2023 Vancouver Archive

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12 Speakers
3 Workshops
Exclusive Hackathon

Speakers

John Donohue

Bio

Dr. John Donohue is the **Senior Manager of Scientific Outreach** at the **Institute for Quantum Computing (IQC)**, a research institute at the University of Waterloo. John is **responsible for making quantum science accessible for everyone**, including through educational programs like the **Undergraduate School on Experimental Quantum Information Processing (USEQIP)**. John earned his **PhD from the University of Waterloo** in 2016 for work in **quantum optics**.

Qubits 101

How do we connect the quantum theory of atoms, photons, and electrons to the information processing power of quantum computing? What tools do we need and what features are we really using? In this session for beginners in quantum information science, we'll overview how we take real quantum mechanical systems and use them to encode, manipulate, and process quantum bits. We'll show how we can model a range of systems with the same simple linear algebra and get at the essence of what makes quantum bits more powerful than classical bits.

Elizabeth Kleisath

Bio

Elizabeth Kleisath is the **Communications Officer** at the **Institute for Quantum Computing (IQC)**, a research institute at the University of Waterloo. Elizabeth holds master's degrees in materials chemistry and science communications. She is passionate about **sharing her curiosity about the world around us** and has a talent for **explaining complicated science topics in approachable ways**. At IQC, Elizabeth is **responsible for sharing quantum stories about the research and breakthroughs happening at the institute**.

Sharing your science passion: communicating quantum without hype

"Quantum" is frequently used as a buzzword favoured by advertisers and marketers, aimed to appeal to consumers for its science-forward and mysterious allure. Yet, all too often, these "quantum-powered" products have nothing to do with actual quantum science or technology.

The broad misrepresentation of quantum in today's pop culture shouldn't prevent us from sharing quantum stories and discoveries in ways that are grounded in scientific reality. Clearly communicating quantum research and its real-world impacts is an important skill. It's key to securing recognition and funding, inspiring new generations of quantum scientists, and engaging and educating the genuinely curious public. This talk will provide you with tools and confidence to share your passion and interest in quantum information science and technology, and find the right communication style for you to meaningfully connect with a variety of audiences.

Katanya Kuntz

Bio
Katanya Kuntz (PhD) is a **Research Associate** at the **Institute for Quantum Computing**, University of Waterloo, Canada, and the **QEYSSat Science Team Coordinator** for **Canada's first quantum satellite mission: Quantum EncrYption and Science Satellite (QEYSSat)**. Katanya received her **PhD in Electrical Engineering (Quantum Optics)** from the **University of New South Wales, Australia**, and **BSc in Physics from the University of Calgary**. She is also the **co-founder and CEO of Qubo Consulting Corp.**, a **quantum education company that teaches businesses and organizations to get them quantum literate**.

Meet QUINT! The QEYSSat User Investigation Team - Update on the QEYSSat mission
I will update on Canada's first Quantum Satellite Mission - the Quantum EncrYption and Science Satellite (QEYSSat). The Canadian Space Agency is preparing to launch QEYSSat in 2025, which will circle the Earth in low-earth orbit (500 km above the ground), and measure individual packets of light (photons) sent from telescopes on the ground up to space. QEYSSat will demonstrate secure communication across Canada using quantum links, and help us explore foundational concepts in physics that cannot be tested on Earth. I will introduce our new QUINT consortium: a five Year NSERC Quantum Alliance grant to support QEYSSat science activities for the Canadian Science Team.

Thomas Baker

Bio
Thomas E. Baker holds a **Tier 2 Canada Research Chair in Quantum Computing** for **Modelling of Molecules and Materials** in the **Department of Physics & Astronomy** and also the **Department of Chemistry** at the **University of Victoria**. He is also an affiliate **member of the Centre for Advanced Materials and Related Technologies (CAMTEC)** at the **University of Victoria**. His **research is focused on the design and use of a quantum computer**, with research methods and techniques spanning all areas of quantum computing. He has a broad background in **density functional theory**, **quantum algorithms**, and **entanglement renormalization methods**. He is the **lead-developer of DMRjulia**, a **computational library for entanglement renormalization**.

