Physics
UNIVERSITY OF TORONTO

Spring 2026

INTERACTIONS

The Department of Physics Newsletter

McLennan Physical Labs
(credit: University of Toronto)

MESSAGE FROM THE CHAIR

Welcome to the Spring 2026 issue of Interactions, the Department of Physics newsletter!

Dear Physics Community,

As I am coming to the end of my second year as Department Chair, I have been reflecting on the many changes taking place in our academic environment and their impact on the University and our Department. These include the new challenges and opportunities brought about by Machine Learning and Artificial Intelligence, a rapidly changing environment for funding and scientific research, ongoing opportunities to recruit emerging

Continued on next page.

scholars, and new opportunities opened through senior faculty recruitment streams like the Canada Excellence Research Chair and Canada Impact+ Research Chair programs. I continue to be inspired to work with our wonderful group of faculty and students through these challenges as we develop strategic plans for our research, for our experimental infrastructure, and for our teaching mission.

In January 2026, we held a two-day planning session on the Department's Research Strategy. We took some time to celebrate the thriving work taking place across the several disciplines we have in the department is thriving. We discussed how, at the same time, our different groups face several common operational challenges, not the least of which includes dealing with our aging facility, which was the subject of last year's retreat in January 2025. The faculty expressed a strong desire to break through the silos that separate our disciplines. Addressing our operational challenges through, for example, coordinated laboratory renovations, provides one pathway to achieving this. I think that next year, when we finish our Faculty Retreat series with a focus on our teaching mission, we'll emerge with ideas and initiatives that will set the stage for collaborative advances in the coming decades. Stay tuned for updates on our exciting plans emerging from these planning sessions!

I hope you find some of the spirit of renewal in the pages of this issue of Interactions, including highlights like the profile of our new faculty colleague, Prof. Chen Wang, in the interdisciplinary world of experimental quantum information science [link]; the latest in the search for Dark Matter in the SuperCDMS experiment (articles about Postdoctoral Fellow Madeleine Zurowski [link] and faculty member Ziqing Hong [link]); and important work to discover the physics of stacked two-dimensional materials (graduate student profile of Erica Nielsen [link]). I hope as well that you'll appreciate learning about the generous graduate scholarship established by U of T alumni and friends of the Department, David and Heather Boal [link]. Alongside this you'll find community updates, important awards and recognitions, and highlights on our latest crop of Ph.D. graduates.

This issue of Interactions is also timed to coincide with advanced notice of the 2026 Welsh Lectures, May 4-5, 2026. I encourage you to mark your calendars and join us at this premier social and scientific event in the life of the Department. You can see this article [link] to read up on our great Lecturers. I hope to see you there!

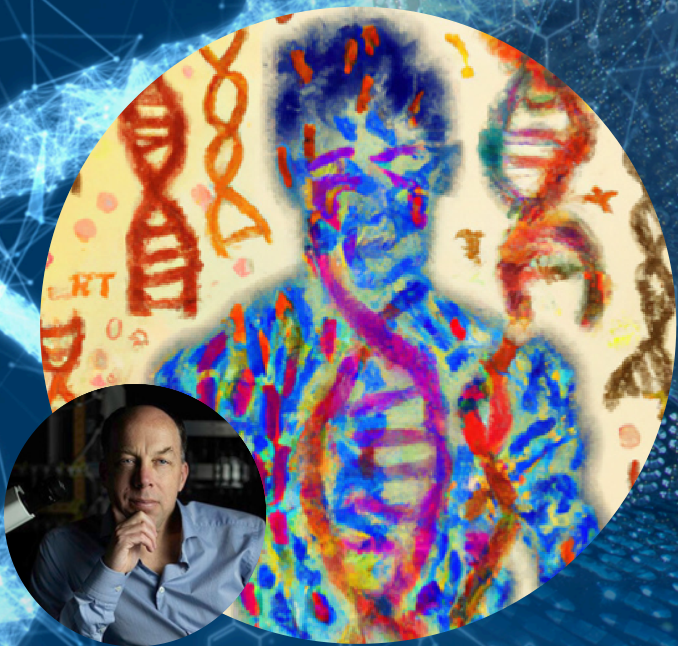
Regards,

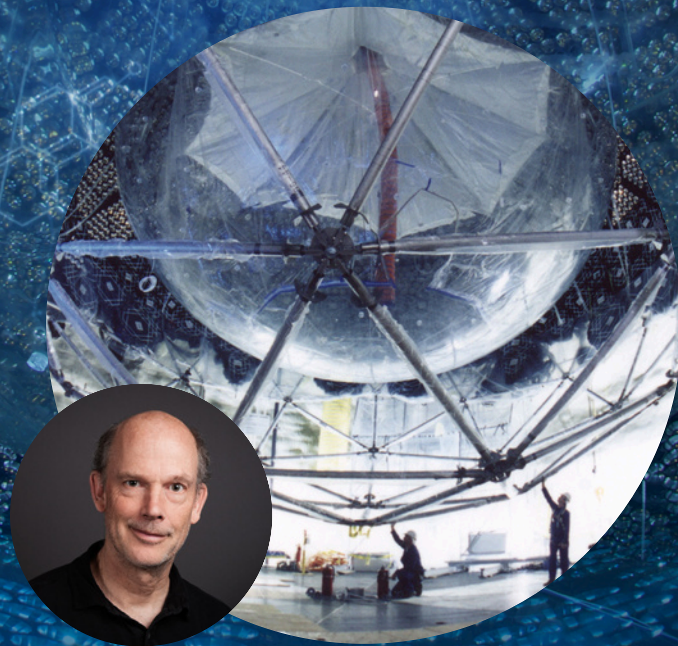
Paul Kushner

Professor & Chair

Physics
UNIVERSITY OF TORONTO

THE WELSH LECTURES
IN PHYSICS 2026





PROF. STEPHEN QUAKE

PUBLIC TALK
MONDAY, MAY 4, 1:30 PM
How cellatlases are reshaping our understanding of life.
EARTH SCIENCES CENTRE
Auditorium ES1050, 5 Bancroft Ave.

COLLOQUIUM TUESDAY, MAY 5, 2:00 PM
Understanding the mysteries of the cell: How do many cell types arise from one genome?
KOFFLER HOUSE
AuditoriumKP108,569Spadina Cres.

PROF. ANTHONY NOBLE

PUBLIC TALK
MONDAY, MAY 4, 3:30 PM
Neutrinos: Probing the enigmatic ghosts that shape our universe.
EARTH SCIENCES CENTRE
Auditorium ES1050, 5 Bancroft Ave.

COLLOQUIUM TUESDAY, MAY 5, 11:00 AM
PICO: How murmurs from the deep are aiding in the search for dark matter.
KOFFLER HOUSE
AuditoriumKP108,569Spadina Cres.

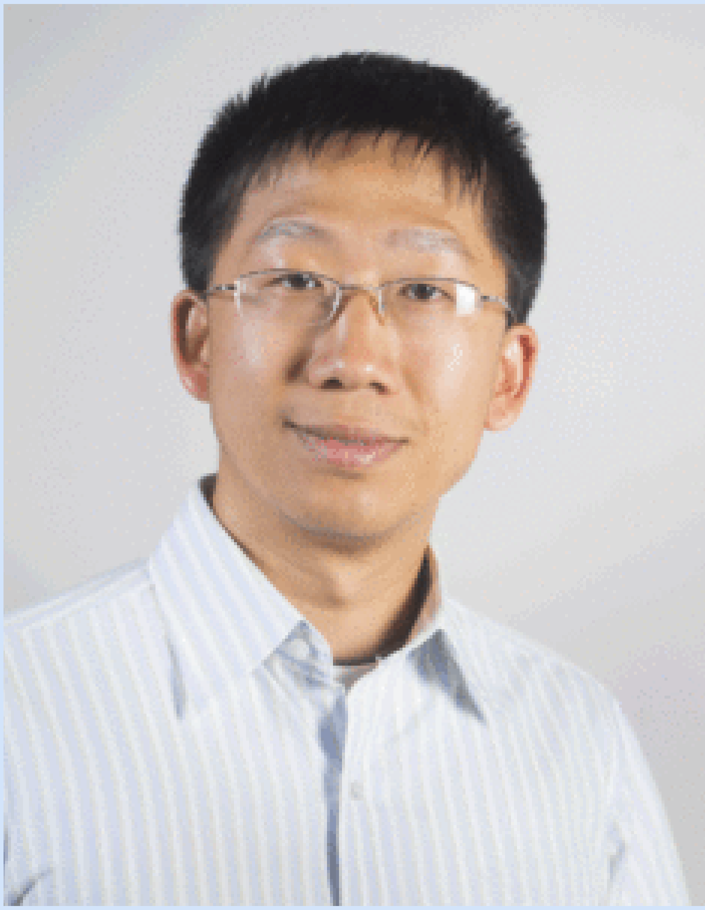
Sponsored by the Department of Physics. Learn more or RSVP at https://uoft.me/WelshLecture

Image Credits: Anthony Noble, Quake Labs, Adobe Stock

Faculty Profile

Chen Wang

Associate Professor, Experimental Quantum Information Science



Dr. Wang will be joining the department in July 2026.

