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Google Scholar: <http://bit.ly/1pCHT3K>
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MISSION STATEMENT

The biological evolution of the human race is reaching a plateau. The only mechanism for us to advance further is via technology. The 20th century was that of the transistor, gifting us unprecedented progress as a species, on an exponential trajectory. However, that trajectory is rapidly approaching saturation. The 21st century will usher in entirely new technologies, far beyond just incremental developments in our current ones. Quantum technology will be one of them, transforming the world as profoundly as the transistor did. My mission is to contribute to the realisation of this, propelling the human race into the future, benefiting all of humanity, blind to demographics and national borders. Together we will make the future — *Carpe futurum. Ad astra per alas fideles. Scientia potentia est.*

EXECUTIVE SUMMARY

- ◇ ARC Future Fellow – AU\$1,024,302 (2016-2020)
- ◇ Lead author & editor of book “*The Quantum Internet – A New Frontier*” (accepted for publication by Cambridge University Press, 2019)
- ◇ 49 publications in international peer-reviewed journals (including 2 in *Science*, 5 in *Physical Review Letters*, 1 in *Optica*), 2 book chapters, 2 popular articles
- ◇ ~1,500 citations, H-index 21, i10-index 39 (via [Google Scholar](https://scholar.google.com/citations?user=peter.rohde))
- ◇ Senior Lecturer in Centre for Quantum Software & Information, University of Technology Sydney (UTS:Q|SI)
- ◇ Recipient of United States National Science Foundation (NSF) grant – US\$9,999 (2014)
- ◇ PhD in theoretical physics (University of Queensland, Australia)
- ◇ Bachelor of Computer Systems Engineering (First Class Honours, GPA 6.6 of 7, University of Queensland, Australia)
- ◇ Fluent English & German
- ◇ Main academic contributions: the quantum internet, quantum economics & quantum politics, spectral structure of photons, mode-matching effects, cluster state quantum computing, quantum algorithms, quantum metrology, quantum walks & boson-sampling, encrypted quantum computation
- ◇ Experience in academia and private sector industry
- ◇ Previous employers: University of Technology Sydney, Oxford University, Max-Planck Institute, University of Queensland, University of Paderborn, Macquarie University, Centre for Quantum Computation & Communication Technology, Centre for Engineered Quantum Systems, Centre for Quantum Computation & Intelligent Systems, Centre for Quantum Software & Information, Institute for Molecular Bioscience, Andrew Corp.
- ◇ Invited speaker at major international conferences
- ◇ Extensive conference organising experience
- ◇ Teaching experience across many disciplines
- ◇ Extensive community & charity work
- ◇ Mountaineer, paraglider, rock climber, freediver, marathon runner, percussionist, DJ, composer, charity worker & stand-up comedian, Armidale Young Citizen of the Year
- ◇ Expelled from pre-school

Nationality: Australian & German
Date of birth: 28th September, 1981



EDUCATION

- University of Queensland**, Brisbane, Australia (2004-2007)
- ◇ **PhD in Theoretical Physics** (supervisor Prof. Timothy Ralph)
 - ◇ Conferral date: April 10, 2008
 - ◇ University of Queensland Postgraduate Research Scholarship
 - ◇ Research topics: quantum computation, quantum optics & quantum information theory
 - ◇ 3 months on exchange at the Max-Planck Institute for the Science of Light, Germany (Prof. Christine Silberhorn)
 - ◇ Visits to Ultrafast Group at Oxford University, UK (Prof. Ian Walmsley), National Institute of Informatics, Japan (Prof. Kae Nemoto), Hewlett-Packard Labs, UK (Dr. William Munro)
 - ◇ Organising committee of departmental Colloquia

University of Queensland, Brisbane, Australia (2000-2003)

- ◇ **Bachelor of Computer Systems Engineering**
- ◇ **First Class Honours**
- ◇ Grade Point Average: 6.6 of 7 (7 = High Distinction, 6 = Distinction)
- ◇ Thesis topic: linear optics quantum computing (supervisor Prof. Timothy Ralph)
- ◇ Specializations: digital system design, computer architecture, signal & image processing, embedded systems, VLSI device physics & technology, semiconductor devices, operating systems, computer networks, electronics, modern physics & mathematics
- ◇ Dean's Commendations for High Achievement (semesters I,II,III,IV,VI,VII,VIII)

Montessori Pre-school, Armidale, Australia (1985): Expelled

EMPLOYMENT HISTORY

ARC Future Fellow, University of Technology Sydney, Australia, Centre for Quantum Software & Information (UTS:Q|SI) (2017-2020)

- ◇ Title: *Secure quantum computing in a distributed world*
- ◇ Total grant value: AU\$1,024,302 (combined ARC & UTS contributions)

Senior Lecturer (Research Intensive), University of Technology Sydney, Australia, Centre for Quantum Software & Information (UTS:Q|SI) (September 2016 - continuing)

- ◇ Quantum optics, quantum computation, quantum information theory, quantum metrology, quantum algorithms & boson-sampling

Lecturer (Research Intensive), University of Technology Sydney, Australia, Centre for Quantum Computation & Intelligent Systems (QCIS), (January 2016 - September 2016)

- ◇ Quantum optics, quantum computation, quantum information theory, quantum metrology, quantum algorithms & boson-sampling

