Physics
UNIVERSITY OF TORONTO

Fall 2021

INTERACTIONS

The Department of Physics Newsletter

MESSAGE FROM THE CHAIR

Welcome to the Fall 2021 issue of Interactions, the Department of Physics newsletter!

Dear Physics community,
The fall term is marching along, meaning that it is time for a new issue of the Physics Newsletter. This term has seen most of our courses return to an in-person format and the easing of distancing and capacity limits on research activities. While many people continue to work at home, there is certainly a lot more activity in the Physics building these days. On the third floor, we have been joined by Joseph Thywissen, who started his three-year term as Associate Chair for Graduate Studies on July 1.

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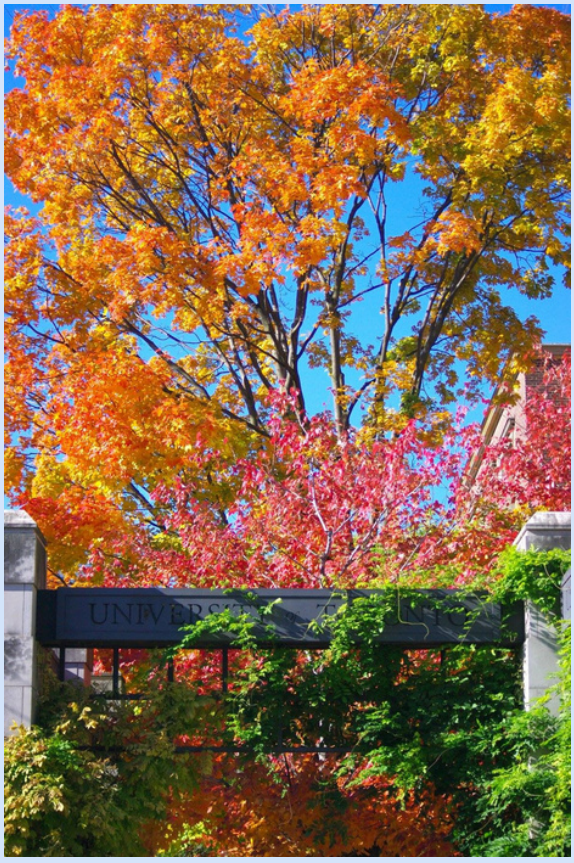
The Newsletter begins with an interview with Ania Harlick, our new Assistant Professor Teaching Stream whom we were delighted to welcome in September. This issue also profiles CQIQC Post-Doctoral Fellow Ilia Khait, Biological Physics PhD Student Spencer Smyth, and Physics Specialist Kehui (Grace) Li. Our Emeriti Profile features astrophysicist Philipp Kronberg, who retired in 2001, but has remained active in research, including writing a book on Cosmic Magnetic Fields. Our Alumni Profile introduces Stephanie Lim-Reinders, who reflects on her path through physics to her current position as a pediatric resident at the Children's Hospital of Eastern Ontario.

Kent Moore's recent work on changes in Arctic sea ice in the Nares Strait between Greenland and Ellesmere Island is highlighted in this issue's Research Spotlight. More of our recent research stories can be found at Physics News.

Congratulations to our eight June 2021 PhD graduates, and a big welcome to our incoming cohort of 37 new MSc and PhD students who have joined us from across Canada and the world!



King's College Circle
(credit: Aephraim Steinberg)

The accomplishments of Physics students, staff, and faculty have been recognized with a plethora of awards over the last six months. At our June end-of-year party, Mathew Bub was awarded the Loudon-Hines Gold Medal, and the four recipients of the Van Kranendonk TA Awards were announced: Ramina Alwarda, Sean Colford, John Feng, and Timothy Samuel. Administrative Staff Awards went to Krystyna Biel and Sheela Manek, while Technical Staff Awards went to Pius Santiago and Alex Cui. Also at the party, the Physics Student Union introduced a new annual award to recognize exceptional pedagogy in undergraduate courses; the inaugural recipients were Aephraim Steinberg for PHY256F and Stephen Julian for PHY152S.