In 2021, he was a Fulbright U.S. Scholar at the University of York in the United Kingdom. From 2017-2020, Prof. Baker was the Prized Postdoctoral Scholar in Quantum Sciences and Technology at Institut quantique à l'Université de Sherbrooke. He is also the recipient of the Pat Beckman Memorial Scholar for the ARCS Foundation during his doctoral studies. While attending the California State University, Long Beach, he earned the Philip J. Old scholarship and sole graduate research fellowship.

He has won 7 first-place speaking awards, including the Kennedy Reed Award for Best Theoretical Research by a Graduate Student. He also won the statewide California Student Research Competition in 2012. He wrote scripts for The Loh Down on Science on National Public Radio.

Prof. Baker is a member of the education committee for the NSERC CREATE program in Quantum Computing affiliated with Quantum BC. He is the Principal Investigator of the quantum photonics, algorithms, light-matter interactions for technology (QuALITy) collaboration at the University of Victoria.

He remains committed to building a diverse research group capable of handling the multitude of challenges related to his wide research interests. He is interested in working with a wide variety of students from all backgrounds.

Information Theory in Quantum Mechanics
Whether making a call on your cellphone or encrypting information to send to someone, information theory plays a critical role in both secret codes and making sure messages get from a sender to a receiver. There is a deep connection with the several fields in physics and information theory. The question I cover in this talk is how information theory plays a role in quantum physics. Inherently, quantum mechanics is uncertain, but we can quantify exactly how uncertain we are. By assigning a definitive meaning to the entropy in physics, we discover a pathway to generating algorithms that solve quantum systems. In this talk, I discuss how formulations of the density matrix, which is used to compute the quantum entanglement in a system can play a crucial role in algorithms for both classical and quantum computers.

Joseph Salfi

Bio
Joseph Salfi completed a **PhD at the University of Toronto** in **2011**. From **2011 to 2015 he was a postdoc** and from **2016 to 2018 was junior faculty** at the **University of New South Wales (UNSW)** and **Centre for Quantum Computation and Communication Technology**, the international epicentre for silicon based qubits. **In 2019, he joined the University of British Columbia as faculty**. His research interests are in the **physics and technology of spin-based quantum computers and quantum simulators**.

Primer on Spin Qubits: State-of-the-art and Challenges
Spin qubits in group-IV materials are an appealing system for building quantum technologies because of their long coherence times and compatibility with industrial manufacturing technologies. The small size of spin qubits is both a blessing and a curse. The small size means that large numbers of qubits necessary to build fault-tolerant quantum computers could in principle be integrated onto a single chip. However, spin qubits are so small that fabricating and controlling them has proven to be more difficult than, for example, superconducting qubits. In this talk I will describe recent progress in an emerging system, spin-orbit qubits in Group-IV materials, which could offer a means to resolve some of these challenges, and in addition, to streamline simulation of materials and chemistry compared to competing systems. I will describe our ongoing efforts to develop spin qubits and superconducting technologies both to explore fundamental physics and build scalable quantum technologies.

Barry Sanders

Bio
Barry Sanders is **Scientific Director of Calgary's "Quantum City"**, which is within the **University of Calgary** and tasked with **building a strong quantum ecosystem in Alberta**. Dr Sanders's 1**988 Doctor of Philosophy and 2018 Doctor of Science** are awarded by **Imperial College London**, and his theoretical research comprises **quantum sensing**, **quantum and quantum-resilient communication**, **quantum computing** and **quantum optics.** He held numerous distinguished international visiting professorships and affiliations and is a Scientist with the Creative Destruction Lab at the

Universities of Toronto and Calgary. Sanders serves as an Expert with the Canadian Council of Academies and on expert panels in Canada, USA and Europe. Dr Sanders is a Fellow of the Royal Society of Canada, of the United Kingdom Institute of Physics, of the American Physical Society, and of Optica, and he received the City of Calgary International Achievement Award in 2022.

