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## SUMMARY

**Objective:** *To be a “full-stack” applied quantum theorist, working directly with both theory and experiment teams.*

## Highlights

- 12 publications (8 as first author) including theory and experiment, cited 145 times
- Featured in *The Economist*, the *MIT News*, and Harvard’s *Tomorrow’s Tech Today* conference
- Ranked in the top 10 STEM graduate students nationally in the Vanier Canada competition
- Received my department’s top annual award for professional promise at MIT

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## EDUCATION

**Massachusetts Institute of Technology**, Cambridge, MA 2016–(2020)

*PhD Quantum Science and Engineering*

- GPA: 5.0/5. Publications: [1–3, 10]
- Thesis: “*Device-adapted quantum error correction for near-term experiments.*” Advisor: Paola Cappellaro
- Committee: Seth Lloyd, William Oliver, Liang Jiang, Paola Cappellaro
- Selected courses: Quantum computation, Superconducting qubits, Algorithms, Machine learning

**University of Waterloo**, Waterloo, Canada 2014–2016

*MMath Applied Mathematics – Quantum Information*

- GPA: 95/100. Publications: [4, 5, 7]
- Thesis: “*Indirect quantum control: An implementation-independent scheme.*” Advisor: Achim Kempf
- Committee: Raymond Laflamme, Eduardo Martín-Martínez, Achim Kempf

**University of Waterloo**, Waterloo, Canada 2010–2014

*BSc Mathematical Physics (Honors, Co-operative)*

- GPA: 96/100. Publications: [6, 8, 9, 11, 12]
- Thesis: “*Universal uncertainty relations.*” Advisor: Robert Spekkens

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## RESEARCH

### Graduate

**Massachusetts Institute of Technology**, Cambridge, MA 2016–(2020)

*Quantum Engineering Group, Advisor: Paola Cappellaro*

- Project 1: Tailored quantum error-correcting codes to common noise sources, exponentially reduced overhead [1]
- Project 2: Developed new error-correcting codes to enhance near-term quantum sensors [2, 3, 10]
- Project 3: Improving robustness of quantum error correction operations in pre-fault-tolerant devices

**Institute for Quantum Computing**, Waterloo, Canada 2014–2016

*Physics of Information Group, Advisor: Achim Kempf*

- Developed a novel scheme to control open quantum systems with high fidelity [5] (see also [4, 7] for background)

### Undergraduate

**Perimeter Institute for Theoretical Physics**, Waterloo, Canada FALL 2013

*Quantum Foundations Group, Advisor: Robert Spekkens*

- Benchmarked and refined a novel method for comparing quantum measurement statistics

**CERN**, Geneva, Switzerland SUMMER 2013

*ATLAS Experiment, Supervisor: Brigitte Vachon*

- One of five students chosen to represent Canada in CERN’s international summer student program
- Performed statistical analysis of LHC calibration data on CLUMEQ supercomputer [12]

- Designed and conducted experiments quantifying noise processes affecting superconducting qubits [6]

- Theoretically developed a protocol to minimize noise in photonic devices [9,11], now in active experimental use [8]

- Developed a program to automatically identify and describe structures of interest in astronomical data

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## PUBLICATIONS

Total Citations: 145

### Submitted Papers

- [1] **D. Layden**, M. Chen, P. Cappellaro, *Efficient quantum error correction of dephasing induced by a common fluctuator*, arXiv:1903.01046 (2019).