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Former graduate students Kristof Bognar and Russell Blackport were awarded CMOS prizes, PhD student Liz Cunningham was selected as a UCAR Next Generation Fellow, and PhD student Griffin Schwartz was awarded a Tyler Lewis Clean Energy Research Foundation grant. Also notable were the results of the last two Canadian Association of Physicists University Prize Exams, both announced earlier this fall. U of T undergraduate students had stellar results, taking four of the ten top spots for 2020 and five of the top ten spots for 2021, with Samuel Li placing first in both years.

Meanwhile, our faculty members have also been doing well. Debra Wunch was awarded the CMOS President's Prize, David Dunlop received the AGU's John Adam Fleming Medal and Aephraim Steinberg was named a University Professor. Sajeev John was honoured with NSERC's Gerhard Herzberg Canada Gold Medal for Science and Engineering. This is Canada's most prestigious prize for science and engineering research and was awarded to Sajeev for his pioneering work on photonic band gap materials. And just before we went to press, Henry van Driel was awarded the CAP-COMP Peter Kirkby Memorial Medal for Outstanding Service to Canadian Physics.

Congratulations to everyone on these well-deserved honours!

Our Physics Career Accelerator Program (physCAP) launched in October, with 49 mentor/mentee pairs, and several professional development workshops have been offered to undergraduate students. In August, the inaugural cohort of grade 10 students completed their first year in Pursue STEM, a program to encourage Black and Caribbean students to pursue studies in science, technology, engineering and math. A new group of students will be joining us this year, while the current cohort continues in the program. Other Outreach in Action initiatives include virtual school visits, the Science Unlimited Summer Camp, Girls SySTEM, and the virtual Fall Campus Week.

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Wilson Gate (credit: Eli Bourassa)

I'd like to remind everyone that the Physics Colloquium series is well underway and that you can view previous talks or subscribe to the mailing list for future talks at: https://www.physics.utoronto.ca/news-and-events/events/colloquium/.

We have two staff anniversaries to mark this fall: both Peter Hurley (Chief Administrative Officer) and Aloma Namasivayam (Finance, Purchasing & uSOURCE Program Administrator) are celebrating 30 years in the Physics Department. In June, we welcomed our newest staff member, Fatima Ijaz, Administrative Assistant for the Earth, Atmospheric and Planetary Physics Group. We also remember Professor Emeritus Allan Jacobs, who passed away on June 30.

To end my remarks on a high note, I am thrilled to introduce three new awards for undergraduate students. The first is the David and Louise Fraser Scholarship, which was recently established with a very generous bequest from the estate of David B. Fraser. David earned his PhD here in 1958 before moving on to Bell Labs and Intel. He has been a long-standing supporter of the Physics Department, with a 30-year record of donations. These scholarships will be awarded annually on the basis of academic merit to undergraduate students enrolled in a Specialist or Major program in Physics or Biological Physics as well as a Major or Minor in another science program. I thank David and his family for their extraordinary generosity to the Department.

The second award is the Richard E. Azuma Summer Fellowship, which has just been announced by TRIUMF. Two Fellowships will be awarded annually to students attending one of TRIUMF's Member Universities (which include U of T). Students are eligible to hold the paid Fellowship at TRIUMF for four months in the summer break before their final graduating year. This award is named after Dick Azuma, who was a faculty member in the Physics Department from 1961 to 1994, and Chair from 1982 to 1987, and a pioneer in the field of nuclear astrophysics.

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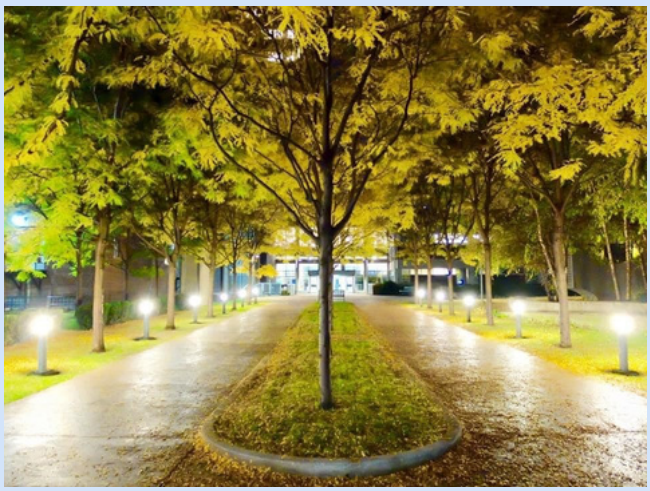

McLennan Physical Labs Walkway
(credit: Aephraim Steinberg)

In keeping with Dick's dedication to fighting prejudice and discrimination, the Azuma Fellowship is seeking not only students with stellar undergraduate records, but also those with diverse backgrounds, collaborative spirit, creativity, and other attributes that will set them apart as future researchers. I encourage our students to apply!