Associate Member (honorary position), Hearne Institute for Theoretical Physics, Louisiana State University, United States (January 2015 - continuing)

Postdoctoral Research Fellow, University of Technology Sydney, Australia (Centre for Quantum Computation & Intelligent Systems) (January 2015 - December 2015)

- ◇ Quantum optics, quantum computation, quantum information theory, quantum metrology, quantum algorithms & boson-sampling
- ◇ Position funded by Lockheed-Martin Corp.
- ◇ Academic visit to University of Maryland (USA)

Postdoctoral Research Fellow, Macquarie University, Australia (Centre of Excellence for Engineered Quantum Systems) (July 2011 - December 2014)

- ◇ Quantum optics, quantum computation, quantum information theory, quantum communication,

- ◊ boson-sampling, quantum walks, quantum algorithms & quantum metrology
- ◊ Tutoring undergraduate physics
- ◊ Departmental postdoctoral representative
- ◊ Organising committee of departmental Colloquia
- ◊ Physics & Astronomy Open Night volunteer
- ◊ Academic visits to NTT Labs (Japan), National Institute of Informatics (Japan), University of Gdansk (Poland), Freie Universität Berlin (Germany), Louisiana State University (United States)

Postdoctoral Research Fellow, University of Paderborn, Germany (July 2011 - January 2012)

- ◊ Quantum walks, quantum optics, quantum computation & quantum information theory

Postdoctoral Research Fellow, University of Queensland, Australia (Centre of Excellence for Quantum Computation & Communication Technology) (September 2010 - June 2011)

- ◊ Quantum optics, quantum computation, quantum information theory & quantum walks

Postdoctoral Research Fellow, Max-Planck Institute for the Science of Light, Germany (February 2010 - August 2010)

- ◊ Quantum optics, quantum computation, quantum information theory & quantum walks

Bioinformatician, Institute for Molecular Biosciences, University of Queensland, Australia (June 2009 - February 2010)

- ◊ Genetic sequencing and mapping of cancer genomes & programming

Verification Engineer, Andrew Corp., Australia (October 2008 - March 2009)

- ◊ Verification of software for mobile positioning systems

Postdoctoral Research Fellow, University of Oxford, UK (July 2007 - July 2008)

- ◊ Quantum computation & quantum information theory

GRANTS RECEIVED

1. Australian Research Council (ARC) Future Fellowship, *Secure quantum computing in a distributed world*, AU\$1,024,302 (combined ARC & UTS contributions)
2. United States National Science Foundation (NSF), *The rise of the boson-sampling quantum computer and the renaissance of the linear optics quantum interferometer*, Jonathan P. Dowling & Peter P. Rohde, US\$9,999

ADVISORY ROLES

1. Entropica Labs (www.entropicalabs.com), Scientific Advisor (2018-ongoing)

TEACHING EXPERIENCE

1. Mathematica workshop (Masters level), Macquarie University, Australia (2014)
2. Tutor (undergraduate physics), Macquarie University, Australia (2013)
3. Guest lecturer (post-graduate quantum optics), University of Paderborn, Germany (2011)
4. Tutor (undergraduate physics & materials engineering), University of Queensland, Australia (2004-2006)
5. Tutor (undergraduate physics, mathematics, software engineering & electrical engineering), Emmanuel College, University of Queensland, Australia (2001-2002, 2006)

RESEARCH INTERESTS

- ◊ Quantum computing; quantum information theory; linear optics quantum computing (LOQC); quantum optics; architectures for quantum computing; cluster state quantum computing; quantum cryptography; encrypted quantum computation; the quantum internet; quantum satellite technology; quantum communication; quantum algorithms; quantum error correction (QEC); boson-sampling; intermediate models for quantum computation; quantum random walks; spectral structure of photons; photo-detection theory; quantum metrology; quantum complexity theory; quantum economics; quantum politics.

CONFERENCE
ORGANISING
EXPERIENCE

1. Conference on the Theory of Quantum Computation, Communication & Cryptography (TQC'18), Sydney, Australia (local organising committee) (2018)
2. Quantum Information Processing (QIP'15) conference, Sydney, Australia (local organising committee) (2014-2015) — *QIP is the world's leading conference in the quantum information sciences. This conference attracted approximately 300 international delegates.*
3. *Dynamical Probability: Simulations & Computing*, International Conference on Mathematical Modelling in Physical Sciences, Madrid, Spain (editorial committee) (2014)
4. Physics & Astronomy Colloquium seminar series, Macquarie University, Sydney, Australia (organiser)
5. First Australian Quantum Walkshop, Sydney, Australia (lead organiser) (2012) — *This was the first Australian workshop dedicated to the field of quantum walks, attracting over 40 delegates from across Australia.*
6. *BrisScience* public science seminar series, Brisbane, Australia (organising committee)
7. Quantum Information Processing (QIP'07) conference, Brisbane, Australia (local organising committee) (2007) — *This conference attracted approximately 250 international delegates.*
8. Mathematical Aspects of Quantum Information Science (MAQIS) workshop, University of Queensland, Brisbane, Australia (co-organiser) (2005)
9. Physics Colloquium seminar series, University of Queensland, Brisbane, Australia (lead organiser)