Could you provide a brief introduction to yourself, including your academic background and area of research?

I'm an experimental physicist working in quantum information science with a focus on quantum computing. I work with solid-state electrical devices, especially microwave circuits made of superconducting materials which I manipulate into exotic quantum states for information processing. In some sense, we are a quantum optics lab that plays with manufactured "atoms" that are millimeters in size using programmable "lasers" in the GHz frequency range. This type of research underpins the technologies behind theexperimental superconducting quantum computers (e.g. from Google, IBM, etc) that you may have seen in the news.

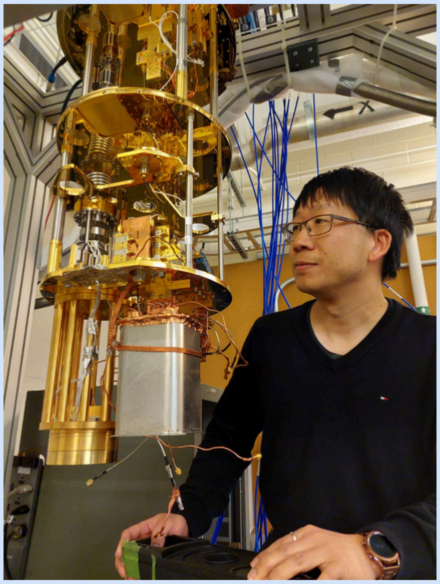
I completed my undergraduate studies in physics at Peking University and earned my PhD at Cornell where I worked on spin transport in nanomagnetic devices. I transitioned into quantum information science during my postdoctoral work at Yale. Before coming to UofT, I've been a faculty member at UMass Amherst for about 10 years.

Could you share some details about your current interests and any specific projects you are working on?

My main research goal currently is to build more robust logical qubits, moving from simple but fragile physical qubits to systems that can reliably store and process quantum information. I approach this from multiple angles: materials science, Hamiltonian design, driven and dissipative dynamics, and quantum error-correcting codes. I'm especially interested in how these layers fit together—how careful hardware design can make error protection more "native" to the device itself.

Continued on next page.

Right now, two directions are particularly exciting to us. The first is scaling up bosonic quantum error-correcting codes, which encode information in oscillator modes rather than simple two-level systems. These approaches are hardware-efficient and very promising, but scaling them requires advances in coherence, control and architecture. The second direction is understanding the microscopic origins of spurious two-level systems in Josephson tunnel junctions—one of the main sources of decoherence in superconducting circuits.



What is your approach to teaching, and are there specific teaching methods or philosophies you are particularly passionate about?

While teaching, I highlight connections between parallel ideas: physics becomes more intuitive and beautiful when students see how different areas reinforce each other. I also try to communicate genuine enthusiasm on the subject matter, relating how my younger self was puzzled and curious about it. In lab and advanced courses, I encourage students to think like researchers, learning to ask questions, troubleshoot, and make design decisions.

Are there any interdisciplinary or collaborative initiatives you are interested in pursuing within the department?

I enjoy operating at the interface between quantum optics and condensed matter, and am very excited when engaging with the broader quantum information community at UofT. Strong collaboration between theorists and experimentalists, and across subfields, is essential if we want to tackle the big challenges in scalable quantum technologies.

Is there a specific accomplishment you are particularly proud of?

One accomplishment I'm especially proud of is our work on autonomous quantum error correction, which demonstrates a way to stabilize a logical qubit through engineered continuous dissipation, essentially embedding part of the error correction logic directly into the hardware in a passive manner. More recently, we reached the break-even point for such passive quantum error correction for the first time, where the logical qubit lives longer than the underlying physical qubits. This milestone is a meaningful step toward practical fault-tolerant quantum computing.

In what ways do you hope to make an impact within the department and the broader academic community?

Continued on next page.

I hope to help build and support a strong cohort of students in the ever-evolving field of experimental quantum information science: it's no longer primarily theoretical, and that makes it an incredibly rich training ground. I believe meaningful progress in quantum technology requires a broad ecosystem across campus, regionally, and nationally, and contribute to building that ecosystem and mentoring students who will shape the next generation of the field.

What advice would you offer to students who are interested in pursuing a career in teaching?

Teaching is a multiplier of your knowledge allowing you to have an impact that extends far beyond your own research. The influence of a good teacher last for decades. In teaching, the same concept can be delivered from many different angles, searching for new ways to present ideas, deepens your own understanding. Continually refining how you present complex ideas is one of the best ways to grow as a teacher and scholar.

Are there any lessons from your own academic journey that you would like to share?

One lesson I've learned is that academic success requires a balance between depth and breadth: early on, you need focus and deep expertise in a specific area to establish yourself; at the same time, major breakthroughs often happen at the intersection of disciplines. Maintaining enough breadth to see connections across fields gives you perspective and allows you to ask bigger questions. Scientists who can speak multiple disciplinary “languages” are rare, but they often have a unique ability to drive innovation.

What drew you to join our department, and what aspects do you find most appealing or unique?

I'm drawn to the collegial and welcoming atmosphere of the department with its strong research footprint in both quantum optics and condensed matter. I am excited to be part of the CQIQC community and being able to contribute to a strategic quantum initiative at a nationally leading university is both intellectually exciting and professionally meaningful.

Beyond your academic pursuits, do you have any hobbies or interests that you'd like to share with the department?

I rock climb and play basketball, and follow news on geopolitics, finance, and technologies. I have always been a fan of competitive real-time strategy games.

Postdoctoral Fellow Profile

Madeleine Zurowski
High Energy Particle Physics

What led you to pursue a postdoctoral position in Physics at U of T?

For a particle physicist working on Dark Matter, Toronto is a great location. The experimental group at the University has a wide array of expertise (from hardware, to simulations, to statistics and analysis), plus it is close enough to SNOLAB to make access to the experiments there much more painless than other places. That, in combination with the fact my family is originally from the area, made it the perfect choice for me.

Where did you complete your PhD? What was the topic of your PhD thesis and what motivated your work?

I did my PhD at the University of Melbourne, Australia. My thesis was on designing an experiment, SABRE, to test the hypothesis that a modulating signal observed by another experiment (DAMA/LIBRA) for around 20 years was from Dark Matter. Such a test is useful to do in Australia, as any modulation caused by the seasons would be flipped, while Dark Matter modulation would look the same.

Could you describe the focus of your current research as a postdoc? What inspired you to pursue this specific research area?

I'm still working in the Dark Matter field, but on a different experiment: SuperCDMS. This is a cryogenic detector with sensitivity to very low energy depositions. It is designed to be one of the most sensitive detectors to low mass (<10 GeV/c2) to date. I knew I wanted to join SuperCDMS after my PhD because of the detector technology and set up used. There are effectively 4 different types of Dark Matter sensors in a single experiment, which means if we do see events that are consistent with Dark Matter we are uniquely positioned to do

Continued on next page

internal consistency checks with different types of targets and be more certain about what it is we're seeing. Couple this with the very cool (pun intended) cryogenic set up and it's an amazing piece of equipment to work on.

