Connor Kupchak

Current Address
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CITIZENSHIP

Canada
Status Indian - Cross Lake First Nation

RESEARCH AND EXPERIENCE

Research Associate — **UOttawa/National Research Council**
Quantum Optics Laboratory — **Ottawa, ON**
09/2018-Present

Developed a theory for the production of cylindrical vector modes in optical fibre. Simulated multi-layer stack devices using genetic algorithms. Supervised multiple students and provided advice and assistance for their research projects.

Postdoctoral Fellow — **National Research Council/UOttawa**
Secure and Disruptive Technologies — **Ottawa, ON**
09/2015-08/2018

Lead project on ultrafast switching of photonic states for quantum information processing and advanced optical applications; work involved collaborative effort with theoreticians as needed. Prepared official reports detailing project accomplishments, milestones, resources, risk etc. Involvement culminated in 5 peer-reviewed publications.

Postdoctoral Associate — **Stony Brook University**
Department of Physics and Astronomy — **Stony Brook, NY**
06/2013-06/2015

Worked on the experimental interfacing of light states with atomic media and quantum state measurement via homodyne tomography. Implemented algorithms and data analysis programs for quantum state and process tomography. Was involved in writing grant applications which subsequently led to the group being awarded more than 1M USD in research funds. Filled in as a lecture substitute in addition to advising and mentoring graduate and undergraduate students.

Graduate Research Student — **University of Calgary**
Institute for Quantum Science and Technology — **Calgary, AB**
09/2007-05/2013

Research was primarily on the experimental characterization of quantum optical processes with a focus on continuous variable quantum memories including Electromagnetically Induced Transparency and Gradient Echo Memory.

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Graduate Research Student — **Western University**
Department of Medical Biophysics — **London, ON**
09/2005-08/2007

Masters research was focused on dose-volume histograms and their relation to healthy tissue complications in patients receiving radiation treatments for cancer. Developed a novel tool to map the probability of a radiation complication to a dose-volume histogram metric commonly used in radiation therapy treatment planning.

Undergraduate Research Student — **University of Manitoba**
Department of Medical Biophysics — **Winnipeg, MB**
Summer 2003, 2004, 2005

Theoretical modelling and experimental verification of advanced radiation therapy treatments using various dose measurement devices. Positions partially funded by the National Science and Engineering Research Council of Canada (NSERC).

Teaching Experience

Graduate Teaching Assistant — **University of Calgary**
Department Physics and Astronomy — **Calgary, AB**
Fall 2007 - Winter 2013

- PHYS 211 - Mechanics (Laboratory) Fall 2007
- PHYS 223 - Introductory Electromagnetism, and Thermal Physics (Laboratory) Winter 2008
- PHYS 223 - Introductory Electromagnetism, and Thermal Physics (Laboratory) Winter 2009
- PHYS 673 - Quantum And Nonlinear Optics (Grader) Fall 2010
- PHYS 323 - Optics & Electromagnetism (Laboratory) Fall 2011
- PHYS 255 - Electromagnetic Theory I (Laboratory) Winter 2012
- PHYS 211 - Mechanics (Laboratory) Fall 2012
- PHYS 325 - Modern Physics (Laboratory) Winter 2013

Led laboratories and tutorials in first and second year level mechanics, electromagnetism, thermodynamics, circuits, modern physics and error analysis. Student classes ranged from engineers, physics majors, and pre-med students. Performed assignment grading for a graduate level quantum optics course taught by Professor A. I. Lvovsky.

Substitute Lecturer — **Stony Brook University**
Department Physics and Astronomy — **Stony Brook, NY**
Fall 2014

- PHY 301 Electromagnetic Theory I (Guest Lecturer) Fall 2014
- PHY452 Lasers (Guest Lecturer) Fall 2014

Substitute lecturer for courses taught by Professor Eden Figueroa.

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Education

09/2007 - 04/2013, Ph.D., Physics, (Awarded 06/2013),
Institute for Quantum Science and Technology
University of Calgary, Calgary, Alberta, Canada
Advisor: Prof. A. I. Lvovsky
Thesis: Quantum Process Tomography of Quantum Memory Systems

09/2005 - 08/2007, M.Sc., Medical Biophysics, (Awarded 10/2007),
Department of Medical Biophysics
Western University, London, Ontario, Canada
Advisor: Prof. J. Van Dyk
Thesis: Experience Driven DVH Maps of NTCP Risk

09/2000 - 12/2004, B.Sc. (Honours), Physics. (Awarded 02/2005),
Department of Physics and Astronomy
University of Manitoba, Winnipeg, Manitoba, Canada
Advisor: Prof. G. Williams
Honours Thesis: Giant Magnetocaloric Effect in Shape Memory Alloys