IN THE MEDIA

1. *Sydney conferences seal city's global quantum computing reputation*, Computer World (July 20, 2018)
2. *A small-scale demonstration shows how quantum computing could revolutionize data analysis*, MIT Technology Review (January 31, 2018)
3. *Virtual interferometers may overcome scale issues*, New Electronics (April 5, 2017)
4. *'Virtual' interferometers may overcome scale issues for optical quantum computers*, Phys.org (April 3, 2017)
5. *'Virtual' interferometers may overcome scale issues for optical quantum computers*, EurekAlert (April 3, 2017)
6. *'Virtual' interferometers may overcome scale issues for optical quantum computers*, Scimex (April 3, 2017)
7. *Think: Digital Futures – A quantum computer does what?*, Radio 2ser FM107.3 (April 10, 2016)
8. *Getting the measure of matter*, Sydney Morning Herald (June 16, 2015)
9. *Australian breakthrough brings quantum computing closer*, The Conversation (September 20, 2012)

EDUCATIONAL
VIDEOS

1. Introduction to Mathematica [<http://bit.ly/1VQRvGL>] (>38,000 views)
2. Introduction to boson-sampling [<http://bit.ly/1rfX7gys>] (>1,900 views)
3. The quantum internet: technology, economics & politics [<https://bit.ly/2RWlwG5>] (>100 views)

EDITORIAL
POSITIONS

1. Founding Reserve Editor, *Quantum*, <http://www.quantum-journal.org> (2016-present)
2. Lead Guest Editor, Special Issue on *The Theory of Quantum Simulation, Quantum Dynamics & Quantum Walks*, Advances in Mathematical Physics (2014)

SCIENTIFIC
OUTREACH

1. *For the love of science*, [The Science Nation](#), Maritime Museum, Sydney, Australia 2019 (invited panel discussion)
2. *Greatest discovery ever made*, [The Science Nation](#) — *Great Debate*, for National Science Week, Maritime Museum, Sydney, Australia 2018 (invited public debate)
3. *Quantum computing — What you need to know and why*, NSW Knowledge Management Forum, 2018 (invited talk for community group)
4. [Science @ The Local](#), 2018 (invited [podcast interview](#))
5. *Spot the Bull*, Sydney Science Festival, 2017 (invited panel discussion for >300 high school students)
6. *Science in the Club — Quantum What?*, Armidale, Australia, 2017 (invited public talk and Q&A discussion)
7. *Australian Institute of Physics Pub Night*, Sydney, Australia, 2016 (invited public Q&A discussion)
8. *Dennis Ritchie: The unsung hero of modern computing*, [The Science Nation](#) — *Great Debate*, Sydney Powerhouse Museum, Sydney, Australia 2016 (invited public debate)
9. *Quantum technologies of the future*, [2016 Pint of Science Festival](#), Sydney (invited public talk)
10. *Computing — Visions of the future*, [The Science Nation](#) — *Storytelling of Science*, Sydney Powerhouse Museum, Sydney, Australia, 2016 (invited public talk and panel discussion)
11. *Think: Digital Futures — A quantum computer does what?*, 2ser FM107.3, Sydney, Australia, 2016 (invited radio and [podcast](#) interview)
12. *Australian Institute of Physics Pub Night*, Sydney, Australia, 2015 (invited public talk)
13. [The Science Nation](#) — *Science Says!*, Sydney Powerhouse Museum, Sydney, Australia, 2015 (invited public panel discussion)
14. *Quantum physics beats astrophysics any day of the week!*, [The Science Nation](#) — *Great Debate*, Sydney Powerhouse Museum, Sydney Science Festival, Sydney, Australia, 2015 (invited public debate)
15. *Australian Institute of Physics Pub Night*, Sydney, Australia, 2014 (invited public talk)
16. *Australian Institute of Physics Free for All Variety Night*, Sydney, Australia, 2015 (invited public talk)
17. [Science @ The Local](#), Blue Mountains, Australia, 2015 (invited public talk)
18. *An interview with Sir Peter Knight*, Macquarie University Physics & Astronomy Society, Sydney, Australia, 2014 (invited interview host)
19. [The Science Nation](#) public science seminar series, Sydney, Australia (volunteer)
20. [BrisScience](#) public science seminar series, Brisbane, Australia (organising committee)

SUPERVISION

1. Christopher Altman (PhD candidate, University of Technology Sydney, Australia)
2. Madhav Krishnan Vijayan (PhD candidate, University of Technology Sydney, Australia)
3. Ryan Mann (PhD graduate, University of Technology Sydney, Australia)
4. Keith R. Motes (PhD graduate, Macquarie University, Australia)
5. Zixin Huang (visiting PhD candidate, University of Technology Sydney, Australia)
6. Elizabeth Camilleri (undergraduate research assistant, Macquarie University, Australia)
7. Deepesh Singh (undergraduate vacation project, Indian Institute of Technology, India)
8. Jihun Cha (PhD mentor for Centre for Engineered Quantum Systems, University of Queensland, Australia)
9. 6 Engineering Masters ‘Capstone’ projects (University of Technology Sydney, Australia)