Most of my work to date has been assisting in the installation and commissioning of the experiment as we get it all set up, and modelling the radioactive background sources we see so that we can perform a robust statistical analysis once the data starts flowing in.

Have your collaborations with other researchers or departments during your postdoc enhanced your research?

The nature of experimental particle physics means you are always collaborating with a larger group. There are around 30 different institutions involved with SuperCDMS spread across North America and Europe, each with their own areas of expertise required to make everything work. Personally, I have worked very closely with SNOLAB and SLAC during the installation phase. I have also worked with nuclear theorists from the Australian National University (ANU) on how uncertainties in nuclear structure might impact how well we can constrain our knowledge of Dark Matter.

How do you believe your research contributes to the broader field or addresses current challenges?

Understanding the nature of Dark Matter is probably one of the most fundamental questions in particle physics at present. We know this particle exists, otherwise the universe wouldn't have evolved the way it did, and galaxies would move very, very differently, and yet no one has observed it directly yet. We need to do this to make progress in understanding this particle, which makes up about 25% of the universe. SuperCDMS is probing a new regime of Dark Matter candidates, meaning no matter what we see we will help answer the question of what Dark Matter might be, and what it's not.

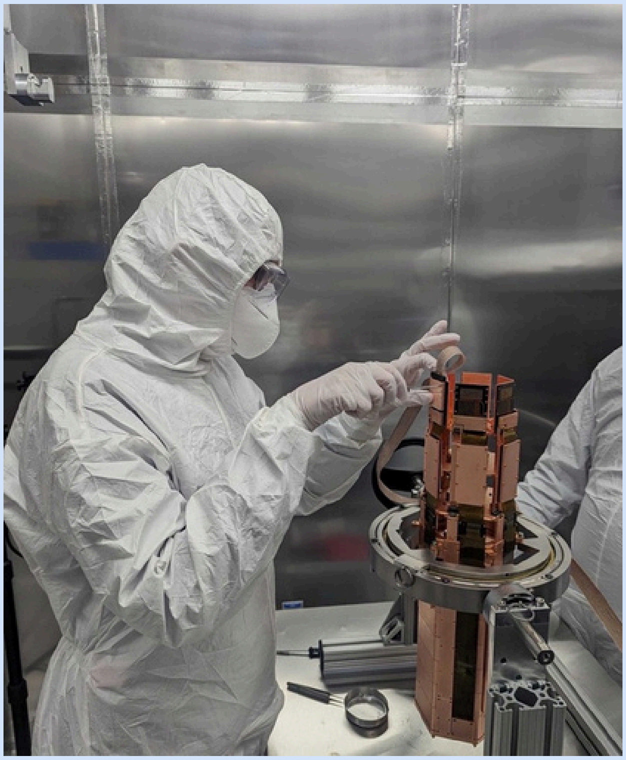
What challenges have you encountered in your research, and how have you worked to overcome them?

I am someone that likes being able to understand the big picture and see how all the small moving parts fit together – I think this is part of the appeal of particle physics for me. But on an experiment like this there are so many technical, moving parts that go on and it's impossible to be an expert in all of them. In that sense, one of my biggest challenges has been learning to be okay with not knowing everything and trusting in the expertise and experience of my collaboration when making decisions.

Continued on next page.

In what ways has your postdoctoral experience contributed to your professional development?

I have been very lucky to have the opportunity to travel extensively during my postdoc – both for international conferences and also getting to spend hands on time with the detectors. But hands down the biggest contribution to my professional development is in the leadership roles I have been able to take on within the collaboration. I am one of the Run Coordinators for the commissioning phase of the experiment, meaning I am responsible for the day-to-day operation of the detectors, as well as longer term planning for tests that need to be done and data that will be taken. This has given me the chance to exercise a level of leadership, scheduling, and communication that I have never done before, and I have grown significantly because of it.


Madeleine performing an electrical check on one of the SuperCDMS detector towers, 2023

What are your future career aspirations after completing your postdoc?

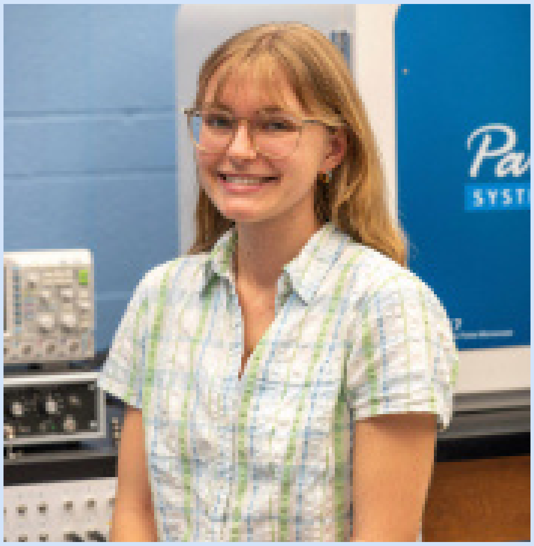
I would love to follow the faculty track and get a lecturer position somewhere. Ideally this would be a position that allows me to continue my involvement with SuperCDMS while also thinking about the future direction of Dark Matter research, and what the next generation of experiments will look like. As the biggest, Xenon based detectors approach the neutrino floor it feels inevitable that the field will start pursuing new and interesting ways to look for Dark Matter, and I'm hopeful my experience in cryogenics experiments lends itself to this.

What advice would you give to graduate students or early-career researchers considering a postdoc?

You are never going to be able to know everything, but it is important to stay curious and keep asking interesting questions. For me, communication and collaboration with other people is a priority – I may have blind spots in my expertise or experience that I'm not even aware of and you don't find those out until you talk to other people.

Graduate Student Profile

Erica Nielsen, Ph.D. Candidate
Quantum Condensed Matter Physics



What sparked your interest in physics?

Both of my parents are engineers, so I grew up surrounded by science and math. Despite this, I never seriously considered pursuing science myself (perhaps because I was eager to establish an identity separate from my parents) until I took Grade 12 physics. In that class, I completed a project on the Large Hadron Collider (LHC), which sparked my interest in experimental physics.

After expressing my interest in the LHC, my dad encouraged me to read Physics of the Impossible by Michio Kaku. The book explores science-fiction ideas such as teleportation and invisibility cloaks, examining their feasibility through the lens of modern physics research. Although reading about concepts like the twin paradox and the Higgs boson in high school was challenging, it motivated me to truly understand them and to explain them to my friends.

Tell us more about your academic journey.

I attended Queen's University, where I pursued a degree in Engineering Physics with a minor in Electrical Engineering. I completed two summer engineering internships in manufacturing. My first position was at Communications and Power Industries, a company that produces klystron devices, which are radio-frequency amplifiers used in satellite communications. While my role was not very technical, I found it fascinating to learn about electron devices and their real-world applications while working there.

The following summer, I worked at Martinrea, an automotive manufacturer, where I contributed to a project on acoustic sensing and monitoring for non-destructive testing in stamping presses. In this role, I applied concepts from wave propagation in materials and signal processing to help identify indicators of split metal during the stamping process. Through this experience, I discovered that I truly enjoyed designing experiments and interpreting data. By my final year of undergraduate studies, this realization led me to pursue research, and I decided to continue on to a Ph.D. in experimental physics in Prof. de la Barrera's Quantum Condensed Matter group.

Continued on next page.

Can you give us a brief summary of your research?

I study two-dimensional (2D) materials which are materials that are atomically thin, or one atom thick. For example, graphite has no dangling bonds in the out-of-plane (z) direction, allowing individual graphene layers to be isolated by overcoming the weak van der Waals forces between graphite layers.