Quantum kittens, cats, combs and compasses: superposing coherent states for sensing, communication, computing and pleasure

Superpositions of coherent states, which have minimum uncertainty and follow, at least transiently, classical motion, constitute codes for quantum computing, enhance quantum communication and are advantageous for quantum sensing and metrology. I present a potted history of this field followed by our proposal for making a nuclear cat state reported in arXiv:2304.13813.

Rogerio De Sousa

Bio
My research is on how to **design quantum hardware with less nois**e, with **particular focus on photons and superconducting materials**. More recently we also became involved with research related to **how to implement quantum algorithms with the cloud-based quantum computers** from IBM and D-Wave. I have collaborators at other universities and national labs in multiple countries (Brazil, Canada, France, USA, etc). I have an **ongoing collaboration with scientists at D-Wave Systems Inc.**, where we **investigate the sources of noise** and how to **reduce them in the D-Wave quantum processor**.

I am also an academic fellow of the British Columbia Quantum Algorithms Institute, based at the Surrey campus of Simon Fraser University. With leading companies in our area (1Qbit, D-Wave, Photonic), our province recognizes the opportunity to develop a quantum ecosystem that can compete worldwide in the development of this exciting new technology. This includes a multi-university effort to form more professionals with expertise in quantum hardware and software. For more information on what is going on in B.C. related to quantum computing, check out our Quantum-BC webpage, http://quantum-bc.ca/ .

From Quantum Mechanics to Quantum Computers
Quantum behavior can be exploited to create a computer that works with superpositions and entangled states of zeros and ones. This so-called quantum computer is exponentially faster than conventional computers for certain problems, most notably the ones requiring linear algebra (e.g. matrix diagonalization and solution of linear systems) and simulation of quantum systems such as molecules and materials.

I will give an informal overview of how quantum computer hardware can be made, using "artificial atoms" as quantum bits (qubits) based on superconducting chips. I will show how you can access these systems over the cloud to run your own experiments, and how we use this to teach quantum computing to second year undergraduate students in science and engineering at University of Victoria. Finally, I will give an overview of the problems we are working on in my research group, related to understanding and mitigating the impact of noise in quantum hardware and software.

Lukas Chrostowski

Bio

Lukas Chrostowski is a **Professor of Electrical and Computer Engineering at the University of British Columbia**, and **co-founder of Dream Photonics Inc**. Through his research in **silicon photonics**, **optoelectronics**, **high-speed laser design**, **fabrication and test**, for applications in optical communications, biophotonics, and quantum photonics, he has **published more than 300 journal and conference publications**. He **co-authored the book "Silicon Photonics Design" (Cambridge University Press, 2015)**. Dr. Chrostowski was the **co-director of the Advanced Materials and Process Engineering Laboratory (AMPEL) Nanofabrication Facility (ANF)**, 2008-2016. Dr. Chrostowski was the **Program Director of the NSERC CREATE Silicon Electronic-Photonic Integrated Circuits (Si-EPIC)** training program in Canada, and has been **teaching numerous silicon photonics workshops and courses since 2008**, which continue today as the SiEPICfab consortium. Chrostowski received the Killam Teaching Prize at the University of British Columbia in 2014, IEEE Photonics Society Technical Skills Educator Award in 2021, and IEEE Canada's J.M Ham Outstanding Engineering Educator Award in 2021. He was an elected member of the IEEE Photonics Society 2014-2016 Board of Governors. He was elected to the college of the Royal Society of Canada in 2019. Chrostowski is the **Program Director for the NSERC CREATE 2020-2026 Quantum Computing program** (Quantum BC), co-leading the Quantum Silicon Photonics design-fabricate-test workshop.

