Grant Salton

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 gsalton   arχiv: salton_g_1   🎓 Scholar

Quantum information scientist

Quantum {error correction, algorithms, applications, solutions}

Seasoned quantum information scientist with broad research experience (quantum error correction, quantum algorithms, quantum and classical optimization, NISQ applications, numerical simulations, etc.) Stanford PhD in quantum error correction, Caltech postdoc in applications of near-term hardware, AWS lead for customer facing quantum applications research. Strong product, program, and project management skills.

Senior Quantum Research Scientist Amazon Web Services (AWS)	*Feb. 2020 – present*
IQIM Postdoctoral Scholar in Theoretical Physics Institute for Quantum Information and Matter, Preskill Group California Institute of Technology (Caltech)	*Nov. 2018 – Feb. 2020*
Visiting Researcher Institute for Quantum Information and Matter Caltech	*Apr. 2020 – Apr. 2023*
Visiting Postdoctoral Scholar Department of Physics Stanford University	*Jan. 2019 – Jan. 2020*

Education

Ph.D. Physics   Stanford University

Stanford, California, USA   *Sept. 2013 – Sept. 2018*

   Supervisor: Prof. Patrick Hayden

   Ph.D. Thesis: Quantum Error Correction and Spacetime

M.Sc. Physics   Stanford University

Stanford, California, USA   *Sept. 2013 – Sept. 2016*

   M.Sc. Thesis: Universal quantum computation by scattering in the Fermi-Hubbard model

M.Sc. Physics   McGill University

Montréal, Québec, Canada   *Sept. 2011 – Dec. 2013*

   M.Sc. Thesis: Power spectrum of CMB polarization due to cosmic string wakes

B.Sc. (Hons) Co-operative   University of Waterloo

Waterloo, Ontario, Canada   *Sept. 2005 – Apr. 2010*

   Major: Mathematical Physics   **Minor:** Pure Mathematics   **Specialization:** Astrophysics

   Thesis: Entanglement degradation from acceleration

Selected Publications

[1] "**qReduMIS: A Quantum-Informed Reduction Algorithm for the Maximum Independent Set Problem**" M. J. A. Schuetz, R. Yalovetzky, R. S. Andrist, G. Salton, Y. Sun, R. Raymond, S. Chakrabarti, A. Acharya, R. Shaydulin, M. Pistoia, H. G. Katzgraber. (arXiv:2503.12551) Submitted to *Nature Physics*

[2] "**Quantum Compilation Toolkit for Rydberg Atom Arrays with Implications for Problem Hardness and Quantum Speedups**" M. J. A. Schuetz, R. S. Andrist, G. Salton, R. Yalovetzky, R. Raymond, Y. Sun, A. Acharya, S. Chakrabarti, M. Pistoia, H. G. Katzgraber. (arXiv:2412.14976) Submitted to *PRX Quantum*

[3] "**Decomposition pipeline for large-scale portfolio optimization with applications to near-term quantum computing**" A. Acharya, R. Yalovetzky, P. Minssen, S. Chakrabarti, R.Shaydulin, R. Raymond, Y. Sun, D. Herman, R. S. Andrist, G. Salton, M. J. A. Schuetz, H. G. Katzgraber, M. Pistoia. *Phys. Rev. Research 7, 023142.* (arXiv:2409.10301)

★ [4] "**Quantum algorithms: A survey of applications and end-to-end complexities**" A. M. Dalzell, S. McArdle, M. Berta, P. Bienias, C. Chen, A. Gilyén, C. T. Hann, M. J. Kastoryano, E. T. Khabiboulline, A. Kubica, G. Salton, S. Wang, F. G. S. L. Brandão. *Cambridge University Press*, 2025. (arXiv:2307.09442) **Published textbook.**

[5] "**Hardness of the Maximum Independent Set Problem on Unit-Disk Graphs and Prospects for Quantum Speedups**" R. S. Andrist, M. J. A. Schuetz, P. Minssen, R. Yalovetzky, S. Chakrabarti, D. Herman, N. Kumar, G. Salton, R. Shaydulin, Y. Sun, M. Pistoia, H. G. Katzgraber. *Phys. Rev. Research* 5, 043277. (arXiv:2307.09442)

