

# Grant Salton

grant@gsalton.com

website: gsalton.com      arXiv profile: salton\_g\_1

## **IQIM Postdoctoral Scholar in Theoretical Physics**

Institute for Quantum Information and Matter  
California Institute of Technology (Caltech)

*Nov. 2018 – present*

## **Visiting Postdoctoral Scholar**

Department of Physics  
Stanford University

*Jan. 2019 – present*

## **Education**

### **Ph.D. Physics**

*Stanford, California, USA*

**Stanford University**

*Sept. 2013 – Sept. 2018*

**Supervisor:** Prof. Patrick Hayden

**Ph.D. Thesis:** Quantum Error Correction and Spacetime

### **M.Sc. Physics**

*Stanford, California, USA*

**Stanford University**

*Sept. 2013 – Sept. 2016*

**Supervisor:** Prof. Patrick Hayden

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

### **M.Sc. Physics**

*Montreal, Quebec, Canada*

**McGill University**

*Sept. 2011 – Dec. 2013*

**Co-supervisors:** Prof. Robert Brandenberger & Prof. Patrick Hayden

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

### **B.Sc. (Hons) Co-operative**

*Waterloo, Ontario, Canada*

**University of Waterloo**

*Sept. 2005 – Apr. 2010*

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

**Thesis:** Entanglement degradation from acceleration. Supervisors: Robert Mann & Nicolas Menicucci

## Research Awards and Funding

Level	Description	Place of Tenure	Competition	Value	Dates Held
Graduate	NSERC Post Graduate Scholarship	Stanford University	National	\$63000	09/2013 – 08/2016
Graduate	McGill Research Assistantship	McGill University	Institutional	\$8700	09/2012 – 08/2013
Graduate	NSERC Canada Graduate Scholarship	McGill University	National	\$17500	09/2011 – 08/2012
Graduate	McGill Research Assistantship	McGill University	Institutional	\$6500	09/2011 – 08/2012
Undergrad	Summer Undergraduate Research Internship	Perimeter Institute for Theoretical Physics	International	\$9000	05/2009 – 09/2009
Undergrad	NSERC Undergrad Student Research Award	University of Waterloo	National	\$8000	09/2008 – 12/2008
Undergrad	NSERC Undergrad Student Research Award	University of Waterloo	National	\$8000	05/2006 – 09/2006

## Fellowships and Other Awards

Level	Description	Place of Tenure	Basis	Value	Dates Awarded
Graduate	Chalk-Rowles Fellowship	McGill University	Academic	\$8000	09/2012
Graduate	Lorne Trottier Science Accelerator	McGill University	Academic	\$2125	09/2011
Graduate	Graduate Excellence Fellowship	McGill University	Academic	\$1000	09/2011
Graduate	Graduate Travel Award	McGill University	Academic	\$1000	01/2012
Undergraduate	Dean's Honours	University of Waterloo	Academic	N/A	All terms
Undergraduate	Helen Sawyer Hogg Scholarship in Astronomy	University of Waterloo	Academic	\$500	01/2010
Undergraduate	I. R. Dagg Memorial Scholarship	University of Waterloo	Leadership	\$1000	09/2009
Undergraduate	University of Waterloo President's Scholarship	University of Waterloo	Academic	\$2000	09/2005

## Publications

- Hayden, P., Nezami, S., Popescu, S., Salton, G., *Error Correction of Quantum Reference Frame Information* (*arXiv:1709.04471*) **Awarded “Best Poster” at QIP2017.**
- Cotler, J., Hayden, P., Salton, G., Swingle, B., Walter, M., *Entanglement Wedge Reconstruction via Universal Recovery Channels* (*arXiv:1704.05839*) **Accepted talk at QIP2018.**
- Salton, G., Swingle, B., Walter, M., *Entanglement from Topology in Chern-Simons Theory* (*arXiv:1611.01516*), *Phys. Rev. D* 95 (2017) 10, 105007
- Hayden, P., Nezami, S., Salton, G., Sanders, B., *Spacetime replication of continuous variable quantum information* (*arXiv:1601.02544*), *New J. Phys.* 18 (2016) 8, 083043
- Bao, N., Hayden, P., Salton, G., Thomas, N., *Universal quantum computation by scattering in the Fermi-Hubbard model* (*arXiv:1409.3585*), *New J. Phys.* 17 (2015) 9, 093028 (master's thesis topic). **Chosen for inclusion in IOPSelect.**
- Salton, G., Mann, R. B., Menicucci, N. C., *Acceleration-assisted entanglement harvesting and rangefinding* (*arXiv:1408.1395*), *New J. Phys.* 17 (2015) 3, 035001 (bachelor's thesis topic) **Won “best talk” award at INTRIQ conference.**
- Brandenberger, R., Park, N., Salton, G., *Angular power spectrum of B-mode polarization from cosmic string wakes* (*arXiv:1308.5693*), 2013, Accepted to *Phys. Rev. D* (master's thesis topic)