Back in the Department, we are launching a Fall Appeal to create a new scholarship to support Black and Indigenous students in physics. We're calling it the **Momentum Builders Scholarship**, as the goal is to build momentum for greater diversity in physics. We hope that these scholarships will help address systemic barriers — including financial — that prevent Black and Indigenous students from pursuing STEM careers. By doing so, we will create opportunities for these students to achieve their educational goals and contribute their ideas, insights and knowledge to the field, thereby enriching our collective understanding of physics and the universe. To this end, we will also be looking at additional ways we can mentor our Momentum Builders. Donations will be matched dollar-for-dollar, and we already have two pledges that will endow two awards. Please consider making a donation to support a new and diverse generation of physicists.

As always, we welcome your feedback on Interactions – please contact our Editor, Sheela Manek, at newsletter@physics.utoronto.ca with your comments and news.

Kimberly Strong
Professor & Chair

McLennan Physical Labs
(credit: University of Toronto)

Faculty Profile

Ania Harlick

Assistant Professor

Teaching Stream

Welcome to U of T Physics Dr. Harlick!

Why did you decide to go into physics? What was your inspiration?

I have never really chosen physics, it has chosen me. I had some troubles sorting out my university admission and ended up in physics in my first year. I found it very hard, but I loved what the classes did to my brain. So at the end of the year, I was considering switching majors (into something that could marry math, which I realized I was OK at) and foreign languages (which I wanted to pursue).

Having heard that, one of my professors asked me why and I told him I find physics hard (unlike the best students in my class) and I do not feel like I am like other physicists. He told me this is exactly the reason why I should stay, as physics needs more people like that. I am not sure if he said that to every doubting student, or if he saw something in me I haven't seen in myself, but I think about it often.

Can you tell us a little bit about your educational background?

I have two MSc degrees (one from Poland and one from Memorial University), both in condensed matter physics and a PhD in the same field. As I have always wanted to be a teacher, I also have completed my Teaching Certificate (so I am qualified and certified to teach high school physics in Poland).

What was the topic of your PhD thesis and why?

"Elastic properties of porous silicon superlattices", because I love the experimental aspect of physics. I was fascinated by systems that exist in the range in which approximations are not justified and I love the organized nature of crystalline structures. So I ruined some beautiful crystalline silicon with hydrofluoric acid and checked how the multilayered structures with pores respond when light is scattered on them.

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You have taught courses at Memorial University and at the University of Calgary. What do you enjoy most about teaching and why?
I enjoy how complicated the learning process is. I am amazed and curious about the multivariable nature and the non-linear character of it. In order to accommodate it, you need to diversify your teaching, try new things, not be afraid to adjust, accept feedback, re-evaluate, unlearn what you thought worked, and learn to do it differently. So my favourite thing about teaching is how dynamic of a process it is. This doesn't mean I do not care about my students – they are the driving force behind the process and the only reason why it makes sense.

What do you like to do when you are not teaching and learning physics?
I love exploring: visiting new places, checking out new areas and going to the towns/cities/districts I have never been to. If I haven't seen it, I am definitely interested in checking it out.

I am pretty boring in the hobby department: I like to read, watch movies and TV series, I am a decent cook but a terrible baker and I enjoy doing many artistic things that I am hilariously bad at.

I decompress by doing embroidery and playing video games (and I used to not ever tell anyone that, but the truth is, I like it).

What are you most looking forward to about being in Toronto?
Exploration of the city and working with people!

