
Dr. Matthew Saul Leifer

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Work Experience

Academic Positions

Part Time Research Associate Dec. 2010 - Present
Department of Physics and Astronomy, University College London, London, UK

Leave of absence due to illness Apr. 2008 - Nov. 2010

Postdoctoral Fellow in Quantum Information Theory Jan. 2007 - Apr. 2008
Institute for Quantum Computing/Department of Applied Math, University of Waterloo, ON, Canada

Associate Postdoctoral Fellow in Quantum Foundations Jan. 2007 - Apr. 2008
Perimeter Institute for Theoretical Physics, Waterloo, ON, Canada

Research Associate in Quantum Information Theory and Quantum Foundations Oct. 2006 - Jan. 2007
Centre for Quantum Computing, DAMTP, University of Cambridge, Cambridge, UK

Postdoctoral Fellow in Quantum Information Theory and Quantum Foundations Jan. 2004 - Sep. 2006
Perimeter Institute for Theoretical Physics, Waterloo, ON, Canada

Research Assistant in Quantum Information Theory Nov. 2003 - Dec. 2003
School of Mathematics, University of Bristol, Bristol, UK

Teaching Experience

Graduate Lecturing

- Introduction to Bayesian Networks (three lectures), University of Queensland, Australia, Oct. 2005

Undergraduate Lecturing

- MATH137 (Intro. Calculus for Math Hons.), University of Waterloo, Canada, Sep. 2007 — Dec. 2007
- Advanced Quantum Mechanics (two lectures covering for lecturer's absence), University of Waterloo, Canada, Sep. 2006
- Interpretations of Quantum Mechanics: Current Status and Future Directions (guest lecture on Quantum Logic), University of Waterloo, Canada, Mar 2005

Undergraduate Tutoring

- Mathematics 1A (Math for 1st year Physics, Chemistry and Economics Students), University of Bristol, UK, Oct. 2000 — June 2003

Undergraduate Computer Lab Demonstrating

- Mathematics 1A (Maple and MATLAB), University of Bristol, UK, Oct. 2001 — June 2003

Research Student Supervision

T. Waterhouse

Jan. 2008 - Apr. 2008

visiting Ph.D. student from University of British Columbia

Project: Temporal Joint Measurements

O. Dahlsten

July 2007 - Sep. 2007

visiting Ph. D. student from Imperial College

Project: Unentangled Bit Commitment in Generic Probabilistic Models

R. Morris

June 2007 - Aug. 2007

University of Waterloo Undergraduate Research Student

Project: Distinguishability as a Resource Theory

Education

Ph.D. in Applied Mathematics

Oct. 2003

University of Bristol (Bristol, United Kingdom)

Research area: Quantum Information Theory

Thesis Title: Entangled Quantum Dynamics. Advisor: Prof. Noah Linden.

Cert. of Advanced Studies in Mathematics (Maths Tripos Part III)

July 2000

University of Cambridge (Cambridge, United Kingdom)

Passed with distinction

B.Sc. in Physics with Theoretical Physics

July 1999

University of Manchester (Manchester, United Kingdom)

Passed with 1st class hon.

Publications

Articles in Refereed Journals

- “[Entropy and Information Causality in General Probabilistic Theories](#)” H. Barnum, J. Barrett, L. Clark, M. Leifer, R. Spekkens, N. Stepanik, A. Wilce, and R. Wilke. *New J. Phys.*, 2010, Volume 12, pp. 033024. eprint arXiv:0909.5075
- “[The de Finetti Theorem for Test Spaces](#)” J. Barrett and M. Leifer. *New J. Phys.*, 2009, Volume 11, pp. 033024. eprint arXiv:0712.2265
- “[Quantum Graphical Models and Belief Propagation](#)” M. Leifer and D. Poulin. *Ann. Phys.*, 2008, Volume 323, pp. 1899. eprint arXiv:0708.1337
- “[Generalized No-Broadcasting Theorem](#)” H. Barnum, J. Barrett, M. Leifer, and A. Wilce. *Phys. Rev. Lett.*, 2007, Volume 99, pp. 240501. eprint arXiv:0707.0620
- “[Quantum Dynamics as an Analog of Conditional Probability](#)” M. S. Leifer. *Phys. Rev. A*, 2006, Volume 74, pp. 042310. eprint arXiv:quant-ph/0606022
- “[Bell's Jump Process in Discrete Time](#)” J. Barrett, M. Leifer, and R. Tumulka. *Europhysics Letters*, 2005, Volume 72, pp. 685—690. eprint arXiv:quant-ph/0506066
- “[Pre- and Post-Selection Paradoxes and Contextuality in Quantum Mechanics](#)” M. S. Leifer and R. W. Spekkens. *Phys. Rev. Lett.*, 2005, Volume 95, pp. 200405. eprint arXiv:quant-ph/0412178
- “[Measuring Polynomial Invariants of Multi-Party Quantum States](#)” M. S. Leifer, N. Linden, and A. Winter. *Phys. Rev. A*, 2004, Volume 69, pp. 052304. eprint arXiv:quant-ph/0308008
- “[Optimal Entanglement Generation from Quantum Operations](#)” M. S. Leifer, L. Henderson, and N. Linden. *Phys. Rev. A*, 2003, Volume 67, pp. 012306. eprint arXiv:quant-ph/0205055
- “[Optimal Simulation of Two-Qubit Hamiltonians using General Local Operations](#)” C. H. Bennett, J. I. Cirac, M. S. Leifer, D. W. Leung, N. Linden, S. Popescu, and G. Vidal. *Phys. Rev. A*, 2002, Volume 66, pp. 012305. eprint arXiv:quant-ph/0107035