[6] "**Explainable AI using expressive Boolean formulas**" G. Rosenberg, J. K. Brubaker, M. J. A. Schuetz, G. Salton, Z. Zhu, E. Y. Zhu, S. Kadıoğlu, S. E. Borujeni, H. G. Katzgraber. *Mach. Learn. Knowl. Extr.* 2023, 5(4), 1760-1795. (arXiv:2306.03976)

[7] "**End-to-end resource analysis for quantum interior point methods and portfolio optimization**" A. M. Dalzell, B. D. Clader, G. Salton, M. Berta, C. Y. Lin, D. A. Bader, N. Stamatopoulos, M. J. A. Schuetz, F. G. S. L. Brandão, H. G. Katzgraber, W. J. Zeng. *PRX Quantum* 4, 040325. (arXiv:2211.12489)

★ [8] "**Quantum Resources Required to Block-Encode a Matrix of Classical Data**" B. D. Clader, A. M. Dalzell, N. Stamatopoulos, G. Salton, M. Berta, W. J. Zeng. *IEEE Trans. on Q. Eng.* 3 (2022): 1-23. (arXiv:2206.03505)

[9] "**Quantum Gravity in the Lab: Teleportation by Size and Traversable Wormholes, Part II**" S. Nezami, H. W. Lin, A. Brown, H. Gharibyan, S. Leichenauer, G. Salton, L. Susskind, B. Swingle, M. Walter. *PRX Quantum* 4.1 (2023): 010321. (arXiv:2102.01064) **Joint work with Google.**

★ [10] "**Quantum Gravity in the Lab: Teleportation by Size and Traversable Wormholes**" A. Brown, H. Gharibyan, S. Leichenauer, H. W. Lin, S. Nezami, G. Salton, L. Susskind, B. Swingle, M. Walter. *PRX Quantum*, 4.1 (2023): 010320. (arXiv:1911.06314) **Joint work with Google.**

★ [11] "**Continuous Symmetries and Approximate Quantum Error Correction**" P. Faist, S. Nezami, V. Albert, G. Salton, F. Pastawski, P. Hayden, J. Preskill. *Phys. Rev. X* 10.4 (2020): 041018. (arXiv:1902.07714) **Selected for plenary talk at QIP2020.**

[12] "**Entanglement Wedge Reconstruction using the Petz Map**" C. Chen, G. Penington, G. Salton. *J. High Energ. Phys.* 2020, 168 (2020). (arXiv:1902.02844)

[13] "**Error Correction of Quantum Reference Frame Information**" P. Hayden, S. Nezami, S. Popescu, G. Salton. *PRX Quantum* 2.1 (2021): 010326. (arXiv:1709.04471) **Awarded "Best Poster" at QIP2017.**

★ [14] "**Entanglement Wedge Reconstruction via Universal Recovery Channels**" J. Cotler, P. Hayden, G. Penington, G. Salton, B. Swingle, M. Walter. *Phys. Rev. X* 9.3 (2019): 031011. (arXiv:1704.05839) **Accepted talk at QIP2018.**

[15] "**Entanglement from Topology in Chern-Simons Theory**" G. Salton, B. Swingle, M. Walter. *Phys. Rev. D* 95 (2017) 10, 105007. (arXiv:1611.01516)

[16] "**Spacetime replication of continuous variable quantum information**" P. Hayden, S. Nezami, G. Salton, B. Sanders. *New J. Phys.* 18 (2016) 8, 083043. (arXiv:1601.02544)

[17] "**Universal quantum computation by scattering in the Fermi-Hubbard model**" N. Bao, P. Hayden, G. Salton, N. Thomas. *New J. Phys.* 17 (2015) 9, 093028. (arXiv:1409.3585) **Included in IOPSelect.**

[18] "**Acceleration-assisted entanglement harvesting and rangefinding**" G. Salton, R. B. Mann, N. C. Menicucci. *New J. Phys.* 17 (2015) 3, 035001. (arXiv:1408.1395) **"Best talk" prize at INTRIQ conference.**}

[19] "**Angular Power Spectrum of B-mode Polarization from Cosmic String Wakes**" R. Brandenberger, N. Park, G. Salton. (arXiv:1308.5693)

Invited Talks

2025 **Quantum Embark and AWS Quantum Technologies**
PS UKI Summit 2025, Virtual, Feb. 2025

2024 **Quantum Computing in the Cloud**
MIT BWSI 2024, Virtual, MIT Summer Program, Aug. 2024