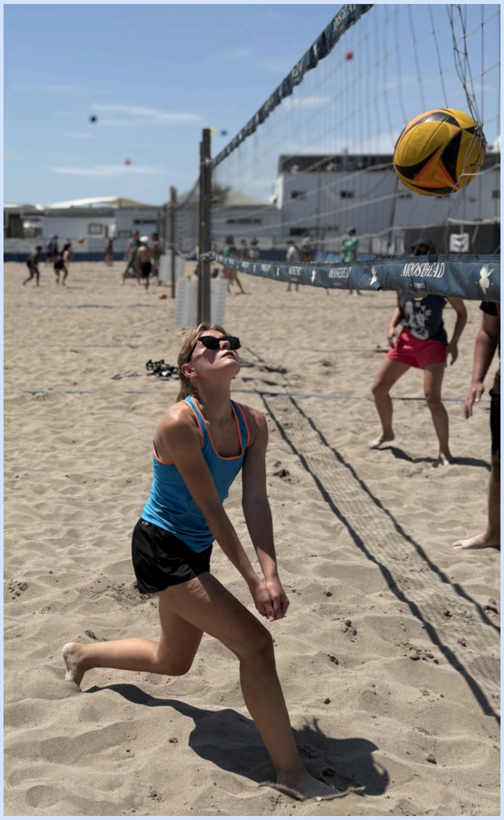
In stacked 2D materials, the crystallographic alignment between layers strongly influences both interlayer and intralayer electronic properties. This alignment can be tuned by rotating one layer relative to another about the out-of-plane axis, creating twisted structures. To investigate these systems, I designed and built a scanning van der Waals microscope (SVM).

The SVM is a modified atomic force microscope (AFM). A conventional AFM consists of two main components: a cantilever with an atomically sharp tip and a sample stage that raster-scans the surface. As the tip approaches the sample, interactions with the surface cause the cantilever to deflect, allowing the surface topography to be imaged. In the SVM, I replaced the sharp tip with a custom flat probe that I placed a 2D material on top of. I also added a rotating sample stage. With 2D materials on both the probe and the sample, this setup enables controlled and repeatable formation of twisted 2D heterostructures.

What extracurricular activities are you involved in?

Outside of research, I like to play volleyball. I played rep volleyball in high school, and I decided to dive back into it when I moved to Toronto, so I joined an adult league.

Other than volleyball, I have a lot of creative hobbies like painting, crocheting, and sewing. I also enjoy snowboarding in the winter and waterskiing in the summer.



Undergraduate Student Profile

Annalisa Teixeira

Physics Specialist Program

Year of Study: 4th

What inspired you to major in Physics?

I've always been fascinated with how the world works, and physics has allowed me to start exploring and answering the questions I've had about our universe since childhood. In 8th grade, I decided to do an inquiry project on black holes; I remember stumbling across arXiv and spending hours and hours trying to piece together enough knowledge to read through the most introductory parts of a paper. I had never been more confused or more excited about Physics, and in that moment, I decided I wanted to spend my life trying to better understand the world around us. In my first year here, I began attending the departmental colloquia, and was met with the familiar feeling of confusion and ever building excitement about working towards understanding more about the physical world. Since then, there's been no looking back!

What do you enjoy most about the physics program?

I really appreciate the amount of passion every single faculty member has, about both their research and their commitment to teaching. Professors are consistently so willing and eager to share their research and love of physics with students, which has cultivated a really welcoming and inspiring environment to be a part of. Both the teaching and research stream professors put so much care into crafting engaging courses that not only give students a high quality education but make them genuinely excited to show up and learn about the material.

I've also really enjoyed the encouragement the department places on going to the departmental colloquia, regardless of your knowledge level. I've been attending the colloquia since first year and it's been a great way to begin getting exposed to a diverse spread of current, cutting-edge research.

Continued on next page.

What other extra-curricular activities are you involved in during your degree?

In my second year, I became involved with the Undergraduate Physics Student Union (PhySU) as the VP Secretary. This past year I have served as the President. I remember initially being hesitant to get involved with student government; looking back, I could not be more glad that I decided to join the executive team. I have been so lucky to work alongside a strong team of individuals who deeply care for the physics student body and are passionate about trying to improve the undergraduate physics experience in any way possible. Serving on PhySU's executive team has been a great opportunity to become more involved with the department and connect with both the student body and faculty members.

Working towards cultivating a welcoming environment amongst our student body and helping to provide new opportunities for undergraduates in our department has been incredibly rewarding. This year we have really focused on trying to help connect students with faculty and make research opportunities more accessible through workshops, information sessions, and increased opportunities to connect with professors on a more personal level. We've also instituted a mentorship program that connects incoming first year students with upper year mentors to guide them throughout their journey in first year. I vividly remember how overwhelming my first year was, and being able to support students in their transition to university has been such a wonderful experience.

This past year I've also worked as a MAT135 and MAT136 Teaching Assistant within UofT's Department of Mathematics. Teaching has been such a fulfilling experience, and it has been an incredible opportunity to watch students become more confident in their mathematical ability and to help students understand concepts I remember struggling with in my first year.

What are your research interests?

My main research interests are within atomic physics and theoretical astrophysics. In other words, if something is either really really big, or really really small, I'll probably be interested in it! Within atomic physics, I am particularly interested in quantum entanglement and quantum information. In astrophysics, I am interested in problems pertaining to black holes and compact objects. I am specifically interested in the black hole information paradox and black hole merger events. More broadly, I hope to explore how fundamental physics manifests in extreme environments.

This year, I have been doing a computational research project in Professor Brumer's group studying ultracold collisions between a hyperfine excited Strontium Fluoride molecule and

Continued on next page.

a Rubidium-87 atom. We are particularly interested in investigating using coherent control as a mechanism for suppressing relaxation processes within this collision. Through this project, we explored using symmetry to help preserve the strength of the control.

Over the upcoming summer I will be joining Professor Drout's group on a project involving cosmic explosions, focusing on collisions, flares and their environments as a mechanism for exploring general relativity, radiative transfer theory and the origin of heavy elements.

What is your favourite course and why?

My favourite course thus far has probably been statistical mechanics (PHY452). I've really appreciated how we've been able to build up to foundational laws of thermodynamics and results we took for granted in PHY252 from very minimal assumptions. The formalization and content in Professor Sipe's lectures made Quantum Mechanics I (PHY356) a close second.

What are your future plans?

I intend to pursue graduate studies to get my PhD in theoretical physics. I'm currently looking into graduate schools in Europe as I think diversifying my background would be a really valuable opportunity that would allow me to grow as both a person and researcher. Outside of academics, I hope to travel the world and spend more time with my loved ones.

Where do you see yourself in 10 years?

Hopefully with a doctorate, working in a job that allows me to conduct research and continue learning more about the world every day! If nothing else, this past year has taught me that time is never guaranteed; I hope that in 10 years I'll be able to look back knowing that I made the most of every day I had.

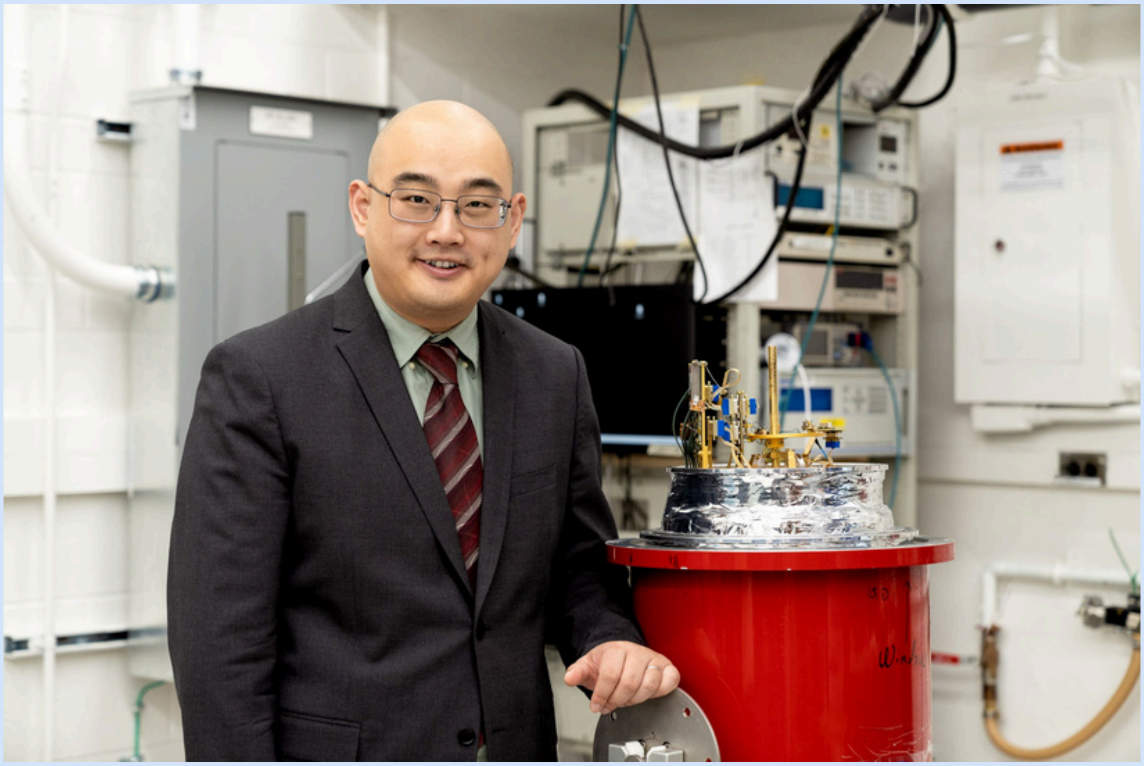
Tell me something interesting about yourself.