Quantum Silicon Photonics

Photonic integrated circuits, implemented in silicon, have become a mainstream technology for providing high-speed optical communication links within data centres. Other applications include various sensors (LIDAR, biomedical, environment), optical computing, and quantum information processing. Perhaps the most ambitious application for integrated photonics is in quantum computing. Photonics can be used for the computation itself (e.g. PsiQuantum, Xanadu), or can be an enabling technology to couple between spin qubits to build scalable hybrid photonic-spin quantum processors (the SFU-UBC SiQL CFI project, Photonic Inc.). Finally, photonics can be used for what it does best – optical communications – to build quantum communication links between quantum processors and quantum sensors. This talk will discuss research to develop the ingredients necessary for these technologies. This includes novel fabrication techniques using electron beam lithography (SiEPICfab consortium), the design of devices such as single photon sources, single photon detectors, and tunable high-Q resonators for spin qubits, and building instrumentation to test these devices and circuits including cryogenic probe stations and cryogenic photonic packaging.

Peter Hoyer

Bio

Peter Hoyer is an **Associate Professor in the Department of Computer Science at the University of Calgary**. His research is on **quantum algorithms**, **quantum complexity theory**, **quantum communication**, and **quantum cryptography**. He is a **co-discoverer of quantum amplitude amplification**, which is a core tool in the design of quantum algorithms and protocols. He has **won several student awards for his teaching in computer science**. He holds a **PhD from University of Southern Denmark**.

The use of quantum computers in cryptography, computation, and communication

We discuss the use of quantum algorithms in three areas: cryptography, computations, and communication. We discuss three aspects: how quantum algorithms can help, the problems for which they can help, and the problems for which they offer no benefits. We give examples of all cases. We discuss which existing crypto-systems are vulnerable or resilient against quantum attacks. We give examples of collaborative communication tasks where quantum communication helps. We conclude by characterizing which tasks and problems are currently believed to be aided by quantum computers.

Roman Krems

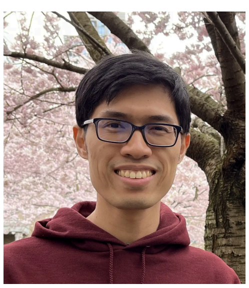
Bio

Roman Krems is a **Professor of Chemistry and Distinguished University Scholar at the University of British Columbia**. He is also a **member of the computer science department at UBC** and a **principal investigator at theStewart Blusson Quantum Matter Institute**. His work is at the intersection of **quantum physics**, **machine learning** and **chemistry** on problems of relevance to quantum materials and quantum technologies. He is particularly **excited about applications of machine learning for solving complex quantum problems and applications of quantum hardware for machine learning**. He is Fellow of the American Physical Society and Member of the College of the Royal Society of Canada.

Can quantum computers enhance machine learning?

In this talk, I will describe how quantum computing and machine learning can be combined to solve a machine learning problem that cannot be solved on a classical computer. This will illustrate the quantum advantage of quantum machine learning. I will then discuss how to build optimal quantum machine learning models for practical applications. In particular, I will show how to increase the complexity of quantum models in order to improve their ability to infer from limited data. I will conclude by a discussion of the title question.

Hoi-Kwon (Kero) Lau



Bio

Kero is a **theorist** working on the interface of **quantum optics and quantum informatio**n. After getting his **PhD from University of Toronto**, Kero was **awarded the Croucher Fellowship**, and later worked as a **postdoc at Max Planck Institute and University of Chicago**. In 2020, Kero joined the **SFU Department of Physics as an assistant professor**. He is also the **Canada Research Chair in Quantum Information Science** and an **affiliate fellow of Quantum Algorithm Institute.** Kero focuses on **studying the physics of Bosonic quantum systems** and **how they can be used for information processing**. His ultimate goal is to **bring quantum technologies to reality**.

Beyond qubits: a glimpse at bosonic quantum technologies

While qubits are the basic unit in most quantum information devices and applications, there is another class of quantum system that offers infinite states per degree of freedom. Bosonic systems, in this respect, are everywhere and provide loads of practical advantages. In this talk, I will introduce the basics and features of bosonic quantum technologies. I will also briefly introduce our group's effort in engineering bosonic quantum gates.