AWARDS

1. Armidale Young Citizen of the Year Award (jointly awarded, 1999)
2. Emmanuel College Foundation Medal (2002)
3. University of Queensland Postgraduate Research Scholarship (UQPRS) (2004-2007)
4. Dean's Commendations for High Achievement (semesters I,II,III,IV,VI,VII,VIII), University of Queensland
5. St. Andrew Society of Scotland (Queensland) D. M. Fraser Bursary for outstanding contribution to the College Community (Emmanuel College)
6. Golden Key Honours Society
7. College Scholarship for Academic Achievement (2001 & 2002, Emmanuel College)
8. College Prize for Academic Achievement with Distinction (2002, Emmanuel College)
9. Emmanuel College Full Blue (for outstanding contribution to the college)
10. Principal's Prize for Meritorious Academic Achievement (2001 & 2002, Emmanuel College)

COMMUNITY & CHARITY ACTIVITIES

1. Lifeline telephone counsellor (2012-2016) — *Suicide intervention and crisis support telephone counselling*
2. Human Capital Project (<http://humancapitalproject.com.au>), Admin committee (2012-2015) — *Providing micro-loans via personal equity contracts to provide university education for underprivileged students in Cambodia*
3. Applied Suicide Intervention Skills Training (ASIST) — *Training in emergency suicide intervention counselling.*
4. Brisbane flood cleanup volunteer (2011) — *Volunteering to assist the recovery operation in Brisbane following the catastrophic 2011 floods*
5. Election scrutineering, Australian federal election (2004) — *Overseeing the counting of election ballots*
6. Charity fundraising band gigs — *Raising money for educational charities in South America and supporting local charity events with entertainment*
7. 'Shave for a Cure' Leukemia Foundation Fundraiser (2002)
8. Community radio announcer (2ARM Armidale & VOX FM Illawarra)
9. Blood bank donor
10. Armidale Dance Party organisation group (1997-1999) — *Providing a safe alcohol- and drug-free social and dance environment for Armidale's youth*
11. Armidale Streamwatch Society (vice president) (1996) — *Engaging with school students for environmental causes, specifically the preservation of waterways*
12. Group leader of the 'Stop Gay- and Trans-Hate Now' workshop — *Leading a workshop for hate-affected gay and transsexual youths to overcome stigma, discrimination and hatred*

PERSONAL ACTIVITIES & INTERESTS

- ◇ Mountaineer, paraglider, rock climber, freediver, marathon runner, percussionist, DJ, composer, artist, stand-up comedian
- ◇ Two electronic music albums
- ◇ Emmanuel College Student Club Executive (Cultural Convener) (2002)
- ◇ Writing and directing of the Emmanuel College musical (2002)
- ◇ University of Queensland Liberal Club Executive (2004-2005)
- ◇ Young Liberals (QLD Management Committee, Fig Tree Pocket Executive, QLD Convention Delegate, QLD Senior Party Conference Delegate, QLD Policy Standing Committee, Fig Tree Pocket Newsletter Editor) (2004-2012)
- ◇ University of Queensland Student Union, Postgraduate Committee (2006)
- ◇ Election campaigning: Michael Johnson MP (Australian Federal election, 2004), Ingrid Tall (Australian Federal election, 2004), Peter Turner (Queensland State election), Cnr. Julian Simmonds (Brisbane City Council election, 2010)
- ◇ Brisbane Marathon ("Lest we forget run") & Bridge to Brisbane run

- ◇ Debating & public speaking (The Oxford Union, University of Queensland Debating Society, Commonwealth Bank Cup, Hume Barbor, Inter-College Cup, Plain English Speaking Awards, Mock Parliament, Young Liberal National Sir Jim Killen Public Speaking Competition, Griffith University Comedy Debate, Paderborn University Debating Society, Gutenberg Cup, Royal Australian Rant Society, Toastmasters)
- ◇ Drama (Emmanuel College One Act Play team)
- ◇ Emmanuel College rowing team (cox)
- ◇ Choir (Macquarie University Choir, Wollongong Gospel Choir, Oxford Student Chorus, University of Queensland Musical Society, Emmanuel College, Armidale High School)
- ◇ Chess (University of Queensland Chess Club, Emmanuel College Chess team - winners of Inter-College competition 2001-2002)
- ◇ Emmanuel College Laughing Society (Founder & President)
- ◇ Drumming (Samba Ninja Sydney, Trommel-Feuer Erlangen, Brisbane Samba School)

PUBLICATION
STATISTICS

- ◇ Peer-reviewed publications: 49
- ◇ Citations: $\sim 1,500$
- ◇ H-index: 21
- ◇ i10-index: 39
- ◇ Lead author & editor of the book “*The Quantum Internet – A New Frontier*”, accepted for publication by Cambridge University Press (2019)
- ◇ 2 publications in *Science* (1 invited)
- ◇ 5 publications in *Physical Review Letters*
- ◇ 1 publication in *Optica*
- ◇ 2 book chapters
- ◇ 2 popular articles
- ◇ Erdős number: ≤ 4

TOP TEN
PUBLICATIONS

Note: Authorship lists where I appear as last author are where I acted as project leader.

1. *A 2D quantum walk simulation of two-particle dynamics*, Andreas Schreiber, Aurél Gábris, Peter P. Rohde, Kaisa Laiho, Martin Štefaňák, Václav Potoček, Craig Hamilton, Igor Jex & Christine Silberhorn, *Science* **336**, 55 (2012) [[arXiv:1204.3555](https://arxiv.org/abs/1204.3555)]

We experimentally demonstrate the first non-trivial optical quantum walk – a quantum walk on a 2D lattice. The architecture is highly scalable with low experimental resource overhead. We applied this quantum walk to performing an elementary quantum simulation, one of the key applications for quantum walks.