Articles in Conference Proceedings

- “[Nonclassicality without Entanglement Enables Bit Commitment](#)” H. Barnum, O. C. O. Dahlsten, M. Leifer, and B. Toner. *IEEE Information Theory Workshop*, 2008. eprint arXiv:0803.1264. Appeared in Proceedings of IEEE Information Theory Workshop 2008 pp. 386—390.
- “[Teleportation in General Probabilistic Theories](#)” H. Barnum, J. Barrett, M. Leifer, and A. Wilce. *Clifford Lectures*, 2008. eprint arXiv:0805.3553. To appear in Proceedings of Symposia in Applied Mathematics (AMS).
- “[Conditional Density Operators and the Subjectivity of Quantum Operations](#)” M. S. Leifer. *Foundations of Probability and Physics—4*, 2006. eprint arXiv:quant-ph/0611233. Appeared in AIP Conference Proceedings vol. 889 edited by G. Adenier, C. A. Fuchs and A. Yu. Khrennikov, pp. 172—186 (2007).
- “[Logical Pre- and Post-Selection Paradoxes, Measurement-Disturbance and Contextuality](#)” M. S. Leifer and R. W. Spekkens. *Quantum Structures*, 2004. eprint arXiv:quant-ph/0412179. Appeared in Int. J. Theor. Phys. vol. 44 pp. 1977—1987 (2005).

Preprints

- “[Formulating Quantum Theory as a Causally Neutral Theory of Bayesian Inference](#)” M. S. Leifer and R. W. Spekkens. 2011. eprint arXiv:1107.5849
- “[Cloning and Broadcasting in Generic Probabilistic Theories](#)” H. Barnum, J. Barrett, M. Leifer, and A. Wilce. 2006. eprint arXiv:quant-ph/0611295
- “[Nondeterministic Testing of Sequential Quantum Logic Propositions on a Quantum Computer](#)” M. S. Leifer. 2005. eprint arXiv:quant-ph/0509193

Talks and Poster Presentations

Invited Talks at Conferences and Workshops

- Pictures, Quanta, Probability. Oxford, UK. Aug. 2010.
- Mini-Workshop on Quantum Foils. Pavia, Italy. Dec. 2007.
- Quantum Information Theory in Quantum Gravity. Perimeter Institute, Canada. Dec. 2007.
- Operational Probabilistic Theories as Foils to Quantum Theory. Cambridge, UK. July 2007.
- Operational Quantum Physics and the Quantum-Classical Contrast. Perimeter Institute, Canada. June 2007.
- Foundations of Physics and Probability—4. Växjö, Sweden. June 2006.
- Being Bayesian in a Quantum World. Konstanz, Germany. Aug. 2005.
- Quantum Information, Computation and Logic. Perimeter Institute, Canada. July 2005.
- QuICT Network Meeting. Abingdon, UK. July 2003.

Contributed Talks at Conferences, Workshops and Summer Schools

- APS March Meeting. Denver, USA. Mar. 2007.
- Operator Structures in Quantum Information. Banff, Canada. Feb. 2007.
- Cats, Kets and Cloisters. Oxford, UK. July 2006.
- Quantum Structures 2006. Malta. July 2006.
- APS March Meeting. Baltimore, USA. Mar. 2006.
- Summer School on Philosophy, Probability and Physics. Konstanz, Germany. Aug. 2005.
- Quantum Structures 2004. Denver, USA. July 2004.
- 4th European QIPC Workshop. Oxford, UK. July 2003.
- Informal Quantum Information Gathering. Imperial College, London, UK. Sep. 2002.
- Winter School on "QuEnt" Quantum Entanglement and Quantum Information. Les Houches, France. Mar. 2001.