Anne Broadbent

Bio

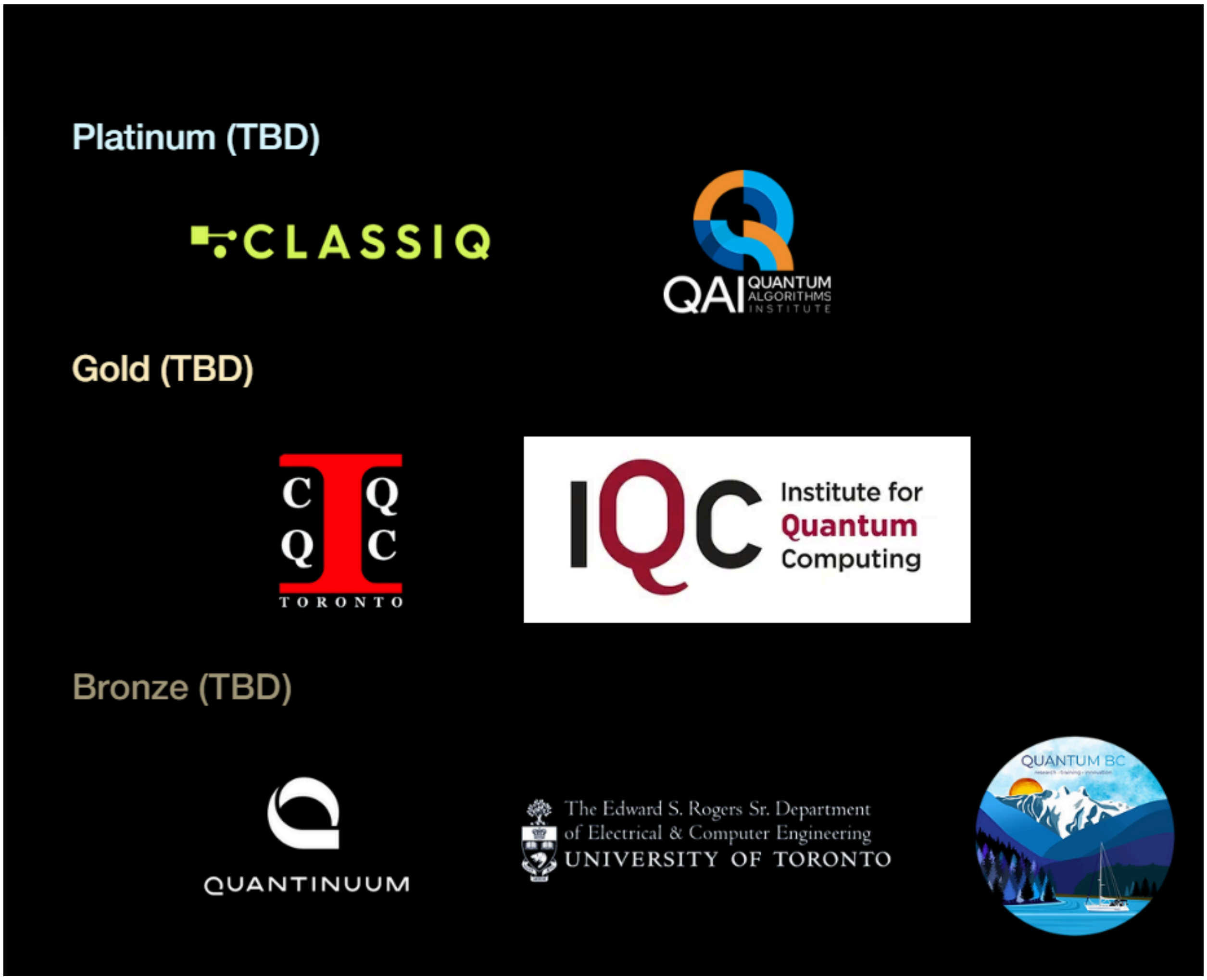
Prof. Broadbent is a **Full Professor at the University of Ottawa**, **Department of Mathematics and Statistics**, with **cross appointments** to the **Department of Physics** and to the **School of Electrical Engineering and Computer Science**. Prof. Broadbent holds the **University of Ottawa Research Chair in Quantum Information and Cryptography**. Her research relates to **cryptography**, **communication**, and **information processing** in a quantum world.

