Sarah **Kaiser**

Research Engineer · Science Communicator

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Summary

Experimental quantum physicist who is an expert at building and automating optical systems. Over eight years experience specializing in quantum cryptography, experimental design, and science communication. Loves working with Python, lasers, and lathes.

Education

Univeristy of Waterloo, Institute for Quantum Computing — *Waterloo, Canada*

Ph.D. Physics (Quantum Information) — *2012 - 2016*

- Quantum key distribution devices: How to make them and how to break them

Bethel University — *St. Paul, Minnesota, USA*

B.S. in Physics, B.A. in Mathematics Summa Cum Laude with Honors — *2007 - 2011*

Skills

Programming	Python, C/C++, Mathematica, Q#, Solid Edge CAD, and Unix/Windows
Research Interests	Quantum Key Distribution, Quantum Sensing, Optical Metrology, Experiment Automation
Thesis Partnerships	Canadian Space Agency, COM DEV (now Honeywell), Excelitas, Institut National D'Optique
Languages	English, Spanish

Experience

Pensar Development — *Seattle, Washington*

Research Engineer — *2018 – Present*

- Developing hardware and software solutions to customers' advanced research and product development needs.
- Managing client relationships by communicating the direction and decisions made by the technical team.
- Building agile teams and processes to ensure that projects always exceed customer expectations.

Macquarie University — *Sydney, Australia*

Postdoctoral Research Fellow — *2016 – 2017*

- Developed new experimental control and automation for optical and microwave characterization of color centers in nanodiamonds, including expanding to low temperature environments.
- Supervised a number of undergrad and HDR students working in the lab.
- Collaborated on industrial corporate partnership projects to explore industrial applications of current lab research.

University of Waterloo, Institute for Quantum Computing — *Waterloo, ON, Canada*

Mike and Ophelia Lazaridis Fellow — *2012 – 2016*

- Characterized optoelectronic network and demonstrated physical side-channel attack on commercial quantum cryptography hardware.
- Helped deliver multiple government grants demonstrating the feasibility of adapting quantum cryptography hardware to satellites.
- Designed optoelectronic systems for single photon detection on a satellite platform for quantum key distribution, as well as the optical characterization of the completed prototypes.
- Developed numerous outreach programs, demos, including an entire museum exhibit to help communicate my research to the public.

Wolfram Research — *Urbana–Champaign, IL, USA*

Jr. Kernel Developer — *2011 – 2012*

- Served on the Information Visualization Team for the Mathematica software program, generating ideas for new software functionality.
- Participated in group development of new program features providing enhanced utility and visualization for the end user.
- Wrote code prototypes to facilitate the development of the new program features decided upon by the team.
- Resolved development issues and resolved submitted bugs in current builds to refine the development of the new features.

National Institute of Standards and Technology — *Boulder, CO, USA*

Undergraduate Research Fellow — *2010 – 2011*

- Researched new modeling techniques to improve the theoretical and practical understanding of newly fabricated laboratory devices.
- Implemented proposed algorithms in Mathematica to characterize and predict future device behavior.
- Participated in lab group collaborations to resolve experimental and theoretical issues.
- Presented research to a variety of audiences, enhancing knowledge of the project.

California Institute of Technology *Pasadena, CA, USA*

Undergraduate Research Fellow *2009 – 2009*

- Engineered and fabricated lab components to aid in facilitating the research project goals.
- Modeled experimental apparatus in Mathematica to better understand the system and its components.
- Collaborated with lab team to identify and successfully meet research challenges.
- Presented research results to a variety of audiences to enhance knowledge of the project.

Honors & Awards

2016	**Equity and Inclusivity Award**, University of Waterloo	*Waterloo, Canada*
2015	**David Johnston Award for Scientific Outreach**, Institute for Quantum Computing	*Waterloo, Canada*
2012-2016	**Mike and Ophelia Lazaridis Fellowship**, Institute for Quantum Computing	*Waterloo, Canada*
2009	**Best Poster Presentation**, Sigma Zeta National Convention	*Pikeville, KY, USA*
2008-2011	**Meritorious Award Winner**, COMAP Competition	*St. Paul, MN, USA*

Leadership

2019	**Co-Founder, Maintainer**, Q# Community	*Seattle, WA*
2016-2017	**Member of the Women in Physics committee**, Australian Institute of Physics	*Sydney, Australia*
2017	**Member**, Macquarie University Equity committee	*Sydney, Australia*
2015-2016	**Founding Member**, Institute for Quantum Computing Equity and Inclusion committee	*Waterloo, Canada*
2014-2015	**Co-founder & Officer**, FemPhys student group at University of Waterloo	*Waterloo, Canada*
2014-2016	**University of Waterloo Chapter Officer**, Optical Society of America	*Waterloo, Canada*
2013	**Local Student Organizer**, QCRYPT: Conference on Quantum Cryptography 2013	*Waterloo, Canada*
2010-2011	**Chapter President**, Bethel University Chapter, Sigma Pi Sigma	*St.Paul, MN, USA*