QSL Customer Engagements
QSL Seminar, Virtual, Apr. 2024

2023 **Practical implementations of quantum communication networks**
AWS re:Invent 2023, Las Vegas, NV, Nov. 2023

Panel Discussion: Novel Quantum Applications and Use Cases
Stanford Responsible Quantum Technology Conference, Stanford University, Stanford, CA, May. 2023

Quantum Computing in the Cloud and Industrial Quantum Technology
Silicon Valley Quantum Computing Group, Virtual, Feb. 2023

2022 **Analyzing Use Cases and Running Applications on Quantum Computers**
AWS re:Invent 2022, Las Vegas, NV, Nov. 2022

Quantum Computing in the Cloud and Industrial Quantum Technology
Physics Colloquium, Cal State Long Beach, Colloquium, Nov. 2022

2021 **Financial Portfolio Optimization with Quantum Computing**
AWS re:Invent 2021, Las Vegas, NV, Nov. 2021

How to Get Started with Quantum Computing on Amazon Braket
AWS re:Invent 2021, Las Vegas, NV, Nov. 2021

Repeat Session: How to Get Started with Quantum Computing on Amazon Braket
AWS re:Invent 2021, Las Vegas, NV, Nov. 2021

Quantum Computing in Practice
CDSE Days 2021, SUNY at Buffalo, virtual conference, Mar. 2021

2020 **Is Now the Right Time to Explore Quantum Computing?**
AWS re:Invent 2020, virtual conference, Dec. 2020

Entanglement Wedge Reconstruction and the Petz Map
Caltech High Energy Seminar, Caltech, Pasadena, CA, Jan. 2020

2019 **Symmetries and Quantum Error Correction**
IBMQ Seminar, IBM Watson Research Center, Yorktown Heights, NY, Nov. 2019

Covariant Quantum Error Correction: Symmetries, Reference Frames, and AdS/CFT
Last Frontiers in Quantum Information Science, Talkeetna, AK, July 2019

Covariant Quantum Error Correction
Quantum Information Seminar, Perimeter Institute, Waterloo ONT, April 2019

2018 **Resource Theory of Non-Gaussian Operators**
Stanford Quantum Information Seminar, Stanford University, Stanford CA, May 2018

Entanglement Wedge Reconstruction via Approximate Operator Algebra QEC
String Seminar, University of Amsterdam, Amsterdam, the Netherlands, Jan. 2018

2017 **Approximate Operator Algebra QEC and Entanglement Wedge Reconstruction**
Perimeter Institute Quantum Information Seminar, Waterloo, ONT, Nov. 2017

Replicating Quantum Information in Spacetime using Continuous Variables
Canadian Institute for Advanced Research Meeting, Niagara Falls, ONT, Oct. 2017

Entanglement Wedge Reconstruction from a Quantum Bayes' Rule
Stanford Quantum Information / Quantum Gravity Seminar, Stanford, CA, June 2017

Entanglement Wedge Reconstruction from a Quantum Bayes' Rule
Caltech High Energy Theory Seminar, California Institute of Technology, Pasadena, CA, May 2017

Public Lecture: Spacetime Replication of Continuous Variable Quantum Info
IEEE Information Theory and IEEE Photonics Societies, Stanford University, Stanford, CA, April 2017

Entanglement Wedge Reconstruction from a Quantum Bayes' Rule
High Energy Theory Seminar, University of British Columbia, Vancouver, BC, March 2017

2015 **Spacetime Replication of Continuous Variable Quantum Information**
Institute for Quantum Science and Technology Seminar, University of Calgary, Calgary, AB, Aug. 2015

Contributed Talks

2019 **Covariant Quantum Error Correction**, *QIST 2019*, Kyoto, Japan

2018 **Quantum Error Correction and Spacetime** *Ph.D. defense*, Stanford University

Approximate Operator Algebra Quantum Error Correction, *SQuInT 2018*, Santa Fe, NM

★ **Approximate Operator Algebra Quantum Error Correction**, *QIP2018*, Delft, the Netherlands

2017 **Covariant Quantum Error Correction in Holography**, *It from Qubit School*, Bariloche, Argentina

Entanglement Wedge Reconstruction via Universal Recovery Channels (poster), *qinfo17*, Santa Barbara, CA