Ania Harlick's LinkedIn Profile:
https://www.linkedin.com/in/ania-harlick-a7b415129/?originalSubdomain=ca

Postdoctoral Fellow Profile

Ilia Khait

Dr. Ilia Khait has been a postdoctoral fellow at the University of Toronto since 2018. He is now a CQIQC postdoctoral fellow working with Professor Dvira Segal. He earned a BSc in electrical engineering, a BSc in physics and a PhD in physics from Technion – Israel Institute of Technology which is located in the beautiful city of Haifa.

In his PhD thesis he worked on various topics in condensed matter physics. One of his achievements was the development of a method for calculating transport properties of strongly interacting bosons and fermions. In general, these are very hard problems with extremely limited tools available. Furthermore, these are often limited to specific regimes. He continues to develop these ideas.

Currently, he is working on incorporating state-of-the-art machine learning techniques to study quantum dynamics and quantum information. As machine learning evolves, it becomes useful in many fields. Apart from natural language processing, image recognition, finance and more, it became popular in physics as well. He believes that with proper modeling we can harness machine learning tools to help us solve problems which would otherwise be hard to solve.

Additionally, Dr. Khait is advising a quantum hardware startup company on solutions for quantum device scaling. One of the field's biggest problems is increasing the capabilities of quantum computers. Right now, these are very fancy huge science toys, which are extremely limited and do not allow game-changing computations. The technology they develop would allow interconnecting quantum computers, hence allowing near-term quantum devices to grow.

In his spare time, he enjoys exploring nature with his family (see photo on right). "Canada in general, and Ontario in particular, have an abundance of beautiful scenery all year long!" Ilia says. He tries to take photographs everywhere he goes and he used to maintain a personal photo gallery (which he says has not been updated in a while). Ilia is also a fan of team sports and used to be a water polo player, he still dreams about his comeback.

Graduate Student Profile

Spencer Smyth

PhD Candidate

Biological Physics - 4th year

Initially pursuing life sciences at the U of T Mississauga Campus, Spencer transitioned to physics where he went on to graduate with Majors in chemistry and physics. He found that solving problems with a small amount of information and quantitative tools was more satisfying than vast amounts of memorization. Spencer also discovered popularizers of physics like Michio Kaku, Lawrence Krauss and Brian Greene. They related not only the incredible intellectual achievements of Physics but also it's role in creating and continuing to shape the modern world.

Spencer's first undergraduate research experience was with an NSERC USRA scholarship in the lab of Professor Claudiu Gradinaru where he learned about microscopes, lasers, programming and proteins.

The amount of work and frustration that accompanied research was balanced by the excitement of discovering new knowledge! This experience also prompted questions that had not been addressed in his physics classes at that point: how do we understand systems that are too complex to model from first principles or perhaps even computationally irreducible?

Spencer joined the U of T Physics department as a graduate student in 2017 where he continued his research with Professor Gradinaru and now focuses on studying intrinsically disordered proteins (IDPs) and their interactions using single-molecule fluorescence and integrative computational modelling.

Traditionally proteins were understood to have a well defined 3-dimensional structure that is intimately related to their function. Although they lack a unique structure, IPDs are able to carry out a diverse range of biological functions while existing as an ensemble of dynamically interconverting structures.

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Single-molecule fluorescence spectroscopy is well suited to study IDPs as it overcomes the ensemble averaging inherent to many techniques. Instead of measuring an average observable from a whole test tube of molecules, single-molecule techniques interrogate molecules one at a time. If there are several biologically functional states present, they can be differentiated, while incorrect conclusions about function can be drawn if one were to look only at ensemble averaged values.

Given the large number of structures IDPs adopt and the limited amount of experimental information available, the determination of a physically representative set of structures is a challenging inverse problem. To address this, structures generated from molecular dynamics simulations or other methods are reweighted such that the experimental observables back calculated from these structures agree with the experimental values. Incorporating several different types of experimental data with different averaging times, back calculator accuracies, and experimental uncertainties is challenging, he is currently exploring the use of Bayesian methods. Spencer hopes that a detailed understanding of IDPs and their interactions will lead to novel therapeutics and advances in biotechnology.