Publications

Learn Quantum Computing with Python and Q# *ISBN 9781617296130*

Sarah Kaiser, Christopher Granade

Manning Publications, MEAP began April 2019, Publication in Spring 2020

ABCs of Engineering, Neural Networks for Babies, and Robotics for Babies *Amazon*

Chris Ferrie and **Dr. Sarah Kaiser**

Soucebooks Explore, ISBN 1492671215, ISBN 1492671207, ISBN 1492671193 (2019)

Airborne demonstration of a quantum key distribution receiver payload *http://doi.org/chbs*

Christopher J. Pugh, **Sarah Kaiser**, Jean-Philippe Bourgoin, Jeongwan Jin, Nigar Sultana, Sascha Agne, Elena Anisimova, Vadim Makarov, Eric Choi, Brendon L. Higgins, Thomas Jennewein

Quantum Science and Technology, 2, 2, 024009 (2017)

Laser damage creates backdoors in quantum communications *http://doi.org/chbt*

Vadim Makarov, Jean-Philippe Bourgoin, Poompong Chaiwongkhot, Mathieu Gagne, Thomas Jennewein, **Sarah Kaiser**, Raman Kashyap, Matthieu Legre, Carter Minshull, Shihan Sajeed

Phys. Rev. A 94, 030302 (2016)

Free-space quantum key distribution to a moving receiver *http://doi.org/bwvw*

J-P Bourgoin, B L Higgins, N Gigov, C Holloway, C J Pugh, **Sarah Kaiser**, M Cranmer and T Jennewein

Optics Express Vol. 23, Issue 26, pp. 33437 - 33447 (2015)

Attacks exploiting deviation of mean photon number in quantum key distribution and coin tossing *http://doi.org/chbv*

Shihan Sajeed, Igor Radchenko, **Sarah Kaiser**, Jean-Philippe Bourgoin, Anna Pappa, Laurent Monat, Matthieu Legré, and Vadim Makarov

Phys. Rev. A 91, 032326 (2015)

Quantum safe cryptography and security: An introduction, benefits, enablers and challenges ETSI White Paper No. 8. *ISBN:979-10-92620-03-0*

Contributor

ETSI White Paper No. 8

Experimental quantum key distribution with source flaws and tight finite-key analysis *http://doi.org/chbw*

Feihu Xu, Shihan Sajeed, **Sarah Kaiser**, Zhiyuan Tang, Li Qian, Vadim Makarov, and Hoi-Kwong Lo

Phys. Rev. A 92, 032305 (2015)

Selected Presentations

Learning Q# with Python: building the quantum programming community *Seattle, WA, USA*

Sarah Kaiser *May 2019*

Microsoft Build 2019

What is Quantum Machine Learning, and Is It A Thing? *Portland, OR, USA*

Sarah Kaiser *Apr. 2019*

ML4ALL Conference 2019

Quantum Machine Learning in context: What is a quantum algorithm anyway? *Portland, OR, USA*

Sarah Kaiser *Oct. 2018*

Portland Data Science Group

Spontaneous superradiance from single diamond nanocrystals *Cairns, Australia*

Sarah Kaiser, Carlo Bradac, Mattias Johnsson, Matthew van Breugel, Ben Baragiola, Rochelle Martin, Mathieu L. Juan, Gavin Brennen, Thomas Volz *May. 2017*

NDNC 2017

Extending the reach of QKD: Satellite prototype for quantum communication *Sydney, Australia*

Sarah Kaiser *Apr. 2017*

QSI seminar series

Photon phreaking or what quantum can (actually) do for security? *Sydney, Australia*

Sarah Kaiser, Alan Robertson *Feb. 2017*

The Gemalto Crypto Club

Extending the reach of QKD: Satellite prototype for quantum communication *Sydney, Australia*

Sarah Kaiser *Nov. 2016*

Quantum Photonics Connections Conference

Towards satellite-based quantum communication: field testing the QEYSSAT payload *Ottawa, Canada*

Sarah Kaiser, Chris Pugh, Jean-Philippe Bourgoin, Brendon Higgins, Thomas Jennewein *May. 2016*

ASTRO 2016

Practical quantum cryptography devices: how to make them and how to break them *Sydney, Australia*

Sarah Kaiser *April. 2016*

QuSciTech Seminar at Macquarie University

Towards satellite-based quantum communication: field testing the QEYSSAT payload *Albuquerque, NM, USA*

Sarah Kaiser, Chris Pugh, Jean-Philippe Bourgoin, Brendon Higgins, Thomas Jennewein *Feb. 2016*

SQuInT 2016

What QKD can learn from classical cryptography *Homer, AK, USA*

Sarah Kaiser *Jun. 2015*

Last Frontiers in Quantum Information Science

Outreach

LIGHT Illuminated *Waterloo, Canada*

Museum Exhibit Planning, Design, and Construction *2014-2015*

Canadian Association for Girls in Science Workshop *Waterloo, Canada*

Lecturer, Quantum Cryptography *2014-2015*

Quantum Cryptography School for Young Students *Waterloo, Canada*

Lecturer, Implementations of Quantum Cryptography *2013-2015*

Undergraduate School on Experimental Quantum Information Processing *Waterloo, Canada*

Lecturer *2013-2014*