### Peer-Reviewed Papers

- [2] **D. Layden**, S. Zhou (equal contributions), P. Cappellaro, L. Jiang, *Ancilla-free quantum error correction codes for quantum metrology*, Phys. Rev. Lett. **122**, 040502 (2019).
- [3] **D. Layden**, P. Cappellaro, *Spatial noise filtering through error correction for quantum sensing*, npj Nature Quantum Information **4**, 30 (2018).
- [4] D. Grimmer, **D. Layden**, E. Martín-Martínez, R. B. Mann, *Open dynamics under rapid repeated interaction*, Phys. Rev. A **94**, 032126 (2016).
- [5] **D. Layden**, E. Martín-Martínez, A. Kempf, *Universal scheme for indirect quantum control*, Phys. Rev. A **93**, 040301(R) (2016).
- [6] J.-L. Orgiazzi, C. Deng, **D. Layden**, R. Marchildon, F. Kitapli, F. Shen, M. Bal, F. R. Ong, A. Lupășcu, *Flux qubits in a planar circuit quantum electrodynamics architecture: quantum control and decoherence*, Phys. Rev. B **93**, 104518 (2016).
- [7] **D. Layden**, E. Martín-Martínez, A. Kempf, *Perfect Zeno-like effect through imperfect measurements at a finite frequency*, Phys. Rev. A **91**, 022106 (2015).
- [8] A. Gribble, **D. Layden**, and I. A. Vitkin, *Experimental validation of the optimum input polarization states for Mueller matrix determination with a dual photoelastic modulator polarimeter*, Opt. Lett. **38**, 5272 (2013).
- [9] **D. Layden**, M. F. G. Wood, and I. A. Vitkin, *Optimum selection of input polarization states in determining the sample Mueller matrix: a dual photoelastic polarimeter approach*, Opt. Express **20**, 20466 (2012).

### Conference Proceedings

- [10] S. Zhou, **D. Layden**, M. Zhang, J. Preskill, P. Cappellaro, L. Jiang, *Error-corrected quantum sensing*, Proc. SPIE 10934, Optical, Opto-Atomic, and Entanglement-Enhanced Precision Metrology, 109341J (2019, invited paper).

### Book Chapters

- [11] **D. Layden**, N. Ghosh, and I. A. Vitkin, “Quantitative Polarimetry for Tissue Characterization and Diagnosis,” in *Advanced Biophotonics: Tissue Optical Sectioning*, V. V. Tuchin and R. K. Wang, eds. (Taylor & Francis 2013), pp. 73–108.

### Published Reports

- [12] **D. Layden**, *Measuring 2012 ATLAS Photon Trigger Efficiency*, CERN-STUDENTS-Note-2013-074.

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## MEDIA COVERAGE

- The Economist: [Letter to the editor](#) regarding *Technology Quarterly: Quantum Devices*
- MIT News, MIT Daily and Phys.org: *Honing quantum sensing*
- MIT Nuclear Science and Engineering Spotlight: *David Layden: Honing quantum sensing*
- Phys.org and University of Waterloo News: *Researchers find new way to control quantum systems*
- Institute for Quantum Computing News: *Handle with quantum care*
- Institute for Quantum Computing Annual Report: *Quantum Control* (featured student profile, page 15)

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## AWARDS

### Highlights

#### Manson Benedict Award (2019)

- Awarded annually to one MIT graduate student for academic performance and professional promise in Nuclear Science and Engineering

#### Vanier Canada Graduate Scholarship (2016, Declined)

Value:  $3 \times 50\,000$  C\$

- Ranked 9th nationally out of 161 finalists across STEM fields

#### Clarendon Scholarship (2016, Declined)

Value: 110 000 £

- For study at the University of Oxford, of greater value than the Rhodes scholarship (as of 2016)

### Other Selected Awards

Award	Value	Years
Meredith and Ray Rothrock Fund Fellowship	37 500 US\$	2016
NSERC Canada Graduate Scholarship - Doctoral (CGS D, declined)	$3 \times 35\,000$ C\$	2016–2019
NSERC Canada Graduate Scholarship - Doctoral (PGS D, declined third year)	$3 \times 21\,000$ C\$	2016–2019
NSERC Canada Graduate Scholarship - Master's (CGS M)	17 500 C\$	2014–2015
Ontario Graduate Scholarship	15 000 C\$	2015–2016
Mensa Canada Scholarship - Woodhams Memorial Trust Award	10 100 C\$	2016
President's Graduate Scholarship ( $\times 2$ )	$2 \times 10\,000$ C\$	2014–2016
Mike Lazaridis Scholarship in Theoretical Physics (declined)	7 500 C\$	2013
Institute of Particle Physics Summer Fellowship	7 100 C\$	2013
NSERC Undergraduate Student Research Award ( $\times 3$ )	$3 \times 4\,500$ C\$	2011–2013
Alpha Nu Sigma (honorary branch of the American Nuclear Society)	-	2018
Rhodes Scholarship Finalist (Quebec, Canada)	-	2014