Prof. Broadbent's research is recognized by multiple awards and accolades, including the University of Ottawa Young Researcher of the Year Award (2019), the Ontario Early Researcher Award (2016), the André Aisenstadt Prize in Mathematics (2016), the John Charles Polanyi Prize (2010) and the NSERC Doctoral Prize (2009).

Quantum Unclonability and Cryptography

According to the unclonability property of quantum information, it is not possible, in general, to duplicate an unknown quantum state. Quantum cryptography is the science of communication and computation in the presence of an adversary. Because quantum adversaries are also bound by the unclonability property, this creates a myriad of opportunities for quantum cryptographers. We will discuss how unclonability permeates quantum cryptography: from the early findings on quantum money and quantum key distribution, to recent work on unclonable quantum encryption, certified deletion, and unclonable software.

Sponsors


Platinum (TBD)
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QAI QUANTUM ALGORITHMS INSTITUTE
Gold (TBD)
CQIQC TORONTO
IQC Institute for Quantum Computing
Bronze (TBD)
QUANTINUUM
The Edward S. Rogers Sr. Department of Electrical & Computer Engineering UNIVERSITY OF TORONTO
QUANTUM BC

Workshops

Good Chemistry

Valentin Senicourt

Bio

Valentin Senicourt is the Quantum Software Lead at Good Chemistry. He leads the development of Tangelo, their open-source python package enabling quantum chemistry simulations on quantum computers. Formerly a mathematics teacher, he then started a career in numerical modeling and High-Performance Computing, spanning 10 years of international experience in various fields (oil and gas, finance, medical imaging, chemistry…), and has been part of the quantum computing community for 5 years. Although he is fond of advanced computing technologies, Valentin has a pragmatic approach to problem solving and believes those tools are simply a means to an end: collaborating with other human beings to tackle challenging problems is what drives him.

Harnessing software for quantum computing research: an application to quantum chemistry simulations

The field of quantum computing has gained a lot of momentum, and software has been key in both training a global quantum workforce and propelling the research community. Our ability to use and design tools harnessing a constant stream of innovation scattered across many software projects, widely led by enthusiastic open-source communities, plays an essential role in pushing the state of the art.

A lot of work in both hardware and algorithm development remains necessary in order to reliably apply quantum computing to solve practical use cases. Applied research in the NISQ era requires software able to express complex workflows making use cases amenable to current devices and simulators, while providing researchers with the ability to explore new avenues and integrate their innovations. It requires the development of software that can harness the latest innovations to keep up with the state of the art.

In this talk, Valentin Senicourt discusses how Good Chemistry is tackling this challenge in the simulation of chemical systems, through the open-source project Tangelo, a python package enabling quantum chemistry workflows on quantum computers and simulators. The content of this session is applicable to fields other than chemistry simulations, and no background in chemistry is required.

Classiq

Erik Garcell

Bio

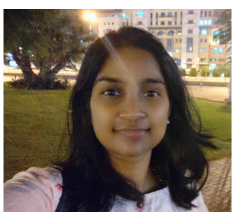
Dr. Erik Garcell is technical marketing manager at Classiq, which is revolutionizing the process of developing quantum computing software by taking quantum software to a higher level. Dr. Garcell was previously innovation product manager for IP.com and an innovation research scientist at Kodak Alaris. He has a doctorate in physics from the University of Rochester and a Master of Science in Technical Entrepreneurship & Management from the University of Rochester's Simon School of Business.

Mastering Quantum Computing with Classiq: A Hands-On Workshop

In this interactive workshop, participants will gain a profound understanding of quantum computing principles and how to leverage the Classiq platform to design high-level functional models and translate them into optimized quantum circuits. Participants will engage in hands-on sessions, exploring the intuitive and user-friendly environment of Classiq, focusing on problem-solving and algorithm development. The workshop aims to empower attendees with the knowledge and practical skills to streamline the quantum algorithm design process, enabling them to design once and deploy anywhere, thanks to Classiq's hardware-agnostic approach. This workshop is suitable for both quantum experts and those new to the field, offering insights into automated conversion, hardware adaptability, and the optimization of quantum circuits, aligning with future advancements in quantum computing.