I did martial arts for over 10 years and have my first degree black belt in taekwondo!

Research Spotlight

Prof. Ziqing Hong

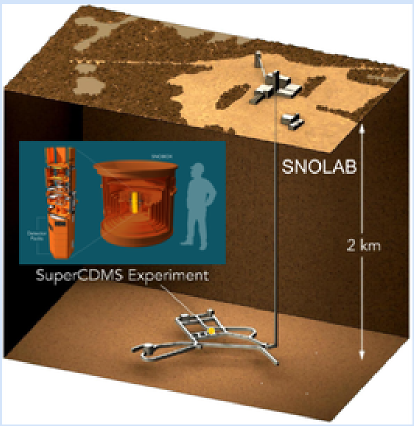
High Energy Particle Physics



I work in experimental particle physics studying the fundamental building blocks of the universe, the elementary particles, and the forces that bind or repel them. The best theory we currently have is the "Standard Model of Particle Physics" which contains dozens of different particles and describes how they interact. Despite being highly successful in describing parts of our universe, it falls short in other aspects, including when predicting the masses of the neutrinos (proved by the work of the SNO experiment, which led to the Nobel prize shared by Dr. Art McDonald in 2015), and the lack of including particles that could be attributed as the "Dark Matter". As an experimentalist, together with the experimental collaborations, I am dedicated to chasing down these shortfalls of the Standard Model of Particle Physics, with the goal of gaining more understanding of the universe. This includes searching for "Dark Matter" with the SuperCDMS@SNOLAB experiment and probing the properties of the neutrino particle with the Ricochet@ILL experiment.

Continued on next page.

Dark matter search with SuperCDMS@SNOLAB



Evidence obtained from astronomy and cosmology calls for a mysterious type of matter, “Dark Matter” (DM), which has only been observed via gravity: measurement shows that DM actually accounts for 85% of all matter in the universe. Due to its gravitational dominance over regular matter, it is a key driver for the evolution of the universe, affecting the formation of galaxies like the Milky Way. Although it is fundamental to our very own existence, we don’t know what it is. Due to the feeble interacting nature of DM, extremely sensitive detectors are needed. Thus, we have built the SuperCDMS experiment at the 2km underground SNOLAB in Lively, ON (40 minutes outside of Sudbury) -- the Nobel-prize-winning lab currently hosting a suite of cutting-edge experiments.

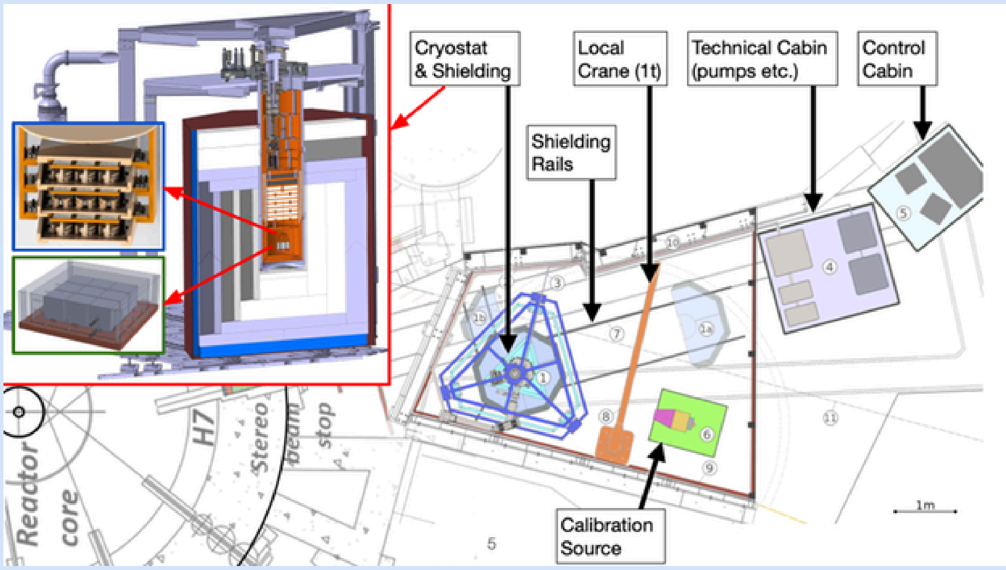
Profs. Miriam Diamond, Pekka Sinervo, and I co-lead the largest team on the experiment, collaborating with research scientists and adjunct Profs. Matt Stukel and Andy Kubik, amongst others. We have recently achieved a milestone of finishing assembling and turning on the experiment. Our students and postdocs are playing leadership roles in almost all aspects of the experiment, from constructing and operating the giant machine to collecting and analyzing data to search for hints of dark matter inside, and everything in between. We are currently going through a period of a few months of “tweaking the machine”, followed by a three-year stable data-taking to give us an unparalleled sensitivity to dark matter candidates that are comparable to the mass of a few protons.

Neutrino elastic scattering sensing with Ricochet@ILL

Aside from chasing dark matter, Prof. Andy Kubik and I are also probing the most enigmatic particles within the Standard Model of Particle Physics: the neutrinos. Although these particles were predicted by the model to have zero masses like the photons, Dr. McDonald and the SNO experiment proved it’s not the case. These elusive particles have been put under the spotlight, going through thorough scrutiny, hoping one day they might tell us some deeper secrets about the universe.

To discover neutrinos’ secrets, we are deploying the sensitive detectors next to their hometown, a nuclear reactor where many neutrinos are born. We are collaborating with the Institut Laue–Langevin (ILL), which operates a research reactor in Grenoble, France, with a detector array placed eight meters from the core of the reactor.

Continued on next page.



Recent news from the French National Institute of Nuclear and Particle Physics (IN2P3) highlighted the start of the scientific phase of Ricochet, featuring our student Elspeth Cudmore finalizing the detector installation at the reactor site. The experiment will continue for at least another year. By the end of this data collection, we expect a definitive identification of the neutrino scattering signal via the "coherent scattering mode", in these state-of-the-art cryogenic crystal detectors. A future upgrade with more and better detectors is under planning, hopefully with a new technology that is naturalized from our own lab.

