University of Oxford, 11/2009.
- Algebra|Coalgebra seminar, University of Amsterdam, 11/2009.
- Mathematics seminar, University of Tokyo, 6/2009.
- Research Institute Mathematical Sciences seminar, University of Kyoto, 6/2009.
- Mathematics seminar, University of Cambridge, 01/2009.
- Foundational structures for quantum information conference, Obergurgl, 9/2008.
- Categories, logic and foundations of physics workshop, Imperial College London, 1/2008.
- Formal Topology conference, Padova, 5/2007.

International research visits

- Bowdoin College (USA): 2 weeks, 4/2014.
- University of California at Berkeley (USA): 1 week, 3/2012.
- University of Zurich (Switzerland): 2 weeks, 5/2011.
- University of California at San Diego (USA): 1 week, 3/2011.
- Free University Brussels (Belgium): 1 week, 1/2011.
- Masaryk University Brno (Czech Republic): 1 week, 8/2010.
- Research Institute for Mathematical Sciences, Kyoto (Japan): 4 weeks, 6/2009.
- University of Cambridge (United Kingdom): 1 week, 1/2009.
- University of British Columbia (Canada): 5 months, 1–5/2004.

Books

1. C. Heunen and J. Vicary, “Categories for Quantum Theory”, *Oxford University Press*, in press, 2015.
2. C. Heunen, M. Sadrzadeh, and E. Grefenstette (editors), “Quantum Physics and Linguistics”, *Oxford University Press*, 2013.
3. C. Heunen, “Categorical Quantum Models and Logics”, *Amsterdam University Press*, 2009.

Journals

4. B. Coecke and C. Heunen, “Pictures of Complete Positivity in Arbitrary Dimension”, *Information and Computation*, 2014.
5. B. van den Berg and C. Heunen, “Extending Obstructions to Noncommutative Functorial Spectra”, *Theory and Applications of Categories* 29(17):457–474, 2014.
6. B. Coecke, C. Heunen, and A. Kissinger, “Categories of Quantum and Classical Channels”, *Quantum Information & Computation*, 2014.
7. R. Kunjwal, C. Heunen, T. Fritz, “All Joint Measurability Structures are Quantum Realizable”, *Physical Review A* 89(5):052126, 2014.
8. C. Heunen, “Characterizations of Categories of Commutative C^* -subalgebras”, *Communications in Mathematical Physics* 331(1):215–238, 2014.
9. C. Heunen, T. Fritz, M. L. Reyes, “Quantum Theory Realises all Joint Measurability Graphs”, *Physical Review A* 89(3):032121, 2014.
10. C. Heunen and M. L. Reyes, “Active Lattices Determine AW^* -algebras”, *Journal of Mathematical Analysis and Applications* 416:289–313, 2014.
11. C. Heunen and C. Horsman, “Matrix Multiplication is Determined by Orthogonality and Trace”, *Linear Algebra and its Applications* 439(12):4130–4134, 2013.
12. C. Heunen and M. L. Reyes, “Diagonalizing Matrices over AW^* -algebras”, *Journal of Functional Analysis* 264(8):1873–1898, 2013.
13. C. Heunen, I. Contreras, and A. Cattaneo, “Relative Frobenius Algebras are Groupoids”, *Journal of Pure and Applied Algebra* 217(1):114–124, 2013.
14. S. Boixo and C. Heunen, “Entangled and Sequential Quantum Protocols with Dephasing”, *Physical Review Letters* 108:120402, 2012.
15. C. Heunen, “Complementarity in Categorical Quantum Mechanics”, *Foundations of Physics* 42(7):856–873, 2012.
16. B. van den Berg and C. Heunen, “Noncommutativity as a Colimit”, *Applied Categorical Structures* 20(4):393–414, 2012.
17. C. Heunen, N. Landsman, B. Spitters, S. Wolters, “The Gelfand Spectrum of a Noncommutative C^* -algebra”, *Journal of the Australian Mathematical Society* 90:39–52, 2011.
18. C. Heunen, N. Landsman, and B. Spitters, “Bohrification of Operator Algebras and Quantum Logic”, *Synthese* 186(3):719–752, 2012.
19. C. Heunen and B. Jacobs, “Quantum Logic in Dagger Kernel Categories”, *Order*, 27(2):177–212, 2010.
20. M. Caspers, C. Heunen, N. Landsman, and B. Spitters, “Intuitionistic Quantum Logic of an n -level System”, *Foundations of Physics* 39(7):731–759, 2009.
21. C. Heunen, “An Embedding Theorem for Hilbert Categories”, *Theory and Applications of Categories* 22(13):321–344, 2009.

22. C. Heunen, N. Landsman, B. Spitters, “A Topos for Algebraic Quantum Theory”, *Communications in Mathematical Physics* 291:63–110, 2009.
23. C. Heunen, B. Jacobs, and I. Hasuo, “Categorical Semantics for Arrows”, *Journal of Functional Programming*, 19(3-4):403–438, 2009.
24. C. Heunen, “Compactly Accessible Categories and Quantum Key Distribution”, *Logical Methods in Computer Science* 4(4), 2008.
25. C. Heunen and D. van Leijenhorst, “Tensegrities, of houtje-touwtje-figuren”, *Nieuw Archief voor Wiskunde* 5(4):279–284, 2004.