When he's not dealing to finicky lasers, debugging analysis programs, or wondering why his proteins won't grow, Spencer enjoys spending time outdoors and power sports. Besides physics he also enjoys learning about economics, history, finance, and technology. When time allows, he enjoys playing musical instruments, weightlifting, reading, and cooking.

U of T Campus (credit: Eli Bourassa)

Undergraduate Student Profile

Kehui (Grace) Li

Program: Physics specialist, Computer Science major, Math Minor

Year of Study: 4

Why did you decide to major in Physics? What was your inspiration?

Because physics is fun! There wasn't really any particular inspiration: I did the Physics Olympiad at my high school. It was fun and I was doing pretty well, so pursuing physics in university seemed natural to me. I still think it was a great decision, because physics gets even more interesting in university!

What do you enjoy most about the physics program?

I enjoy the freedom to choose from a wide range of courses, especially in 3rd and 4th year. Also, I think it's great that the physics program provides lots of research opportunities, like SURF, NSERC USRA, and the supervised research courses. I've benefited immensely from them.

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

I didn't do many extra-curriculars. I was in the language exchange initiative in the first semester of my first year, and stopped going because of schedule conflicts. I still enjoy learning languages in my free time, but I just do it on my own now.

What are your research interests?

I'm interested in quantum optics and quantum information.

What is your favorite course and why?

PHY354, advanced classical mechanics because Lagrangian and Hamiltonian mechanics are fascinating! Also, Professor David Curtin's lectures were always a pleasure to attend, despite them being online and at 9am.

What are your future plans?

I'm going to apply to graduate school and pursue a PhD in physics. I'm still not sure whether I want to do theory or experimental, so I might just apply to both.

Where do you see yourself in 10 years?

I want to say a physics professor, but that might be a very optimistic estimate. I just hope that I'll have completed a PhD and am doing research in something interesting. Also, I want to be a cat owner by then. Very important as well!

Tell me something interesting about yourself.

I'm right-handed, but I can write with my left hand (although not very well), because I took all my grade 12 physics notes with my left hand.

Emeriti Profile
Philipp Kronberg

Welcome to our third Emeriti Profile where we ask one of our emeritus faculty questions about their careers and what they have being doing since retirement. Is there a faculty member that you recall from being a student and are you wondering what they are up to? Do you have fond memories of a certain instructor? Tell us who they are and we will try and connect with them for an update.

How many years were you a faculty member?

I was appointed lecturer in the Physics Department at the University of Manchester from 1966-1968, then at the University of Toronto from 1968 to 1999. At that point I retired early to the position of Lifetime Research Professor Emeritus in Residence. Within a year of that event, I received an invitation to work in plasma astrophysics at Los Alamos National Laboratory, an institution of the U.S. Department of Energy in New Mexico.

Can you tell us about your educational background?

My graduation with a BSc in engineering physics at Queen's University was followed by a few months of initial employment in nuclear reactor engineering at Atomic Energy of Canada Limited, Chalk River Ontario where I worked on a 200 megawatt prototype of the Canadian CANDU power reactors.

This experience, though very pleasant, also provided me with a little more thinking time, during which I made a major decision, to follow an offer to enroll in an MSc program in radio astronomy at Queen's University in the Departments of Physics and Electrical Engineering.

My MSc thesis project produced a world-class imaging radio telescope. This was thanks to being given a free hand in the design, encouraging and supportive supervision by Professors George Harrower and Robin M. Chisholm and unusually generous funding from Queen's University.

The telescope earned a place in the annual 1965 Government of Canada Yearbook. Illustrated in the figure below, it produced a 146MHz image of part of the radio sky with an angular resolution of ~ 1 degree – which was state of the art at that time.

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After my MSc, I completed a PhD in 1967 and DSc in 1995, both from the University of Manchester.

Can you tell us about your PhD and your early postdoctoral work?
I obtained my PhD in physics at Manchester University, UK. During this time, I combined the largest existing fully steerable 79-metre radio telescope with a second, just constructed slightly smaller radio telescope. They were combining them as a 2-element interferometer spaced about 425m apart. I designed and built the antenna feeds and electronics to produce radio images of some quasars and radio galaxies, including their magnetic field structure.