Entanglement from Topology in Chern-Simons Theory (poster), *qinfo17*, Santa Barbara, CA

Entanglement Wedge Reconstruction via Universal Recovery Channels (poster), *QEC17*, Univ. of Maryland

Entanglement from Topology in Chern-Simons Theory (poster), *SQuInT 2017*, Baton Rouge, LA

Entanglement from Topology in Chern-Simons Theory (poster), *QIP2017*, Seattle, WA

2016 **Characterizing States in Chern-Simons Theory**, *It from Qubit Workshop*, Waterloo, ONT

Spacetime Replication of Continuous Variable Quantum Information, *RQI North*, Waterloo, ONT

2016 **Spacetime Replication of Continuous Variable Quantum Information**, *SQuInT 2016*, Albuquerque, NM

Spacetime Replication of Continuous Variable Quantum Information (poster), *QIP2016*, Banff, AB

2015 **Spacetime Replication of Continuous Variable Quantum Information**, *QIQG*, Waterloo, ONT

Algebraic Quantum Error Correction: a Unified Theory (poster), *SQuInT 2015*, Berkeley, CA

Universal Quantum Computation by Scattering in the Fermi-Hubbard Model (poster), *QIP2015*, Sydney

2014 **Spacetime Replication of Continuous Variable Quantum Information**, *QEC14*, ETH Zurich, Switzerland

2013 **Acceleration-Assisted Entanglement Harvesting**, *CONFETI 2013*, Orford, QC. **(Award for best talk)**

2012 **Cosmic String Signals in CMB Polarization**, *Cosmic Strings in New Windows*, Montréal, QC

Measuring Distance by Harvesting Entanglement, *Quantum Information Seminar*, Montréal, QC

Black Holes, Information, Complementarity, and Firewalls, *Graduate Student Seminar*, Montréal, QC

Measuring Distance with Acceleration-assisted Entanglement Harvesting, *RQI North*, Waterloo, ONT

Measuring Distance by Harvesting Entanglement, *Canadian Student Conf on Quantum Info*, Waterloo, ONT

Referee for Journals and Conferences

- Nature Quantum Information
- IEEE Transactions
- PRX Quantum
- New Journal of Physics
- Quantum
- Physical Review X
- Physical Review A
- Quantum Information Processing
- Theory of Quantum Computation, Communication and Cryptography
- Quantum Science and Technology

Other Previous Positions

Scientific Advisor — Area: Cloud Computing
Earth Computing, Palo Alto, California — Dec. 2018 – Oct. 2019
- Served on the board of advisors for a distributed computing startup, providing guidance on the company's core protocols

Graduate Research Student — Area: Quantum Information Science
Stanford University, Stanford, California — Sept. 2013 – Aug. 2018
- Research at the interface of quantum information theory and other areas of physics
- Emphasis on quantum error correction, quantum computation, and quantum gravity

Graduate Research Student — Area: Quantum Information in Cosmology
McGill University, Montréal, Québec — Sept. 2011 – Aug. 2013
- Researched cosmological models of the early universe with an emphasis on quantum information

Research Affiliate — Project: Relativistic Quantum Information
Perimeter Institute for Theoretical Physics, Waterloo, Ontario — Sept. 2010 – May 2011
- Studied the effects of non-inertial motion on entanglement harvested from quantum fields

Summer Research Intern — Project: Quantum Gambling
Perimeter Institute for Theoretical Physics, Waterloo, Ontario — May 2009 – Sept. 2009
- Developed a theory of decision making in the face of quantum uncertainty ("quantum gambling")

Astrophysics Research Student — Project: Extremely Isolated Galaxies in the SDSS
University of Waterloo, Waterloo, Ontario — May 2006 – Sept. 2006 and Sept. 2008 – Feb. 2009
- Studied the formation and evolution of extremely isolated galaxies
- Used data science methodology to analyze large astrophysical datasets

Space Plasma Physics Researcher — Project: Magnetospheric Kelvin-Helmholtz Instabilities
Canadian Space Agency, St. Hubert, Quebec — Sept. 2007 – May 2008
- Studied space plasma physics phenomena and developed research simulations

Research Assistant — Project: Chirped-Pulse Interferometry
Institute for Quantum Computing, Waterloo, Ontario — May 2007 – Sept. 2007
- Performed numerical analysis of a new chirped-pulse laser interferometry technique