Poster Presentations at Conferences and Workshops

- The Seventh International Conference on Quantum Communication, Measurement and Computing. Glasgow, UK. July 2004.
- Reference Frames and Superselection Rules in Quantum Information Theory. Perimeter Institute, Canada. July 2004.
- MaPhySto/QUANTOP Workshop on Quantum Measurements and Quantum Stochastics. Aarhus, Denmark. Aug. 2003.
- The Sixth International Conference on Quantum Communication, Measurement and Computing. MIT, Cambridge, USA. July 2002.
- Quantum Information: Conceptual Foundations, Developments and Perspectives. Oviedo, Spain. July 2002.

Seminars Given in the Last Twelve Months

- Quantum Information Seminar. University of Toronto, ON, Canada. May 2011.
- Quantum Foundations Seminar. Perimeter Institute, Waterloo, ON, Canada. May 2011.
- Quantum Information Group Meeting. Université de Sherbrooke, QC, Canada. May 2011.
- Quantum Information Group Meeting. IQC, University of Waterloo, ON, Canada. Apr. 2011.
- Quantum Information and Foundations Seminar. University of Cambridge, Cambridge, UK. Mar. 2011.
- Quantum Dynamics Seminar. Royal Holloway, University of London, London, UK. Feb. 2011.
- Quantum Information Seminar. Imperial College, London, UK. Dec. 2010.

Scholarships and Awards

- Mary Higgins Postgraduate Scholarship. Girton College, Cambridge, 2000
- C. B. West Postgraduate Prize in Mathematics. Girton College, Cambridge, 2000
- Platt Prize in Physics. University of Manchester, 1999
- Heginbottom Exhibition for best performance in first year exams in Physics. University of Manchester, 1997

Academic Service

Committees

- Postdoc Representative, Postdoc Hiring Committee, Perimeter Institute, Canada, Nov. 2004 - June 2005
- Postdoc Representative, Quantum Information Faculty Hiring Committee, Perimeter Institute, Canada, Jan. 2004 - June 2005

Refereeing for International Journals

- Foundations of Physics, Journal of Physics A, New Journal of Physics, Philosophy of Science, Physical Review A, Physical Review Letter, Quantum Information and Computation, Studies in the History and Philosophy of Modern Physics

Editorial Work

- Editorial board member, "The Quantum Times", newsletter of the APS Topical Group on Quantum Information, Jan. 2008

Confereces, Workshops and Summer Schools Organized

- Invited Session on Quantum Information Meets Gravitation, APS March Meeting, New Orleans, USA (co-organized with L. Viola), Mar. 2008
- Quantum Foundations Summer School, Perimeter Institute, Canada (co-organized with H. Burton and L. Hardy), Aug. 2007
- Workshop on Quantum Information, Computation and Logic: Exploring New Connections, Perimeter Institute, Canada (co-organized with H. Barnum), July 2005

Discussion Groups Organized

- Contextuality Workgroup of Perimeter Institute Experts (CoWPIE), Perimeter Institute, Canada, 2004 - 2005
- Quantum Information Journal Club, University of Bristol, UK, 2002 - 2003

Additional Items

Research Grants

- 2008: 7,500USD FQXi mini-grant (Foundational Questions Institute <http://www.fqxi.org>) for APS Invited Session: Quantum Information Meets Gravitation — Role: Principal Investigator
- 2007 - 2011: 70,000USD FQXi award (Foundational Questions Institute <http://www.fqxi.org>) for project on Abstract Quantum Probability — Role: Principal Investigator

Summer Schools Attended

- Aug. 2005: Summer School on Philosophy, Probability and Physics, Konstanz, Germany
- July 2004: Summer School on Foundations of Physical Theories, Urbino, Italy
- Mar. 2001: Winter School on "QuEnt" Quantum Entanglement and Quantum Information, Les Houches, France

Articles In Progress

- "Quantum Conditional States" M. S. Leifer and R. W. Spekkens
- "Quantum State Compatibility and Pooling in the Conditional States Formalism" M. S. Leifer and R. W. Spekkens
- "Quantum Causal Networks and Influence Diagrams" M. S. Leifer
- "Retrodiction in Quantum Bayesianism, or Why Wigner's Friend is Fuchs' Enemy" M. S. Leifer
- "Reverse Distinguishability" R. Morris and M. S. Leifer

Last updated: Aug. 2, 2011