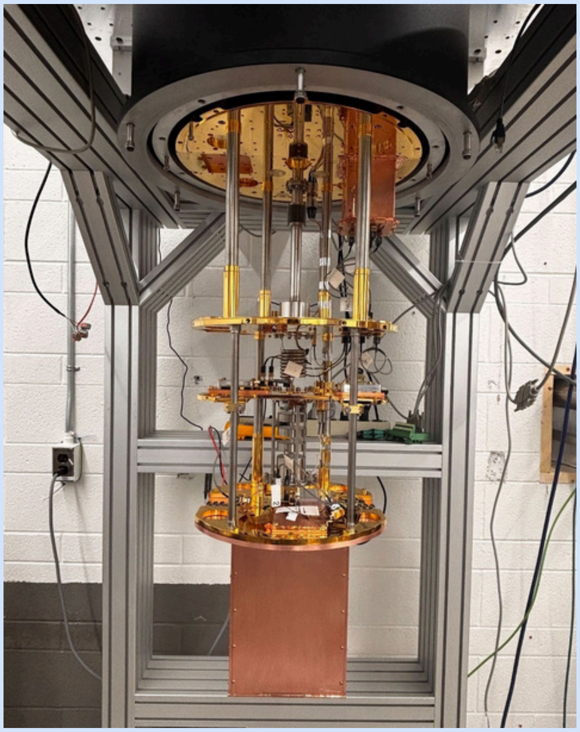
Core technology: Cryogenic crystal detectors

The common feature of both the dark matter search SuperCDMS experiment and the neutrino measurement Ricochet experiment lies in the cryogenic crystal detector. These semiconductor crystals are cooled down to about 0.01 degrees above absolute zero to best suppress their intrinsic noise, then are fitted with either the "Transition-Edge Sensors" utilizing superconductors or the "Neutron-Transmutation-Doped" germanium thermistors, which are the most precisely engineered semiconductor sensors. Their extreme sensitivities to temperature make them the best thermometers existing, measuring the heat induced by the slightest particle interactions, either from the neutrinos or from the potential dark matter particles.

To pursue increasingly fainter signals, we continue to develop this technology in our basement laboratory in the McLennan Physics building. We recently acquired a dilution refrigerator capable of achieving single-digit milliKelvin temperatures and fitted it with an array of Superconducting Quantum Interference Devices (SQUIDs) as the electronics read-

Continued on next page.

out system. Benefiting from the Toronto NanoFabrication Center (TNFC) on campus, we can rapidly prototype improved detector designs and test them in our basement lab with a short turnaround time. We also heavily rely on our friendly relations with our basement neighbours, especially groups sharing similar cryogenic facilities and groups who have extensive experience dealing with all sorts of crystals, both in understanding theories about these solid-state systems, and in handling these fragile objects, especially when we face our common challenges: calming down the temperamental fridges.



Varsity Centre at U of T, Credit: Daisy Yuan

Xanadu Award

PhD candidate Kyle Thompson receives the 2026 Xanadu Award for an Outstanding Publication

Through generous support from Xanadu, the Xanadu Award for an Outstanding Publication was established in the Department of Physics to acknowledge PhD students who have published a peer-reviewed article in an academic journal on a topic related to **quantum information and quantum optics**. We are delighted to announce this year's recipient Kyle Thompson – who received the award in recognition of his paper "How much time does a photon spend as an atomic excitation before being transmitted through a cloud of atoms?", which was published in APL Quantum Journal in 2025.

This award is the result of a donation from Xanadu, a Toronto-based start-up company with close ties to the Department of Physics. A number of former post-doctoral fellows, PhD students and undergraduate students are affiliated with Xanadu.

Xanadu founder and CEO Christian Weedbrook says *"we wanted to encourage students in the field of quantum information and quantum optics and to let them know that Xanadu, and many other quantum startups in Canada, exist when they graduate."*

https://pubs.aip.org/aip

Kyle Thompson shared his thoughts on his award-winning research:

In this paper we answer a very simple yet fundamental question about light-matter interaction: if a photon passes through a cloud of atoms without being scattered, does it spend any time as an atomic excitation along the way? If so, how much? We introduce a way of defining and measuring this time by monitoring the atoms with a second beam of light. Surprisingly, we show that this time can be negative because of quantum interference. These results provide a new perspective on how light propagates through an absorbing medium—a process that is central to atomic, molecular, and optical physics and plays an important role in many emerging quantum technologies.

Continued on next page.

What theoretical framework or experimental setup did you use, and what made it particularly effective for your study?

This problem is theoretically challenging for two reasons. First, we wanted to know not just the average time a photon spends as an atomic excitation, but the time conditioned on the photon successfully passing through the cloud. Second, the full quantum description of a photon propagating through a cloud of atoms is very complicated because the photon can scatter into an effectively infinite number of directions.

To address these challenges, we combined two theoretical tools that are not often used together: the weak value formalism and quantum trajectory theory. This combination was especially effective because it allowed us to isolate the single quantum trajectory in which the photon is transmitted through the cloud, without having to explicitly describe all of the many ways it could have instead been scattered.

How could your findings influence future developments in physics or related technologies?

This work is the result of purely curiosity-driven research. We asked a conceptually simple question about light-matter interaction, and we were genuinely surprised by the answer. Although the paper is fundamentally about deepening our understanding of a basic physical process, such advances in perspective can often shape how researchers think about related problems. By offering a new perspective on light-matter interaction, this work may help inspire further developments in quantum optics or related technologies. More broadly, I hope that our findings serve as a reminder that curiosity-driven research can lead to unexpected and meaningful insights.

McLennan Physics Labs Undergrdaute Wing, Credit: Emanuel Istrate

November Ph.D. Graduates

Congratulations to our November 2025 graduates!

ALKHATIB, I., ANALYSIS OF SIGNALS IN SEMICONDUCTOR CRYOGENIC DARK MATTER SEARCH DETECTORS AND NEW CONSTRAINTS ON INTERACTIONS OF LIGHT DARK MATTER WITH ELECTRONS (PROF. DIAMOND)

BOSE, A., PROXIMATE QUANTUM SPIN LIQUIDS IN FRUSTRATED MAGNETS (PROF. PARAMEKANTI)

COX, A. A., A FEW INSIGHTS INTO THE CONFINEMENT PROBLEM AND OTHER NON-PERTURBATIVE QUESTIONS ABOUT GAUGE THEORIES (PROF. POPPITZ)

DESROCHERS, F., EXPLORING FRACTIONALIZATION IN QUANTUM SPIN ICE (PROF. Y.B. KIM)

DUFF, A. H., MICROSCOPIC TREATMENT OF CHARGE AND SPIN RESPONSE TO ELECTROMAGNETIC FIELDS (PROF. SIPE)

FRONTINI, F. I., RESONANT INELASTIC X-RAY SCATTERING STUDIES OF STRONGLY CORRELATED RHENIUM BASED DOUBLE PEROVSKITES (PROF. Y.J. KIM)

GEMMELL, C.B., MAKING A MAP OF SHADOWS AND STARS: ASTROPHYSICAL PROBES OF DARK SECTORS (PROF. CURTIN)

Continued on next page.

November Ph.D. Graduates

GERRY, M. L., USING FLUCTUATIONS TO PROBE STRUCTURE AND ASSESS METHODS IN NANOSCALE OPEN SYSTEMS (PROF. SEGAL)

GILLESPIE, L.D., MEASURING METHANE EMISSIONS IN THE URBAN ENVIRONMENT (PROF. WUNCH)

HAGAN, M., A QUANTUM MECHANICAL ANALOG OF HAMILTONIAN MONTE CARLO (PROF. WIEBE)

HOGAN-LAMARRE, P., SERIAL ELECTRON CRYSTALLOGRAPHY FOR HIGH-RESOLUTION STRUCTURE DETERMINATION OF RADIATION-SENSITIVE MATERIALS (PROF. MILLER)

IYENGAR, S. R., PERTURBATION RESPONSES OF COMPLEX STOCHASTIC BIOLOGICAL SYSTEMS (PROF. HILFINGER)

KELL, B. J., LIMITS OF CONTROL AND ROBUSTNESS IN BIOCHEMICAL REACTION NETWORKS (PROF. HILFINGER)

KNIGHT, T.M., SEARCHING FOR DARK MATTER THROUGH EVENTS WITH LARGE MISSING TRANSVERSE ENERGY RECOILING FROM HADRONICALLY DECAYING VECTOR BOSONS WITH THE ATLAS DETECTOR (PROF. TEUSCHER)

PLOTNYKOV, M., INTERIOR STRUCTURE INFERENCE OF LOW-MASS EXOPLANETS: INVESTIGATING PLANET TO STAR COMPOSITION CORRELATION (PROF. VALENCIA)

XIE, F., DYNAMICALLY DOWNSCALED CLIMATE CHANGE IMPACTS IN THE GREAT LAKES BASIN OF NORTH AMERICA AND THE MEDITERRANEAN BASIN AND NORTHERN AFRICA OF EUROPE (PROF. PELTIER)

Awards & Recognitions

Faculty Award

Prof. Miriam Diamond is a recipient of the 2025 Dorothy Shoichet Award

This fund provides teaching-release-time funds to pre-tenure/early tenured female professors in any of the physical or life sciences, computer sciences, statistical sciences or mathematics within the Faculty of Arts & Science.