I outfitted the Jodrell Bank Interferometer, it consisted of two of the World's largest radio telescopes with suitable feed antennas and electronics. These two telescopes were the 79-metre Lovell telescope and a second slightly smaller, likewise fully steerable telescope completed in the early seventies, close to the beginning of my PhD studies in England. Also for my thesis, I applied a new technique for the interferometric Fourier transform synthesis 2-D imaging of polarized radio sources. This technique was soon adopted by the 3-telesope US National Radio Astronomy Observatory Interferometer in West Virginia, USA and later by the 27-antenna Very Large Array in New Mexico.

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Other achievements while at Manchester University included:
- The first detection of the physical gyration period of Jupiter's Van Allen belt structure using the Jodrell Bank Interferometer
- Produced the first full aperture synthesis distribution of linearly polarized emission of radio galaxies and quasars at 2" resolution and sensitivity
- Among the first to propose that the starburst galaxies are primarily powered by "normal" stellar processes like supernovae and massive star

What kind of physics did you teach?
At the University of Manchester in the U.K., I lectured in undergraduate physics and labs from 1966-1968. I also lectured in radio astronomy to masters level graduate students.

What are your fondest memories of being a faculty member at U of T Physics Department?
I enjoyed interactions with, and guiding graduate students into interesting MSc and PhD theses projects. I enjoyed hosting more senior researchers at U of T and working and co-publishing with them as well.

I also enjoyed the fruitful interactions with many colleagues in the course of my numerous committee and board memberships.

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Philipp Kronberg

What have you been doing during your retirement?
I have been involved in ongoing research, some of which began prior to my early retirement, as well as various committee and board memberships in Canada and elsewhere.

In 2002-2003 I was awarded the Orson Anderson Scholar at Los Alamos National Laboratory and in 2005 I was nominated a Fellow of the American Physical Society. In 2007-2008, I was invited to Australia as a Visiting International Fellow at Sydney University and as a Distinguished Visitor at Commonwealth Scientific and Industrial Research Organization.

My research since retirement includes: I provided evidence to quantitatively calibrate the energy conversion from gravitational-to-magnetic energy in extragalactic magneto-plasmas and energy feedback between massive galactic black holes and intergalactic space.

With colleagues at Los Alamos National Laboratory and Cornell University, I published the first experiment-based estimate of the electric current in a jet powered by a central supermassive black hole. This work can be found in the 2011 paper, "Measurement of the Electrical Current in a kpc-scale jet" in The Astrophysical Journal Letters.

Full link to paper:
https://iopscience.iop.org/article/10.1088/2041-8205/741/1/L15/pdf

Some of my recent publications include an invited Cambridge University Press book in 2016, titled Comic Magnetic Fields.

More information on this book can be found here:
https://www.nhbs.com/cosmic-magnetic-fields-book

More recently, in January 2019, I co-authored a review article titled "The Origin of the Most Energetic Galactic Cosmic Rays: Supernova Explosions into Massive Star Plasma Winds".

Full link to paper here:
https://www.mdpi.com/2075-4434/7/2/48

Alumni Profile

Stephanie Lim-Reinders

Class of 2016 - HBSc Physics

Dr. Stephanie Lim-Reinders is a pediatric resident at the Children's Hospital of Eastern Ontario, Ottawa. She completed medical school at the University of Toronto and published widely in medical physics on the MRI-Linac technology through this time. She is a graduate of the biophysics specialist program at the University of Toronto.

Why did you choose physics?

It all started with my high school physics teacher, Dr. Burns. He was a NASA physicist who transitioned into teaching high school after being inspired by a NASA outreach program. Not only was he absolutely brilliant and passionate, he also had a very special way of making physics seem simple. He taught us that we already understood physics - it was intuitive through our deep sense of forces and kinetics. We know a ball will roll down a ramp. He guided us through the formulae and used physics to explain a world we already understood. I was so lucky to have a high school physics teacher who taught us that we were capable of grasping the tough stuff of physics.

When I got to university, I was not at all sure what I wanted to do. I definitely did not think I would be completing a physics degree – that was a program for people much smarter than myself. But I loved physics in high school, and enrolled in first year physics as an elective. Alas, I loved the balance of creativity in problem solving and the concrete answer you would find that explained the world around me.