Awards

- 09/2009-08/2012 Alexander Graham Bell Canada Graduate Scholarship (CGS D3) $35,000 CAD per annum (NSERC)
- 09/2009-08/2012 PhD Graduate Scholarship in Information Communications Technology (ICT) $36,000 CAD + $1,500 CAD research allowance (Alberta Innovates)
- 09/2008-08/2009 MSc Graduate Student Scholarship in ICT $12,500 CAD + $1,500 CAD research allowance (Alberta Ingenuity)
- 09/2008-08/2009 Alexander Graham Bell Canada Graduate Scholarship (CGS M) $17,500 CAD (NSERC)
- 09/2006-08/2007 CIHR Strategic Training Program $22,600 CAD (Western University, CIHR STP Program)
- 2003, 2004, 2005 Undergraduate Student Research Award (USRA) $4,500 CAD (NSERC)
- 2001, 2002, 2003, 2004 Cross Lake Education Authority Performance Bursary $1,000 CAD (CLEA)
- 2000 Winnipeg Blue Bombers Football Entrance Scholarship (Athletic) $1,500 CAD (CIS)

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Research Papers

Postdoctoral Research:

C. Kupchak, J. Erskine, D.G. England, B. J. Sussman, *Terahertz-bandwidth switching of heralded single photons*, Optics Letters **44**(6), 1427-1430, 15 March 2019

J. Erskine, D.G. England, C. Kupchak, B. J. Sussman, *Real-time spectral characterization of a photon pair source using a chirped supercontinuum seed*, Optics Letters **43**(4), 907-910, 14 February 2018

C. Kupchak, P.J. Bustard, K. Heshami, J. Erskine, M. Spanner, D.G. England, B. J. Sussman, *Time-bin-to-polarization conversion of ultrafast photonic qubits*, Physical Review A **96**(5), 053812, 6 November 2017

M. Namazi, C. Kupchak, B. Jordaan, R. Shahrokhshahi, E. Figueroa, *Ultralow-Noise Room-Temperature Quantum Memory for Polarization Qubits*, Physical Review Applied 8 (3), 034023, 25 September 2017

P.J. Bustard, D.G. England, K. Heshami, C. Kupchak, B.J. Sussman, *Quantum frequency conversion with ultra-broadband tuning in a Raman memory*, Physical Review A **95**(5), 053816, 5 May 2017

P.J. Bustard, D.G. England, K. Heshami, C. Kupchak, B.J. Sussman, *Reducing noise in a Raman quantum memory*, Optics Letters **41**(21), 5055-5058, 1 November 2016

C. Kupchak, S. Rind, B. Jordaan, and E. Figueroa, *Quantum Process Tomography of an Optically-Controlled Kerr Non-linearity*, Scientific Reports **5**: 16581, 20 November 2015

M. Namazi, T. Mittiga, C. Kupchak, and E. Figueroa, *Cascading Quantum Light-Matter Interfaces*, Physical Review A **92**(3), 033846 24 September 2015

C. Kupchak, T. Mittiga, B. Jordaan, M. Namazi, C. Nölleke, and E. Figueroa, *Room-Temperature Single-photon level Memory for Polarization States*, Scientific Reports **5**: 7658 (5 pp.), 7 January 2015

PhD Thesis Research:

R. Kumar, E. Barrios, C. Kupchak, and A. I. Lvovsky, *Experimental characterization of bosonic photon creation and annihilation operators* , Physical Review Letters **110**(13): 130403 (5 pp.), 25 March 2013

R. Thomas, C. Kupchak, G. S. Agarwal and A. I. Lvovsky, *Observation of electromagnetically induced transparency in evanescent fields* , Optics Express **21**(6): 6880-6888, 25 March 2013

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M. Lobino, S. Rahimi-Keshari, D. Korystov, C. Kupchak, E. Figueroa, A. Scherer, B. C. Sanders and A. I. Lvovsky, *Quantum-optical process tomography using coherent states* Proceedings of *10th International Conference on Quantum Communication, Measurement and Computation*, pp. 197 - 206 Published by American Physical Society (APS), College Park, United States of America, 2011

M. Lobino, C. Kupchak, E. Figueroa and A. I. Lvovsky, *Memory for light as a quantum process*, Physical Review Letters **102**(20): 203601 (4 pp.), 19 May 2009

E. Figueroa, J. Appel, C. Kupchak, M. Lobino, D. Korystov and A. I. Lvovsky, *Electromagnetically-induced transparency and squeezed light* Proceedings of *9th International Conference on Quantum Communication, Measurement and Computing* AIP Conference Proceedings, volume 1110, issue 1, pp. 249 - 252 (2009)

M. Lobino, D. Korystov, C. Kupchak, E. Figueroa, B. C. Sanders and A. I. Lvovsky, *Coherent-state quantum process tomography* Proceedings of *9th International Conference on Quantum Communication, Measurement and Computing* AIP Conference Proceedings, volume 1110, issue 1, pp. 447 - 450 (2009)

M. Lobino, D. Korystov, C. Kupchak, E. Figueroa, B. C. Sanders, A. I. Lvovsky, *Complete Characterization of Quantum-Optical Processes*, Science **322**, 563 (2008)

Master Thesis Research:

C. Kupchak, J. Battista, and J. Van Dyk, *Experience drive dose-volume histogram maps of NTCP risk as an aid for radiation treatment plan selection and optimization*, Medical Physics **35** (1), 333-343 (2008).