2. *Scalable boson-sampling with time-bin encoding using a loop-based architecture*, Keith R. Motes, Alexei Gilchrist, Jonathan P. Dowling & Peter P. Rohde, *Phys. Rev. Lett.* **113**, 120501 (2014) [[arXiv:1403.4007](https://arxiv.org/abs/1403.4007)]

One of the key challenges to building large-scale optical quantum information processing systems is the number of optical elements required as the size of the computation is increased. We present a highly scalable architecture for boson-sampling, where the required number of optical elements is constant and does not scale with the size of the computation, and requires only a single photon source and a single photo-detector. This represents a major experimental simplification. Our design was recently employed by a world-leading experimental group to demonstrate the largest experimental implementation of photonic quantum computing to date.

3. *Quantum walks with encrypted data*, Peter P. Rohde, Joseph F. Fitzsimons & Alexei Gilchrist, *Phys. Rev. Lett.* **109**, 150501 (2012) [[arXiv:1204.3370](https://arxiv.org/abs/1204.3370)]

We present the first encryption protocol for the quantum walk and boson-sampling models for optical quantum computing – a technique known as homomorphic encryption, which allows a computation to be performed on encrypted data by a remote host, without an eavesdropper or the host learning the client’s data.

4. *Linear optical quantum metrology with single photons: Exploiting spontaneously generated entanglement to beat the shot-noise limit*, Keith R. Motes, Jonathan P. Olson, Evan J. Rabeaux, Jonathan P. Dowling, S. Jay Olson & Peter P. Rohde, Phys. Rev. Lett. **114**, 170802 (2015) [[arXiv:1501.01067](#)]

A central use for quantum photonics is quantum metrology, whereby we wish to estimate unknown phases by probing them with optical states within an interferometer. Previous protocols for doing this optimally require very elaborate and challenging optical state engineering. We demonstrate that a very simple approach, using nothing more than single photon states, linear optics and photo-detection, is able to beat the shot-noise limit for quantum metrology. This work for the first time connects two disparate fields – boson-sampling and quantum metrology.

5. *Simple scheme for universal linear optics quantum computing with constant experimental complexity using fiber loops*, Peter P. Rohde, Phys. Rev. A **91**, 012306 (2015) [[arXiv:1410.0433](#)]

We take our architecture for fiber-loop boson-sampling and demonstrate that it can be generalised beyond boson-sampling to the implementation of full-fledged, universal, linear optics quantum computing. As before, the number of optical elements is constant and does not scale with the size of the computation. This could reduce the experimental complexity of large-scale optical quantum computing by orders of magnitude.

6. *Spontaneous parametric down-conversion photon sources are scalable for boson-sampling in the asymptotic limit*, Keith R. Motes, Jonathan P. Dowling & Peter P. Rohde, Phys. Rev. A **88**, 063822 (2013) [[arXiv:1307.8238](#)]

A key problem facing the implementation of large-scale boson-sampling is photon sources. We demonstrate that spontaneous parametric down-conversion sources – the most readily available photon source technology – is suitable for scalable boson-sampling.

7. *Information capacity of a single photon*, Peter P. Rohde, Joseph F. Fitzsimons & Alexei Gilchrist, Phys. Rev. A **88**, 022310 (2013) [[arXiv:1211.1427](#)]

One of the central uses for quantum optical systems is quantum communication, whereby we encode data into photons. We present an analysis of photonic quantum communication using single photons, where information is encoded into the spectral structure of the photons, and derive information theoretic bounds on the achievable communication rates.

8. *Boson sampling with photons of arbitrary spectral structure*, Peter P. Rohde, Phys. Rev. A **91**, 012307 (2015) [[arXiv:1410.3979](#)]

A key obstacle facing large-scale boson-sampling is that photons must be completely indistinguishable for the protocol to function correctly. We show that large-scale boson-sampling might still be possible, and still implement a computationally hard problem, even in the presence of significant photon distinguishability.

9. *Multi-walker discrete time quantum walks on arbitrary graphs, their properties, and their photonic implementation*, Peter P. Rohde, Andreas Schreiber, Martin Štefaňák, Igor Jex & Christine Silberhorn, New J. Phys. **13**, 013001 (2011) [[arXiv:1006.5556](#)]

Quantum walks can be considered as a quantum particle, such as a photon, ‘hopping’ between vertices in a graph. Most commonly, a linear graph is considered, and most experimental implementations have focussed on this simple case. We present a theoretical formalism for generalising quantum walks to arbitrary graph topologies, and describe how they may be experimentally realised using quantum optics.

10. *Spectral structure and decompositions of optical states, and their applications*, Peter P. Rohde, Wolfgang Mauerer & Christine Silberhorn, New J. Phys. **9**, 91 (2007) [[arXiv:quant-ph/0609004](#)]

Photons have a rich spectral structure, and cannot be treated as indistinguishable, monochromatic particles. We present a full theoretical formalism for describing and analysing the spatio-spectral structure of photons, and their interference characteristics. This has broad applications in optical quantum information processing protocols.