IBM

Hemavathi Santhanam



Bio
Hemavathi Santhanam is an IBM Quantum Ambassador and a Qiskit Advocate. As for her day job, Hema is a Delivery Consultant at IBM Expert Labs building enterprise solutions around Data Governance and AI with IBM Cloud Pak for Data. She is a graduate in Computing and Data Analytics from Saint Mary's University, Halifax, Nova Scotia.

Qiskit workshop
Come join the Qiskit hands-on workshop to learn the fundamentals of programming a quantum computer. Learn how to create quantum circuits visually using Circuit Composer IBM Quantum platform, and programmatically, using open source Qiskit framework. Run your circuits on quantum simulators and real quantum computers. To get the best experience out of the workshop, sign-up for a free account on IBM Quantum platform beforehand at https://quantum-computing.ibm.com/

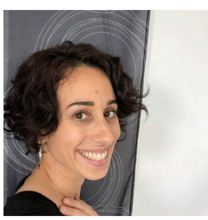
Lightning Talks

Rahul Deshpande

Bio
Rahul Deshpande is a senior experimental physicist at D-Wave, working on developing and characterizing the next generation of superconducting quantum processors. A scientist with a passion for developing new technologies, he completed his PhD in Physics at the University of Waterloo, where he studied nuclear spins in silicon with applications towards quantum computing and quantum sensing at the Institute for Quantum Computing (IQC).

Introduction to Annealing Quantum Computing
Unlike other types of quantum technology, annealing quantum computing is uniquely suited for solving optimization problems. In this talk, I'll introduce the basic concepts behind this approach and the hardware implementation at D-Wave using superconducting qubits. I will also briefly discuss scalability, the role of coherence and showcase some of the progress D-Wave has made on these fronts.

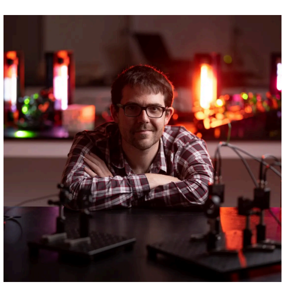
Bahiyyih Peters



Bio
Bahiyyih Peters is the Program Coordinator of the NSERC CREATE in Quantum Computing Program. With a background in Sociology and Music, Bahiyyih has years of work and volunteer experience organizing events and building community. She is passionate about student engagement and providing opportunities for marginalized groups in STEAM.

The Quantum BC Community
The Quantum BC Community includes students, faculty and industry involved in quantum computing in British Columbia (and beyond). Find out about the many exciting activities and opportunities including seminars, workshops, courses, mentorships, scholarships and more. There will also be a virtual Quantum BC Open House on November 8 with lots of information and a chance to ask questions. Find out more at www.quantum-bc.ca

John Donohue



Bio
Dr. John Donohue is the Senior Manager of Scientific Outreach at the Institute for Quantum Computing (IQC), a research institute at the University of Waterloo. John is responsible for making quantum science accessible for everyone, including through educational programs like the Undergraduate School on Experimental Quantum Information Processing (USEQIP). John earned his PhD from the University of Waterloo in 2016 for work in quantum optics.

Opportunities at the Institute for Quantum Computing
The Institute for Quantum Computing (IQC) is a research institute at the University of Waterloo advancing the field of quantum information science. We will overview opportunities for undergraduate students at IQC, including graduate programs in science, engineering, and mathematics as well as the Undergraduate School for Experimental Quantum Information Processing (USEQIP).

Erik Garcell

Bio
Dr. Erik Garcell is technical marketing manager at Classiq, which is revolutionizing the process of developing quantum computing software by taking quantum software to a higher level. Dr. Garcell was previously innovation product manager for IP.com and an innovation research scientist at Kodak Alaris. He has a doctorate in physics from the University of Rochester and a Master of Science in Technical Entrepreneurship & Management from the University of Rochester's Simon School of Business.