Professor Miriam Diamond will focus this time to intensely pursue her experimental physics work on dark matter direct detection searches in the Super Cryogenic Dark Matter Search (SuperCDMS) experiment at SNOLAB. Along with this, Prof. Diamond will pursue an ambitious R&D program for next-generation dark matter detectors.

More information here:
https://www.physics.utoronto.ca/news-and-events/news/physics-news/congratulations-to-prof-miriam-diamond-on-winning-a-2025-dorothy-shoichet-award/

Prof. Pekka Sinervo, C.M. is the recipient of the 2026 Vivek Goel Citizenship Award

The Vivek Goel Faculty Citizenship Award recognizes a faculty member who has served the University of Toronto with distinction in multiple leadership capacities in diverse spheres over many years. The intended recipient of this award is an exemplary university citizen and a senior member of the faculty.

Prof. Sinervo has been recognized for his university-wide service at the departmental, divisional, and institutional level. Alongside a stellar career of research, teaching, and mentorship, he has served as a great citizen of the University providing distinguished service to the University at many levels and in many spheres. He has served with distinction as Chair of Canada's largest Physics Department and as Dean of the Faculty of Arts and Science strengthened diversity in faculty recruitment and improved the experience of first-year entry undergraduate students.

More information here: https://www.physics.utoronto.ca/news-and-events/news/physics-news/httpswwwphysicsutorontocaadminpages5086/

Continued on next page.

Arrivals & Departures

We welcome one new staff and bid goodbye to two staff members

Arrivals

Diedra Dick
Manager, Finance and HR Administration

Diedra has been with the University of Toronto since 2017 and joins us from OISE, where she served as a Business Officer. A proud U of T alumna, Diedra holds a Bachelor of Commerce with a specialization in Accounting and is a Chartered Professional Accountant (CPA).

Outside of work, she enjoys travel experiences especially to the Caribbean, exploring music and culture, and volunteering with the Kiwanis Club of Toronto Caribbean.

Departures

Michael Manley shares his journey at the department:

During my six years in the Department of Physics, I was privileged to be part of a welcoming community of faculty, staff, and students. Supporting an outstanding group of researchers advancing important work in climate sciences, particle physics, quantum materials and optics, biological physics, and high-energy physics was deeply rewarding. I was also truly fortunate to work alongside an amazing finance and research administration team, all of whom I was proud to have had an opportunity to work with, and whose efforts in the department will continue to have a meaningful impact. The department's strength in both research and pedagogy made it a truly special place to grow. During this time, I grew professionally, developed new skills, and contributed to a dynamic academic mission. This experience has naturally led me to continue supporting the broader research enterprise at U of T in my current role as Manager, Finance, Research and Innovation Operations in the Office of the Vice-Principal, Research and Innovation at UTM.

Helen Iyer pens a note on her retirement:

I came to Canada in 1995 and wanted to continue my career in a university as I had experience providing administrative and secretarial support in the Math Dept. for 8 years at Sultan Qaboos University in Sultanate of Oman. While checking the classifieds in the Toronto Star, I came across a classified Ad for a Secretarial position with special emphasis on latex scientific typing for manuscripts at the Physics Department at the University. I started in May 1996 and eventually supported multiple groups like Theoretical Quantum Optics, Condensed Matter and High Energy Physics groups. Event planning was also an integral part of my job as I managed seminars, Welsh Lectures and several other workshops. From 2018, I supported the Centre for Quantum Information and Quantum Control handling a range of administrative, event planning and financial duties. I enjoyed my job at the Physics Department and took up any challenge that came my way. It was a pleasure to work with faculty and staff alike and I enjoyed my thirty years of service in the same department which felt like a second home to me.

CN Tower from Kings College Circle, Credit: Mattew Hagan

PhysCAP Recap

Updates from the Physics Career Accelerator Program

Physics Mentorship Program

This year's mid-year Mentorship Program was held on January 29, where mentors and students chatted in breakout rooms, forming new connections while discussing their futures.

The farewell Mentorship Program Event for this year's cohort was held on March 31 in the Grad Lounge to thank everyone involved and to celebrate the value of mentorship.

More information on the Physics Mentorship Program:
https://www.physics.utoronto.ca/undergraduate/physics-career/mentorship/

Zoom Meeting from the Mid-year Mentorship Progran

Farewell Mentorship Program, 2026

Continued on next page.

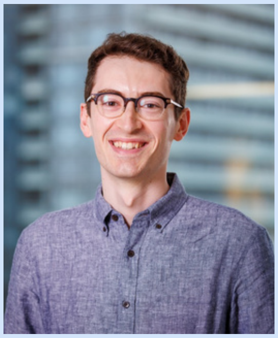
PhysCAP Recap

PhysCAP Careers Outside Academia

The 2025-2026 PhysCAP Careers Outside Academia panel event was held on March 4, focused on careers outside academia. Students learned about career opportunities that could be pursued starting with their degrees in Physics. The event featured a diverse group of speakers who shared their personal stories and described the paths they had taken over the years and how their trajectories had shifted from their original plans. The 2026 alumni panelists are featured below:

Brian Nguyenvo
Senior Director,
Compass Data & AI

Yasaman Soudagar
Co-Founder and CEO,
Startup in stealth mode



Eli Bourassa
Quantum Architecture
Scientist at Xanadu

Abhinav Bhargava
Senior Consultant
KPMG

More information about the Careers Events can be found here:
https://www.physics.utoronto.ca/undergraduate/physics-career/physics-career-fair/

At the event: Career Panel

Outreach in Action

School Visits

Physics Day by Let’s Talk Science

The 2026 edition of the Let's Talk Science Physics Day with the Department of Physics was held on February 18, this year in collaboration with Lakehead University! This event is an annual Let's Talk Science event at the University of Toronto, targeting grades 9-10 but welcoming all grades in high school. The focus of this year's event was quantum physics, as chosen by the planning committee, consisting of content experts Kiera Pond Grehan (doctoral student), Simon Cao (undergraduate student), and Dr. Jason Harlow, and led by Let's Talk Science coordinator Sandhya Mylabathula. If you are interested in helping out with this event, or other STEAM activities, please contact Sandhya at s.mylabathula@mail.utoronto.ca.

Continued on next page.