I remember sitting down with Dr. Daniel James, my first-year physics professor. I told him plainly that I loved it – it was interesting, engaging, and satisfying – but was I capable, and what on Earth was I going to do with a physics degree? I remember him telling me that you can do anything. He had grads who became physicists, lawyers, doctors, anything they dreamed of becoming. He said it was like being at the top of the mountain, you could go anywhere from those heights.

What did you love about physics?

Most of all, I loved the people in my program. My fondest memories in undergrad were getting takeout with my friends and sitting in the library until the wee hours of the morning, staring at a (still) largely blank blackboard and problem set. We hoped that one of us would have the "aha" moment that would release us all from the problem set and send us off to bed. There were some tough head-scratching days, and not a moment passes where I am not filled with gratitude that we did it together.

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The U of T professors were also wonderful, special people. For all the days where I thought physics was for smarter people than myself, they made time in their schedules to help me understand the material. As one of the few female students in the department, I also benefited from mentorship from numerous profs who were heavily invested in their students' success. I really felt like part of the department.

The material was also a big draw for me! I love how, despite the complexity of physics, it was also simple in explaining a world we intuitively understand. I remember a moment in quantum physics when we learned about the randomness in the particle spin, and the professor asking us if we thought this meant that on the deepest particulate level there was a degree of free will. This was the stuff that kept me curious and always coming back for more.

How did physics help you in your career path?

I had a very unconventional path to medicine, coming from physics, as opposed to biology. I am so grateful I spent those four pre-med years learning a subject I loved. I was nervous that physics would not have prepared me for medicine, but it equipped me with many strengths and skills I had not anticipated. I learned to see problems and the world differently. Those nights staring at the blackboard taught us to lay out everything we knew, determine what we did not know, and work creatively to fill in the gaps to reach a solution. This skill has helped me endlessly in medicine.

It also brought me through a really wonderful research lab in medical physics. I had the chance to see the intersection of cutting-edge technology and its impact on patient care. The medical physicists at Sunnybrook, especially my supervisor, Dr. Anthony Kim, really inspired me to ask the big questions, and consider what matters most to patient care. He always followed with a push to be at the edge of innovation and creativity. It was a matter of envisioning what medicine could be and the quality of care we could be capable of delivering in his lab. I have taken this mindset forward to many of my patient visits, and in every subsequent research project.

Any final thoughts?

While I often felt unsure during those blank chalkboard nights in the library, in hindsight, I am forever grateful that I chose physics. The material was always challenging, but it was engaging, and the people made it worthwhile. Not only did it explain the world around us, but it also challenged us to see the world differently and tackle our problems, and all their variables, creatively. I now understand the advice from Dr. James, that physics brings you to the top of a mountain, and I am so glad we journeyed through that climb together. You really can go anywhere from a physics degree, and it will serve you well in any career you choose.

David and Louise Fraser Scholarship

Gratitude inspired Arts & Science alumnus David B. Fraser to mentor students and colleagues

By: Peter Boisseau - A&S News

Kind, genuine and incredibly modest, Arts & Science alumnus David B. Fraser was more interested in lifting up the next generation of scientists and researchers than focusing on his many accomplishments, including securing more than 75 U.S. patents.

A proud Canadian, Fraser flew the flag every July 1 after moving to the U.S. in 1959. Photo credit: All photos courtesy of Sharon Holt.

The outpouring of affection from friends and colleagues after his passing reflected a universal admiration for Fraser's selfless mentorship of young colleagues and students while working as a cutting-edge research physicist at Bell Labs and Intel.

"*I remember at his retirement dinner when he left Intel, every one of the scientists in his research group got up and talked about him in an almost fatherly way*," says Fraser's daughter Sharon Holt.

"*He really took them under his wing and coached them, not only about their work and their careers but also little life lessons.*"

The first in his family to attend university, Fraser was grateful for his opportunities.

Fraser also established a strong intern program at Intel to attract grad students.

"*He was very committed to making sure young students had opportunities to experience industrial research because that was such a big thing for him*," says Holt.