Conference proceedings

26. C. Heunen, A. J. Lindenhovius, “Domains of Commutative C^* -subalgebras”, *Logic in Computer Science*, 2015.
27. C. Heunen, J. Vicary, and L. Wester, “Mixed Quantum States in Higher Categories”, *Quantum Physics and Logic XI*, Electronic Proceedings in Theoretical Computer Science 172:304–315, 2014.
28. C. Heunen, “Piecewise Boolean Algebras and their Domains”, *International Colloquium on Automata, Languages, and Programming*, Lecture Notes in Computer Science 8573: 208–219, 2014.
29. C. Heunen, A. Kissinger, and P. Selinger, “Completely Positive Projections and Biproducts”, *Quantum Physics and Logic X*, Electronic Proceedings in Theoretical Computer Science 171:71–83, 2013.
30. B. Coecke, C. Heunen, and A. Kissinger, “A Category of Classical and Quantum Channels”, *Quantum Physics and Logic IX*, Electronic Proceedings in Theoretical Computer Science 158:1–14, 2012.
31. B. Coecke and C. Heunen, “Pictures of Complete Positivity in Arbitrary Dimension”, *Quantum Physics and Logic VIII*, Electronic Proceedings in Theoretical Computer Science 95:27–35, 2012.
32. C. Heunen and S. Boixo, “Completely Positive Classical Structures and Sequentializable Quantum Protocols”, *Quantum Physics and Logic VIII*, Electronic Proceedings in Theoretical Computer Science 95:91–101, 2012.
33. B. van den Berg and C. Heunen, “No-go Theorems for Functorial Localic Spectra of Noncommutative Rings”, *Quantum Physics and Logic VIII*, Electronic Proceedings in Theoretical Computer Science 95:21–25, 2012.
34. S. Abramsky and C. Heunen, “ H^* -algebras and Nonunital Frobenius Algebras” *Clifford Lectures*, Symposia in Applied Mathematics 71:1–24, American Mathematical Society, 2012.
35. I. Hasuo, C. Heunen, B. Jacobs, and A. Sokolova, “Coalgebraic Components in a Many-sorted Microcosm”, *Conference on Algebra and Coalgebra III*, Lecture Notes in Computer Science 5728:64–80, 2009.
36. C. Heunen and B. Jacobs, “Quantum Logic in Dagger Kernel Categories”, *Quantum Physics and Logic VI*, Electronic Notes in Theoretical Computer Science 270(2):79–103, 2009.
37. C. Heunen, “Semimodule Enrichment”, *Mathematical Foundations of Programming Semantics XXIV*, Elec. Notes in Th. Comp. Sci. 218:193–208, 2008.
38. C. Heunen, N. Landsman, and B. Spitters, “The Principle of General Covariance”, *Internat. Fall Workshop on Geometry and Physics XVI*, American Institute of Physics 1023(1):93–102, 2008.
39. C. Heunen and B. Jacobs, “Arrows, like Monads, are Monoids”, *Mathematical Foundations of Programming Semantics XXII*, Elec. Notes in Th. Comp. Sci. 158:219–236, 2006.
40. C. Heunen, “Accurate Silhouettes—Do Polyhedral Models Suffice?”, *Geometric Modeling and Graphics III*, 69–74, IEEE Conference Proceedings, 2003.

Book chapters

41. S. Abramsky and C. Heunen, “Operational Theories and Categorical Quantum Mechanics”, *Logic & Algebraic Structures in Quantum Computing & Information* (editors: J. Chubb, V. Harizanov), *Association for Symbolic Logic, Cambridge University Press, Lecture Notes in Logic*, in press, 2015.
42. C. Heunen, “On the functor ℓ^2 ”, *Computation, Logic, Games, and Quantum Foundations* (editor: P. Panangaden), *Springer*, 2013.
43. B. Coecke, C. Heunen, and A. Kissinger, “Compositional Quantum Logic”, *Computation, Logic, Games, and Quantum Foundations* (editor: P. Panangaden), *Springer*, 2013.
44. C. Heunen, N. Landsman, and B. Spitters, “Bohrification”, *Deep Beauty: Understanding the Quantum World through Mathematical Innovation* (editor: H. Halvorson), *Cambridge University Press*, 2011.

Under submission

45. J. Barrett, C. Heunen, C. Horsman, M. Pusey, and R. Spekkens, “Can quantum states extend over time?” *Nature Communications*, 2015.
46. C. Heunen and M. L. Reyes, “On Discretization of C*-algebras”, *Bulletin of the London Mathematical Society*, 2015.
47. C. Heunen and A. Kissinger, “Can quantum theory be characterized in information-theoretic terms?” *Information and Computation*, 2015.
48. C. Heunen and M. Karvonen, “Reversible Monadic Computation” *Mathematical Foundations of Programming Semantics*, 2015.
49. C. Heunen, “The Many Classical Faces of Quantum Structures”, *Handbook of Quantum Interpretations*, 2015.
50. O. Cunningham and C. Heunen, “Axiomatizing categories of completely positive maps” *Quantum Physics and Logic XII*, 2015.
51. C. Heunen, A. Kissinger, and J. Vicary, “Categorical constructions of complete positivity” *Symmetry*, 2015.