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## PRESENTATIONS

◊ expenses paid by organizers

### Invited Talks

- ◊ Institute for Quantum Computing Special Seminar, April 10, 2018 (Waterloo, Canada) “*Spatial noise filtering through error correction for quantum sensing*”

### Contributed Talks

- APS March Meeting 2019 (Boston, MA) “*Spatial noise filtering through new error-correcting codes for quantum sensing*”
- MIT-Harvard Center for Ultracold Atoms 2019 Retreat (Plymouth, NH) “*Spatial noise filtering through new error-correcting codes for quantum sensing*”
- APS March Meeting 2016 (Baltimore, MD) “*A universal scheme for indirect quantum control*”
- ◊ GRC Quantum Control of Light & Matter 2015 (South Hadley, MA) “*Emergent unitarity in open quantum systems*”
  - Only student talk out of 50-75 applicants
- APS March Meeting 2015 (San Antonio, TX) “*Perfect Zeno effect through imperfect measurements at a finite frequency*”
- CERN Student Sessions 2013 (Geneva, Switzerland; Video: 12:30 – 26:30)

### Posters

- 5<sup>th</sup> International Conference on Quantum Error Correction 2019 (London, UK)
- MIT Nuclear Science and Engineering Graduate Research Expo 2019 (Boston, MA)
- ◊ GRC Quantum Science 2018 (Easton, MA – partial financial support)
- IBM ThinkQ 2017: Approximate Quantum Computing (Yorktown Heights, NY)
- MIT-Harvard Center for Ultracold Atoms 2017 Retreat (Plymouth, NH)
- ◊ Coherent Control of Complex Quantum Systems 2016 (Okinawa, Japan)
- ◊ GRC Quantum Control of Light & Matter 2015 (South Hadley, MA)
- CERN Summer Student Poster Session 2013 (Geneva, Switzerland)

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## TEACHING, SUPERVISION & SERVICE

### Course Development

#### Theory of Quantum Optics (QIC 895), University of Waterloo

SPRING 2015

- Designed and organized a graduate seminar/reading course featuring faculty guest speakers

## Supervision

- Supervising MIT undergraduate Louisa Huang for [UROP](#) and [SuperUROP](#) research projects 2018

## Service and Outreach

- Selected to give the *Quantum Technology* talk at Harvard's [DayCon 2018](#), a public event on emerging technologies
- Leadership board member for MIT's [Interdisciplinary Quantum Information Science and Engineering](#) seminar series
- Outreach volunteer for [Let's Talk Science](#), conducted classroom (K–12) and community visits (2015–16)
- Reviewer for Physical Review Letters and Physical Review A

## Teaching Programs

[Kaufman Teaching Certificate Program](#), Massachusetts Institute of Technology SUMMER 2019

## Teaching Assistantships

[Quantum Theory 2 \(AMath 673/473\)](#), University of Waterloo (Instructor: Robert Koenig) FALL 2014  
[Multivariate Calculus \(Math 207\)](#), University of Waterloo FALL 2015

- Nominated for [Outstanding TA Awards](#) for both courses on the basis of my tutorials

Declined a TA position for MIT's [Intro to Machine Learning](#) course (6.036 Spring 2019).

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## PROGRAMMING

**Languages & Systems:** Python, Matlab, Mathematica, Maple, Git  
**Libraries:** QuTiP, Keras, NumPy, SciPy

Prepared July 5, 2019.