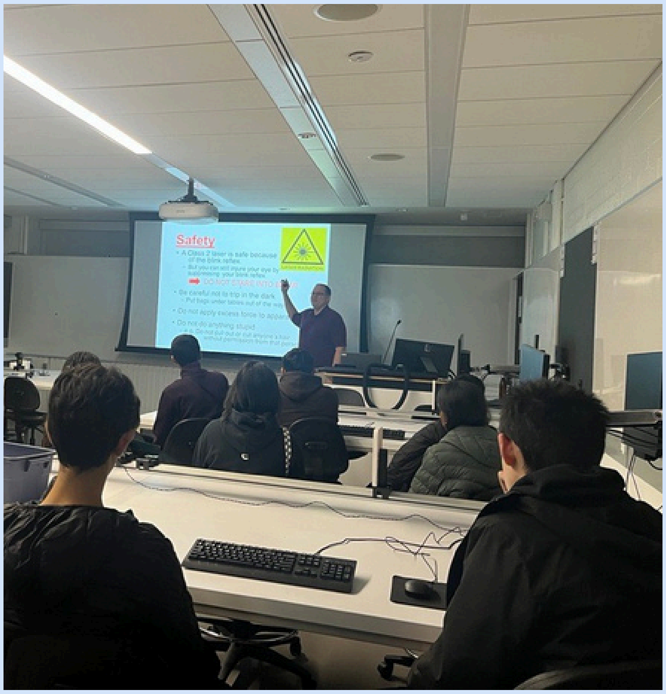
Outreach in Action

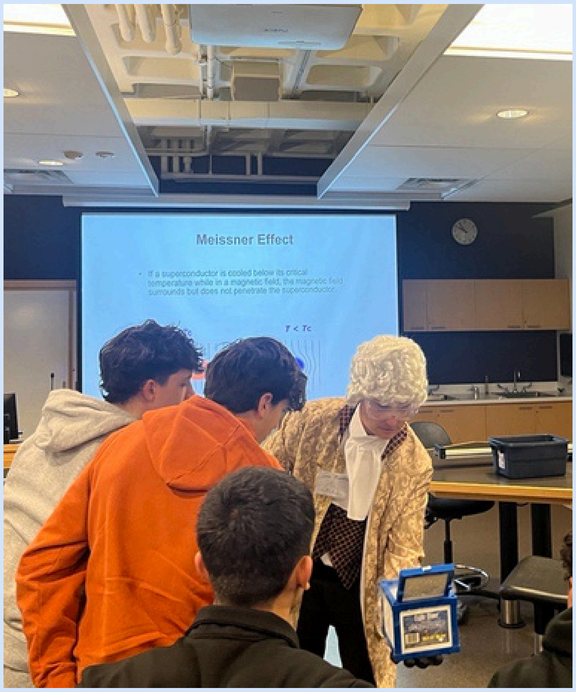
School Visits

On October 30, 2025, students in grade 11 and 12 from Garth Webb Secondary School visited the Department of Physics for first year lab demonstrations by Professor Ania Harlick.

On October 31, 2025, students from Stephen Leacock Collegiate Institute visited the Department of Physics for a workshop offered by Professor Miriam Diamond.

Continued on next page.





On October 31, 2025, students from North Toronto Collegiate Institute visited the Department of Physics for workshops offered by Professor Brian Wilson and Professor Jason Harlow.

On December 15, 2025, students from Albert Campbell Collegiate Institute visited the Department of Physics for a workshop offered by Professor Brian Wilson.

On November 4, 2025, students from Ascension of Our Lord Secondary School visited the Department of Physics for a workshop offered by Professor Matthew Robbins.

On December 9, 2025 Professor Matthew Robbins offered another workshop to students in grade 4 at the department.

For more information visit:
https://www.physics.utoronto.ca/physics-at-uoft/outreach/school-visits-students/

Continued on next page.

Outreach in Action

Pursue Stem

If you come to the Physics Department on what you expect to be a quiet Saturday afternoon, you will often be surprised by the many excited students in our undergraduate wing and the crowd of parents in MP125 Physics lounge. Pursue STEM, the Physics-Department-led program for high-achieving Black students launched its 6th year on February 5 with record attendance of almost a hundred students along with many, many parents. From February to June, students have hands-on workshops led by faculty and students from Astronomy, Cell & Systems Biology, Chemistry, Computer Science, Physics, Earth Sciences, Environment, Mathematics, Statistics, and Victoria College. The program is part of the Lifelong Leadership Institute's Leadership By Design Program for students of Black, Caribbean, and African heritage.

The year started with Prof. Kaley Walker's Physics team again helping Grade 10 students learn about Atmospheric Physics and build their own spectrometers, while Prof. Emanuel Istrate from Victoria College had record Grade 11/12 attendance for a brand-new workshop on Scientific Creativity. A follow-up workshop will soon have students demonstrating their ingenuity and inventiveness with Lego blocks, and many students have already demonstrated their scientific creativity at the Canadian Black Scientists Network Ontario Youth Science Fair, where most contestants are Pursue STEM participants.

Grade 10 students attending a Physics workshop

With many workshops still to come, students have already become familiar with both old and new technologies. Prof. Cory Lewis from the Institute for the History and Philosophy of Science and Technology helped students create cuneiform tablets and write with quill pens. The Computer Science workshop with Prof. David Lindell and his team provided students with hands-on experience with computer vision and artificial intelligence. Another workshop had the halls filled with students trying to figure out how to make a piece of paper fall the fastest and slowest.

Continued on next page.

The program is not just for students. Many of their parents attend sessions with the workshop presenters where they learn not just about what their students have done that day but also have lively discussions about scientific careers, research, and social impacts.
All this would not be possible without the great Pursue STEM graduate student team of Coordinator Jennifer Akaade and Facilitators Cecil Chikezie, Maryama Mohamed, Zahin Mustari, Samuel Nyandwi, and Olga Pimbi. Pursue STEM is financially supported by the departments as well as the Dunlap Institute, the Canadian Institute of Theoretical Astrophysics, with past support and future commitments from the Provost's Access Programs University Fund and the Faculty of Arts and Science.

By Prof. David Bailey

High School Canadian Association of Physicists (CAP) Exam Preparation Workshops

The annual preparatory workshops were held on February 7 and March 21 for high school students eager to participate in the upcoming Canadian Association of Physicists (CAP) exam. There was significant engagement, with participants asking numerous insightful questions. A heartfelt thank you goes to Prof. Harlick for leading the sessions and to Prof. Hong for conducting a lab demonstration.

We would also like to extend a special thanks to our undergraduate students who generously volunteered their time to facilitate the second workshop.

Wishing the best of luck to all participants this year!

Other Physics News

McLennan Physics Renewal Update

Did you know that McLennan Physical Laboratories will soon be turning 60 years old?

Consultations have been happening with department members on the renewal plan of the McLennan Physics, with a view to setting McLennan Physics up for many more decades of research and teaching. The University has initiated a "Masterplan Renewal Project" and is soliciting input from Physics and the other Departments that share space in McLennan Physics.

Credit: Eva Cheung

The following update has been shared by Mladen Stojanovic, CAO, Department of Physics.

Work on the McLennan Infrastructure Renewal Master Plan continues both behind the scenes and on-site. Jenny Hung, Project Manager with University Planning, Design and Construction, is actively working with Architecture 49 (A|49) to advance the project.

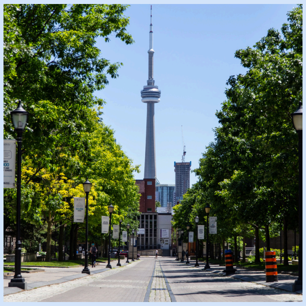
Recently, the consultant team conducted an on-site visit, including tours of the upper floors of Burton Tower and the roof area. The Faculty's Infrastructure Planning team also remains closely involved, providing regular input to support the planning process.

The next major milestone will be the delivery of a comprehensive Building Conditions Assessment Report, expected in late spring 2026. Following this, and the University's concurrence with the findings, the project team will begin pursuing the recommendations portion, with a final report anticipated in late summer to early fall.

Upcoming Events

Distinguished Lecture Series: WELSH LECTURES
May 4 - 5, 2026
Learn more or RSVP at https://uoft.me/WelshLecture
Featuring talks by Professor Stephen Quake of Stanford University and Professor Anthony Noble of Queen's University.

Science Rendezvous
11:00 AM – 5:00 PM
May 9, 2026, Kings College Circle
The festival will feature numerous exhibits that explore the theme IGNITE and integrate science, technology, engineering, mathematics, and human ingenuity.



Doors Open Toronto
10:00 AM – 4:00 PM
May 23, 2026
McLennan Physics Laboratories, 60 St George Street
Each May, Doors Open Toronto invites the public to explore the city's most-loved buildings and sites, free of charge.

Alumni Reunion Lecture
Thursday, June 18
6:00 PM – 8:00 PM
An evening to socialize and delve into the latest research in AI and Physics. Keep an eye on your inbox for the invitation!

First-ever Career Collider networking event
Coming Fall 2026
Calling all Physics alumni! This fall, we invite you to connect with undergraduate students about internships and to share your advice for a career in the industry. If you or your organization would like to know more about this event, please contact physu@studentorg.utoronto.ca. Learn more here.

Burton Tower from King's College Circle, Jo-Anne Wurster

Contact Us

Department of Physics
University of Toronto
60 St. George Street.
Toronto ON M5S 1A7
Canada

Phone:
416-978-3307
Email:
newsletter@physics.utoronto.ca