## Talks

- *Quantum Error Correction and Spacetime* (Ph.D. defense), Stanford University, July 2018
- **(Invited)** *Resource Theory of Non-Gaussian Operators*, Stanford Quantum Information Seminar, Stanford University, May 2018
- *Approximate Operator Algebra Quantum Error Correction (Decoding the Hologram in AdS/CFT)*, SQuInT 2018, Santa Fe, Feb. 2018
- **(Invited)** *Entanglement Wedge Reconstruction via Approximate Operator Algebra Quantum Error Correction*, University of Amsterdam, Amsterdam, the Netherlands, Jan. 2018
- *Approximate Operator Algebra Quantum Error Correction*, QIP2018, Delft, the Netherlands, Jan. 2018
- *Covariant Quantum Error Correction in Holography*, It from Qubit Gong Show, Bariloche, Argentina, Jan. 2018
- **(Invited)** *Approximate Operator Algebra Quantum Error Correction and Entanglement Wedge Reconstruction*, Perimeter Institute Quantum Information Seminar, Waterloo, Ontario, Nov. 2017
- **(Invited)** *Replicating Quantum Information in Spacetime using Continuous Variables*, CIFAR Quantum Information Science Program Meeting, Niagara Falls, Oct. 2017
- *Entanglement Wedge Reconstruction via Universal Recovery Channels* (poster), qinfo17, KITP, Santa Barbara, Oct. 2017
- *Entanglement from Topology in Chern-Simons Theory* (poster), qinfo17, KITP, Santa Barbara, Oct. 2017
- *Entanglement Wedge Reconstruction via Universal Recovery Channels* (poster), QEC17, Univ. of Maryland, Sept. 2017
- **(Invited)** *Entanglement Wedge Reconstruction from a Quantum Bayes' Rule*, Stanford Quantum Information / Quantum Gravity Seminar, Stanford University, June 2017
- **(Invited)** *Entanglement Wedge Reconstruction from a Quantum Bayes' Rule*, Caltech High Energy Theory Seminar, California Institute of Technology, May 2017
- **(Invited Public Lecture)** *Spacetime Replication of Continuous Variable Quantum Information*, Co-sponsored by the IEEE Information Theory and Photonics Societies, Stanford University, Stanford, California, April 2017
- **(Invited)** *Entanglement Wedge Reconstruction from a Quantum Bayes' Rule*, High Energy Theory Seminar, University of British Columbia, Vancouver, March 2017
- *Entanglement from Topology in Chern-Simons Theory* (poster), SQuInT 2017, Baton Rouge, Louisiana, Feb. 2017
- *Entanglement from Topology in Chern-Simons Theory* (poster), QIP2017, Seattle, Washington, Jan. 2017
- *Characterizing States in Chern-Simons Theory*, It from Qubit Workshop, Perimeter Institute, Waterloo, Ontario July 2016
- *Spacetime Replication of Continuous Variable Quantum Information*, Relativistic Quantum Information - North 2016, Waterloo, Ontario, June 2016
- *Spacetime Replication of Continuous Variable Quantum Information*, SQuInT 2016, Albuquerque, New Mexico, Feb. 2016
- *Spacetime Replication of Continuous Variable Quantum Information* (poster), Quantum Information Processing 2016, Banff, Alberta, Jan. 2016
- *Spacetime Replication of Continuous Variable Quantum Information*, Quantum Information in Quantum Gravity, Perimeter Institute, Ontario Aug. 2015
- **(Invited)** *Spacetime Replication of Continuous Variable Quantum Information*, Institute for Quantum Science and Technology Seminar, University of Calgary, Aug. 2015
- *Algebraic Quantum Error Correction: a Unified Theory* (poster), SQuInT 2015, Berkeley, California, February 2015
- *Universal Quantum Computation by Scattering in the Fermi-Hubbard Model* (poster), Quantum Information Processing 2015, Sydney, Australia, Jan. 2015
- *Spacetime Replication of Continuous Variable Quantum Information*, Quantum Error Correction 2014, ETH Zurich, Switzerland, Dec. 2014
- **(Award for best talk)** *Acceleration-Assisted Entanglement Harvesting*, CONFETI 2013, Quebec, Canada, Jan. 2013
- *Cosmic String Signals in CMB Polarization*, Workshop: Searching for Cosmic Strings in New Observational Windows,