Presentations

C. Kupchak, J. Erskine, D.G. England, B.J. Sussman *THz Bandwidth Switching ofHeralded Single Photons*, Photonics North 2019 (Contributed), Quebec, QC, May 21 - May 23 2019

C. Kupchak, J. Erskine, D.G. England, B.J. Sussman *Ultrafast Switching of Single Photons*, Photonics North 2018 (Contributed), Montreal, QC, June 5 - June 7 2018

C. Kupchak, P.J. Bustard, K. Heshami, J. Erskine, M. Spanner, D.G. England, B.J. Sussman *Efficient Conversion of Qubits Between Timebin and Polarization Encodings at Ultrafast Timescales*, Photonics North 2017 (Contributed), Ottawa, ON, June 6 - June 8 2017

C. Kupchak *Quantum Optical Processing In Lambda-Level Systems At Room Temperature*, Photonics North 2016 (Invited), Quebec, QC, May 24- May 26 2016

C. Kupchak, S. Rind, and E. Figueroa, *Towards Quantum Process Tomography of an Optical Quantum Gate*, Latin America Optics and Photonics Conference (LAOP) 2014 (Poster), Cancun, Mexico, 17 November 2014 - 21 November 2014

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C. Kupchak, Z. Burkley, B. Jordann, C. Chueng, C. Nölleke, and E. Figueroa, *Towards a cavity electromagnetically induced transparency based quantum gate*, 41st Annual Meeting of the APS Division of Atomic, Molecular and Optical Physics (DAMOP 2014), Madison, WI, 2 June 2014 - 6 June 2014

C. Kupchak, T. Mittiga, B. Jordann, M. Namazi, C. Nölleke, and E. Figueroa, *Room Temperature Memory for Few Photon Polarization Qubits*, 41st Annual Meeting of the APS Division of Atomic, Molecular and Optical Physics (DAMOP 2014), Madison, WI, 2 June 2014 - 6 June 2014

C. Kupchak *Room Temperature Quantum Memory for Polarization States*, 3rd HANAS Consortium Meeting, Dresden, Germany, 13 February 2014 - 14 February 2014

C. Kupchak, R. Thomas and A. I. Lvovsky, *Characterization of a high efficiency optical memory for the storage of quantum light states* (contributed), 21st International Laser Physics Workshop (LPHYS'12), Calgary, Alberta, 23 July 2012 - 27 July 2012

C. Kupchak, R. Thomas and A. I. Lvovsky, *Characterization of High Efficiency Quantum Memory* (contributed), Canadian Association of Physicists Congress, Calgary, Canada, 10 June 2012 - 14 June 2012

C. Kupchak, R. Thomas and A. I. Lvovsky, *Gradient Echo Memory for High Efficiency Quantum Light Storage* (contributed), 39th Annual Meeting of the APS Division of Atomic, Molecular and Optical Physics (DAMOP 2012), Anaheim, CA, 4 June 2012 - 8 June 2012

C. Kupchak, R. Thomas and A. I. Lvovsky, *Evanescent EIT and Goos-Hanchen shifts* (contributed), Quantum 2012 - Workshop ad memoriam of Carlo Novero, Turin, Italy, 20 May 2012 - 26 May 2012

C. Kupchak, M. Lobino, E. Figueroa and A. I. Lvovsky, *Process tomography of quantum-optical memory* (invited), International Laser Physics Workshop (LPHYS'09), Barcelona, Spain, 13 July 2009 - 17 July 2009

Executive Positions and Committees

- Co-chair: Photonics North: Light-matter interactions at the quantum limit, Montreal QC June 5-7, 2018
- President: OSA/SPIE University of Calgary Student Chapter, 09/2009-09/2010
- Vice-President: OSA/SPIE University of Calgary Student Chapter, 09/2008-09/2009
- Organizer: Canadian Quantum Information Students Conference (CQISC), University of Calgary, July 12-16 2010
- Principal Organizer: Alberta Quantum and Nano-Optics (QuNO) Inagural Meeting, University of Calgary, June 24-27 2009