REFEREED
PUBLICATIONS

Note: Authorship lists where I appear as last author are where I acted as project leader, except (1, 35 & 49).

1. *The resurgence of the linear optics interferometer — Recent advances & applications*, Si-Hui Tan & Peter P. Rohde, (invited) *Reviews in Physics*, 100030 (2019) [[arXiv:1805.11827](#)]
2. *Practical quantum somewhat-homomorphic encryption with coherent states*, Si-Hui Tan, Yingkai Ouyang & Peter P. Rohde, *Physical Review A* **97**, 042308 (2018) [[arXiv:1710.03968](#)]
3. *Demonstration of topological data analysis on a quantum processor*, He-Liang Huang, Peter P. Rohde, Xi-Lin Wang, Yi-Han Luo, You-Wei Zhao, Chang Liu, Li Li, Nai-Le Liu, Chao-Yang Lu & Jian-Wei Pan, *Optica* **5**, 193 (2018) [[arXiv:1801.06316](#)]
4. *Passive quantum error correction of linear optics networks through error averaging*, Ryan J. Marshman, Austin P. Lund, Peter P. Rohde & Timothy C. Ralph, *Physical Review A* **97**, 022324 (2017) [[arXiv:1709.02157](#)]
5. *Multiphoton interference in quantum Fourier transform circuits and applications to quantum metrology*, Zu-En Su, Yuan Li, Peter P. Rohde, He-Liang Huang, Xi-Lin Wang, Li Li, Nai-Le Liu, Jonathan P. Dowling, Chao-Yang Lu & Jian-Wei Pan, *Physical Review Letters* **119**, 080502 (2017) [[arXiv:1708.00296](#)]
6. *Linear optical quantum metrology with single photons — Experimental errors, resource counting, and quantum Cramér-Rao bounds*, Jonathan P. Olson, Keith R. Motes, Patrick M. Birchall, Nick M. Studer, Margarite LaBorde, Todd Moulder, Peter P. Rohde & Jonathan P. Dowling, *Physical Review A* **96**, 013810 (2017) [[arXiv:1610.07128](#)]
7. *Measurement-based linear optics*, Rafael N. Alexander, Natasha Gabay, Peter P. Rohde & Nicolas C. Menicucci, *Physical Review Letters* **118**, 110503 (2017) [[arXiv:1606.00446](#)]
8. *Efficient recycling strategies for preparing large Fock states from single-photon sources: Applications to quantum metrology*, Keith R. Motes, Ryan L. Mann, Jonathan P. Olson, Nicholas M. Studer, E. Annelise Bergeron, Alexei Gilchrist, Jonathan P. Dowling, Dominic W. Berry & Peter P. Rohde, *Physical Review A* **94**, 012344 (2016) [[arXiv:1603.00533](#)]
9. *Quantum random walks on congested lattices*, Keith R. Motes, Alexei Gilchrist & Peter P. Rohde, *Scientific Reports* **6**, 19864 (2016) [[arXiv:1310.8161](#)]
10. *Implementing scalable boson sampling with time-bin encoding: analysis of loss, mode mismatch, and time jitter*, Keith R. Motes, Jonathan P. Dowling, Alexei Gilchrist & Peter P. Rohde, *Physical Review A* **92**, 052319 (2015) [[arXiv:1507.07185](#)]
11. *Multiplexed single-photon state preparation using a fibre-loop architecture*, Peter P. Rohde, L. G. Helt, M. J. Steel & Alexei Gilchrist, *Physical Review A* **92**, 053829 (2015) [[arXiv:1503.03546](#)]
12. *Multi-scale quantum simulation of quantum field theory using wavelets*, Gavin K. Brennen, Peter P. Rohde, Barry C. Sanders & Sukhwinder Singh, *Physical Review A* **92**, 032315 (2015) [[arXiv:1412.0750](#)]
13. *The on-ramp to the all optical quantum information processing highway*, Peter P. Rohde & Jonathan P. Dowling, invited perspective article, *Science* **349**, 696 (2015)
14. *Linear optical quantum metrology with single photons: Exploiting spontaneously generated entanglement to beat the shot-noise limit*, Keith R. Motes, Jonathan P. Olson, Evan J. Rabeaux, Jonathan P. Dowling, S. Jay Olson & Peter P. Rohde, *Physical Review Letters* **114**, 170802 (2015) [[arXiv:1501.01067](#)]
15. *Boson sampling with displaced single-photon Fock states versus single-photon-added coherent states — The quantum-classical divide and computational-complexity transitions in linear optics*, Kaushik P. Seshadreesan, Jonathan P. Olson, Keith R. Motes, Peter P. Rohde & Jonathan P. Dowling, *Physical Review A* **91**, 022334 (2015) [[arXiv:1402.0531](#)]

16. *Sampling arbitrary photon-added or photon-subtracted squeezed states is in the same complexity class as boson sampling*, Jonathan P. Olson, Kaushik P. Seshadreesan, Keith R. Motes, Peter P. Rohde & Jonathan P. Dowling, *Physical Review A* **91**, 022317 (2015) [[arXiv:1406.7821](#)]
17. *Evidence for the conjecture that sampling generalized cat states with linear optics is hard*, Peter P. Rohde, Keith R. Motes, Paul Knott, Joseph Fitzsimons, William Munro & Jonathan P. Dowling, *Physical Review A* **91**, 012342 (2015) [[arXiv:1310.0297](#)]
18. *Simple scheme for universal linear optics quantum computing with constant experimental complexity using fiber loops*, Peter P. Rohde, *Physical Review A* **91**, 012306 (2015) [[arXiv:1410.0433](#)]
19. *Boson sampling with photons of arbitrary spectral structure*, Peter P. Rohde, *Physical Review A* **91**, 012307 (2015) [[arXiv:1410.3979](#)]
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1. *“The Quantum Internet – A New Frontier”*, Peter P. Rohde *et al.* (lead author & editor), accepted for publication by Cambridge University Press (2019).