McGill University, Oct. 2012

- *Measuring Distance by Harvesting Entanglement*, Quantum Information Seminar, McGill University, Oct. 2012
- *Black Holes, Information, Complementarity, and Firewalls*, Graduate Student Seminar, McGill University, Oct. 2012
- *Measuring Distance with Acceleration-assisted Entanglement Harvesting*, Relativistic Quantum Information, Perimeter Institute, Waterloo, Ontario, June 2012
- *Measuring Distance by Harvesting Entanglement*, 2nd AQUA Student Congress & 9th Canadian Student Conference on Quantum Information, Institute for Quantum Computing, Waterloo, Ontario, June 2012
- *Betting on Quantum Theory*, Perimeter Institute Quantum Foundations Seminar, Waterloo, Ontario 2009
- *Entanglement Degradation from Acceleration*, Thesis Seminar Series, University of Waterloo, Waterloo, Ontario, 2010
- *Entanglement Degradation from Acceleration*, (poster) 2010, University of Waterloo, thesis poster session

## Summer Schools

- It from Qubit Summer School, July 18-29, 2016. Perimeter Institute for Theoretical Physics. Waterloo, Ontario
- Princeton Summer School on Condensed Matter Physics, July 28-31, 2014. Princeton University
- Quantum Hamiltonian Complexity Boot Camp, Jan 15-18, 2014. Simons Inst. for the Theory of Computing, Berkeley, CA
- 13th Canadian Summer School on Quantum Info., June 17-21, 2013. University of Calgary, Calgary, Alberta
- 12th Canadian Summer School on Quantum Info., June 11-16, 2012. Institute for Quantum Computing, Waterloo, Ontario
- Summer School on Cosmology, July 15-Aug. 3, 2012. International Centre for Theoretical Physics, Trieste, Italy

## Teaching Experience

### Teaching Assistant

---

*Stanford University, Stanford, CA*

*April 2014 – June 2018*

- TA for PHYS 25 (Modern Physics), Sprint 2018
- TA for PHYS 43 (Electricity and Magnetism), Spring 2017
- TA for PHYS 134/234 (Advanced Topics in Quantum Mechanics), Autumn 2015
- TA for PHYS 134/234 (Advanced Topics in Quantum Mechanics), Autumn 2014
- TA for PHYS 25 (Modern Physics), Spring 2014

### Physics Teaching Mentor

---

*Stanford University, Stanford, CA*

*April 2015 – June 2018*

- Facilitate interactions between physics TAs and the department of physics
- Mediate conflicts and provide support for TAs
- Run evaluation session with students to provide feedback for first-time TAs

### Teaching Assistant

---

*McGill University, Montreal, Quebec*

*Sept. 2011 – Aug. 2013*

- Taught introductory lessons for physics labs
- Volunteered to proctor exams and labs

### Private Tutor

---

*Waterloo, Ontario*

*May 2010 – July 2013*

- Tutored math and physics privately at high school and university levels

### Teaching Assistant (First Year Physics)

---

*University of Waterloo, Waterloo, Ontario*

*Sept. 2009 – Dec. 2009*

- Ran a help center for a first year physics course and taught tutorials

## Previous Positions

---

### 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 and quantum gravity

---

### Graduate Research Student

Area: Quantum Information in Cosmology

*McGill University, Montreal, Quebec*

*Sept 2011 – Aug. 2013*

- Studied various topics relating to both quantum information and cosmology
- Thesis focused on CMB polarization due to cosmic string wakes

---

### Research Student

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 preliminary theory of quantum gambling

---

### Astrophysics Research Student

Project: Extremely Isolated Galaxies in the SDSS

*University of Waterloo, Waterloo, Ontario*

*Sept. 2008 – Feb. 2009*

- Studied the formation and evolution of extremely isolated galaxies after defining criteria for isolation

---

### 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*

- Conducted numerical study of chirped-pulse interferometry technique

---

### Researcher/Experimenter

Project: Thermal Expansion of Accuracy Assessment Kit

*Northern Digital Inc., Waterloo, Ontario*

*Jan. 2007 – May 2007*

- Designed and conducted experiments using highly specialized equipment

---

### Astrophysics Research Student

Project: Extremely Isolated Galaxies in the SDSS

*University of Waterloo, Waterloo, Ontario*

*May 2006 – Sept. 2006*

- First part of the two term astrophysics research project described above