Classiq and the Future of Quantum Computing

This lightning talk will delve into the revolutionary advancements Classiq brings to the quantum computing landscape. Attendees will gain insights into how Classiq's quantum operating system sets unprecedented standards in quantum algorithm design by offering an automated, intuitive, hardware-agnostic platform. The talk will highlight Classiq's commitment to user-centric innovation, enabling users to focus on solving complex problems rather than the intricate details and limitations of quantum hardware. By providing an overview of Classiq's approach to creating optimal quantum circuits from high-level user models, this talk will illuminate the pathway toward a future where quantum computing is more accessible, efficient, and scalable, catering to both today's needs and tomorrow's quantum advancements.

Anna Dyring

Bio
Anna Dyring is the Quantum Strategic Initiative Lead at the Centre for Quantum Information and Quantum Control (CQIQC), UofT's quantum centre with more than 30 research groups working both theoretically and experimentally on a range of quantum topics. Anna's previous roles include project/product manager in several aerospace, technical consulting and biotechnology companies, where she led complex product development and delivery projects. She holds an MSc in Engineering Physics from Uppsala University, Sweden and a PhD in High Energy (Particle) Physics from Uppsala University and CERN. Anna has a broad interest in science, technology and the arts, and enjoys working at the intersection of academia, industry and the public sphere.

Quantum Careers
I will talk broadly about quantum career paths and how CQIQC supports students through a range of learning and research opportunities in quantum science and technology. I will also share some

observations and advice that may help anyone interested in exploring a career in the exciting and growing quantum sector. My goal is to inform, inspire, and challenge.

Ara Ghukasyan

Bio
Ara Ghukasyan is a Research Software Engineer at Agnostiq Inc. (agnostiq.ai). He holds an undergraduate degree in Mathematics & Physics and a Ph.D. in Engineering Physics from McMaster University. Before working in quantum computing, he researched semiconductor hardware and atomistic simulations of nanoscale heat transport. Ara's casual interests include music, film, and broad topics in science and computation. Ara also enjoys an avid interest in electric guitar and bass.

Agnostiq: Time Series Anomaly Detection with Quantum Variational Rewinding
A variety of important problems in healthcare, finance, and technology rely on detecting strange, potentially dangerous, sequences of events among normal everyday occurrences. Formally, this is precisely the notion of time series anomaly detection (TAD). Rather than flagging individual events that deviate from the norm – a less difficult problem – a more salient goal here is to identify several events that represent anomalous behaviour when considered in context. In this talk, we present a highly scalable quantum machine learning algorithm for TAD with freely available NISQ hardware. This algorithm, which we refer to as Quantum Variational Rewinding (QVR), relies on training a family of parameterized unitary time-devolution operators to cluster normal time series instances that are encoded within quantum states. In other words, we train a quantum model to "rewind" series-encoding states to initial states which are similar for normal time series, but differ for abnormal ones. As a proof of concept, we demonstrate the efficacy of this algorithm on the real-world problem of identifying anomalous transactions in cryptocurrency market data.

Jane Dong

Bio
Jane Dong is an IBM Quantum Ambassador and Digital Enablement Leader for Hybrid Cloud Services. Jane graduated from the University of Toronto specializing in Physics and Mathematics with high distinction. She has solutioned and delivered enterprise level digital solutions for clients across North America. Outside of her Quantum Ambassador role, Jane and her team focus on creating digital, emerging tech and hybrid cloud solutions consulting works the following streams: Solution Envisioning, Proof-of-concept Development, Production Ready Pilot development services for clients in Energy Utilities, Retail, Engineering & Construction, FSS and Public Sectors.

Getting Started with Quantum Computing
Curious about IBM's Quantum ecosystem and development roadmap? Come learn more about the IBM Quantum Network, Qiskit community and exciting offerings that can empower you with the knowledge and resources you need to begin your quantum computing journey.