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2. *Why I am opposed to an Australian Bill of Rights*, Peter P. Rohde. In: *Issues in Society – Human Rights & Civil Liberties* **325**, 43 (2011)

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2. *Boson sampling private-key quantum cryptography*, Zixin Huang, Peter P. Rohde, Dominic W. Berry, Pieter Kok, Jonathan P. Dowling & Cosmo Lupo (2019) [[arXiv:1905.03013](#)]
3. *Homomorphic encryption of linear optics quantum computation on almost arbitrary states of light with asymptotically perfect security*, Yingkai Ouyang, Si-Hui Tan, Joseph Fitzsimons & Peter P. Rohde (2019) [[arXiv:1902.10972](#)]
4. *Relativity of quantum states in entanglement swapping: Violation of Bell's inequality with no entanglement*, Chris Nagele, Ebubechukwu O. Ilo-Okeke, Peter P. Rohde, Jonathan P. Dowling & Tim Byrnes (2018) [[arXiv:1806.02407](#)]
5. *A quantum optics argument for the #P-hardness of a class of multidimensional integrals*, Peter P. Rohde, Dominic W. Berry, Keith R. Motes & Jonathan P. Dowling (2016) [[arXiv:1607.04960](#)]
6. *Bosonic interference as a complementary resource for implementation of quantum walks*, Magdalena Stobińska, Peter P. Rohde, Paweł Kurzyński & Anton Zeilinger (2015) [[arXiv:1504.05480](#)]
7. *Will boson-sampling ever disprove the Extended Church-Turing thesis?*, Peter P. Rohde, Keith R. Motes, Paul Knott & William J. Munro (2014) [[arXiv:1401.2199](#)]
8. *Optimising number resolving photo-detectors using classical post-processing*, Peter P. Rohde (2011) [[arXiv:1107.2747](#)]
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11. *Noise thresholds for entanglement purification*, Peter P. Rohde (2007) [[arXiv:quant-ph/0702065](#)]
12. *Error propagation in loss- and failure-tolerant quantum computation schemes*, Peter P. Rohde, Timothy C. Ralph & William J. Munro (2007) [[arXiv:quant-ph/0701090](#)]
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2. *Non-idealized models in linear optics quantum computing*, Peter P. Rohde, Honours thesis, University of Queensland, Australia (2004)

PRESENTATIONS

Note: Authorship lists where I appear as last author are where I acted as project leader.

Note: Presenter is underlined.

1. (invited public debate) *Should Australia be a Republic or a Monarchy?*, Peter P. Rohde, Australian Libertarian Society Friedman Conference, Sydney, Australia (2018)
2. (invited talk) *The quantum internet — Towards the singularity*, Peter P. Rohde, Indian Institute of Science (IISc), Bangalore, India (2018)
3. (invited talk) *The quantum internet — Implications for society, the economy & international geo-strategic politics*, Peter P. Rohde, Quantum Frontiers & Foundations, Bangalore, India (2018)
4. (invited talk) *The quantum internet — Implications for society, the economy & international geo-strategic politics*, Peter P. Rohde, University of Science & Technology China, Shanghai, China (2018)

5. (invited talk) *The quantum internet — Implications for society, the economy & international geo-strategic politics*, Peter P. Rohde, International Workshop on Quantum Computing & Quantum Information Processing (QCQIP), Beijing, China (2017)
6. (invited talk) *Quantum computing — A gentle introduction*, Peter P. Rohde, Department of Nanoscience & Engineering, Indian Institute of Science, Bangalore, India (2017)
7. (invited talk) *Introduction to optical quantum computing*, Peter P. Rohde, Brainstorming Workshop on Quantum Computation, Information, Communications & Cryptography, Indian Institute of Science, Bangalore, India (2017)
8. (invited four-part talk series – sponsored by IEEE Photonics) *Optical quantum information processing — From beginnings to the cutting edge*, Peter P. Rohde, Summer school in Optics & Photonics (SOAP), Indian Institute of Science, Bangalore, India (2017)
9. (invited talk) *Advances in linear optics quantum information processing*, Peter P. Rohde, Centre for Quantum Technologies (CQT), National University of Singapore, Singapore (2017)
10. (invited talk) *Encrypted optical quantum computation*, Peter P. Rohde, Si-Hui Tan, Yingkai Ouyang, Alexei Gilchrist & Joseph Fitzsimons, Centre for Quantum Computation & Communication Technology (CQC²T) Quantum Optics Workshop, University of Queensland, Brisbane, Australia (2017)
11. (invited talk) *Introduction to optical quantum information processing*, Peter P. Rohde, COM-MAD'2016, Optoelectronic & Microelectronic Materials & Devices, University of New South Wales, Sydney, Australia (2016)
12. (invited talk) *Post-classical quantum computation — A vision for the future*, Peter P. Rohde, Centre for Ultrahigh bandwidth Devices for Optical Systems (CUDOS) Quantum Photonics Connections Conference, Sydney, Australia (2016)
13. (invited talk) *Verification of boson-sampling devices*, Peter P. Rohde, University of Science & Technology China, Shanghai, China (2016)
14. (invited talk) *An introduction to boson-sampling*, Peter P. Rohde, University of Science & Technology China, Shanghai, China (2016)
15. (invited talk) *An introduction to computational complexity theory*, Peter P. Rohde, University of Science & Technology China, Shanghai, China (2016)
16. (invited talk) *Bitcoin, the Blockchain & smart contracts*, Peter P. Rohde, Australian Libertarian Society Friedman Conference, Sydney, Australia (2016)
17. (invited talk) *Strategies for the efficient preparation of large photon-number Fock states*, Keith R. Motes, Ryan L. Mann, Jonathan P. Olson, Nicholas M. Studer, E. Annelise Bergeron, Alexei Gilchrist, Jonathan P. Dowling, Dominic W. Berry & Peter P. Rohde, Centre for Quantum Computation & Intelligent Systems, University of Technology Sydney, Australia (2016)
18. (invited talk) *Errors and scalability in boson-sampling*, Peter P. Rohde, RMIT Photonic Quantum Computing Workshop, Melbourne, Australia (2016)
19. (invited talk) *Resource efficient schemes for linear optics quantum computing using fiber-loops*, Peter P. Rohde, Keith R. Motes, L. G. Helt, M. J. Steel, Jonathan P. Dowling & Alexei Gilchrist, University of Maryland, United States (2015)
20. (invited talk) *Resource efficient schemes for linear optics quantum computing using fiber-loops*, Peter P. Rohde, Keith R. Motes, L. G. Helt, M. J. Steel, Jonathan P. Dowling & Alexei Gilchrist, Macquarie University Quantum Science seminar, Sydney, Australia (2015)
21. (invited talk) *Linear optical quantum metrology with single photons — Exploiting spontaneously generated entanglement to beat the shotnoise limit*, Keith R. Motes, Jonathan P. Olson, Evan J. Rabeaux, S. Jay Olson, Jonathan P. Dowling & Peter P. Rohde, University of Sydney Quantum Optics group, Sydney, Australia (2015)
22. (invited talk) *Fiber-loop architectures for optical quantum information processing*, Keith R. Motes, Jonathan P. Dowling, Alexei Gilchrist & Peter P. Rohde, University of Sydney Quantum Optics group, Sydney, Australia (2015)
23. (invited talk) *Boson-sampling: the first post-classical quantum computer?*, Peter P. Rohde, Sydney Quantum Information Theory Workshop, Australia (2014)
24. (invited talk) *The role of charity in civil society*, Peter P. Rohde, Australian Libertarian Society Friedman Conference, Sydney, Australia (2014)

25. (invited talk) *Boson-sampling: a new route for optical quantum computing*, [Peter P. Rohde](#), Centre for Engineered Quantum Systems, Macquarie University, Sydney, Australia (2014)
26. (invited talk) *Quantum walks with memory*, [Peter P. Rohde](#), Gavin K. Brennen, Elizabeth Camilleri, Jason Twamley & Alexei Gilchrist, American Mathematical Society Special Session on Quantum Walks, Quantum Computation & Related Topics, Baltimore, United States (2014)
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28. (invited talk) *An introduction to boson-sampling*, [Peter P. Rohde](#), Institute of Theoretical Physics & Astrophysics, University of Gdansk, Gdansk, Poland (2013)
29. (invited talk) *An introduction to wavelet theory*, [Peter P. Rohde](#), Centre for Engineered Quantum Systems, Macquarie University, Sydney, Australia (2012)
30. (invited talk) *An introduction to quantum walks*, [Peter P. Rohde](#), First Australian Quantum Walkshop, Sydney, Australia (2012)
31. (invited talk) *Advances in linear optics quantum computing*, [Peter P. Rohde](#), Leibnitz University, Hannover, Germany (2011)
32. (invited talk) *What do we need to build an optical quantum computer?*, [Peter P. Rohde](#), University of Paderborn, Paderborn, Germany (2011)
33. (invited talk) *Escher — A de novo genetic sequencing tool using graph theory*, [Peter P. Rohde](#), Nicole Cloonan, Sean Grimmond, International Conference on De Novo Sequencing, Beijing, China (2009)
34. (invited talk) *Strategies for the preparation of cluster states using non-deterministic gates*, [Peter P. Rohde](#) & Sean D. Barrett, Oxford University, UK (2007)
35. (invited talk) *Mode-matching effects in linear optics quantum computing*, [Peter P. Rohde](#) & Timothy C. Ralph, International Conference on Quantum Optics (ICQO), Minsk, Belarus (2006)
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41. *Tradeoff between located and unlocated errors in quantum error correction* (poster presentation), Henry L. Haselgrove, [Peter P. Rohde](#), Timothy C. Ralph & William J. Munro, Quantum Information Processing 2007, Brisbane, Australia (QIP'07)
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