Gratitude for the opportunities and education he got was a driving force for the father of six with a strong love of family, who graduated from U of T with a master of arts in 1955 and a PhD in physics in 1958.

After growing up in 1930s Winnipeg and becoming the first in his family to graduate from university, her father felt a responsibility to help others, says Holt.

Fraser donated to U of T for more than 30 years and was in the process of setting up a bequest for the David and Louise Fraser Scholarship in the Department of Physics when he passed away on December 2, 2020.

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"*The Department of Physics is honoured to receive this generous bequest from our alumnus Dr. David Fraser*," says Chair Kim Strong.

"*Dr. Fraser has been a steadfast supporter of the department through a series of donations over the past 30 years. We are deeply grateful for his long record of commitment and for this wonderful gift, which will enable us to provide new scholarships for our undergraduate students.*"

At the time of his passing, Fraser was also establishing a scholarship at the University of Manitoba, where he graduated in 1954 with a bachelor of science before attending U of T, says Holt. A retired technology executive, she has taken over management of both of her father's gifts.

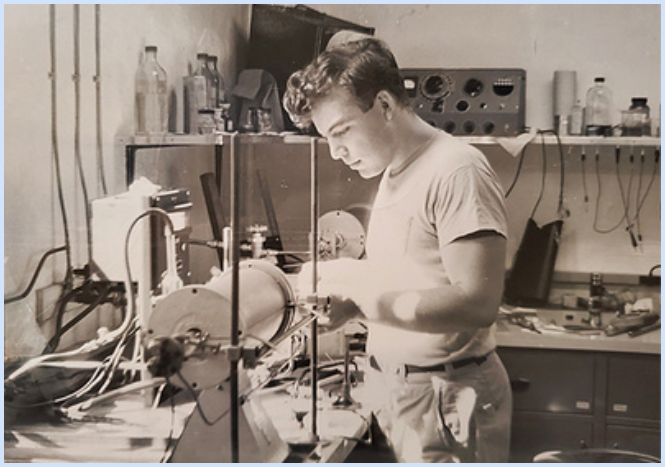
"*His family didn't have a lot of money. When he went away to school, it was very much a struggle, and he and my mom got married very young. I think he was extremely grateful for the opportunity to go to university at all,*" Holt says.

"*I think it was important to him to make sure he was reaching into the future to help young people, perhaps people like himself, who didn't come from families where everybody went to university.*"

A proud Canadian, Fraser made the difficult decision to move his young family to New Jersey in 1959 to work at Bell Labs, then a mecca of research.

Fraser was fascinated by lab research on quartz and helped make breakthrough discoveries in holographic information storage, capturing the esteemed C. B. Sawyer Memorial Award in 1968 and generating more than 40 patents before leaving Bell Labs after 25 years to join Intel in 1985.

In an era when women faced open discrimination in academia and the workplace, Fraser stood out as someone who treated everyone with the same respect regardless of gender, says Olga Mitchell, a family friend who graduated from U of T with a PhD in 1962 as Olga Mary Mracek Mitchell after obtaining a master of science in physics from U of T in 1958 and a bachelor of arts in physics in 1955 as a member of Victoria College.



At Bell Labs and Intel, Fraser was fascinated by lab-based research.

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"*He was a wonderful person and very well respected," says Mitchell, who worked with Fraser at Bell Labs. "And when it came to working with women, he didn't see any differences. There was absolutely no male-female discrimination.*"

A financial supporter of Victoria College and the Physics Department, Mitchell says she's inspired by Fraser funding a scholarship.

Passionate about education and devoted to his children, Fraser encouraged them to think about what they might like to learn about, while ensuring they all received the financial assistance they needed to pursue their academic goals.

Holt says she and her siblings had a deep pride in their soft-spoken father and were influenced by his appreciation for education, but she laughs about the fun-loving debates they had after she pursued electrical engineering instead of scientific research.

"*We joked a lot about the fact that we both ended up in the same industry, just in very different types of roles.*"

One of her sisters became a software engineer and both of her brothers followed in their father's footsteps by attending U of T.

Dr. Grant Fraser fondly recalls his days at U of T, where he met his wife.

"*U of T is a very good university with an extremely broad range of subject areas that it covers very well. It was an excellent place to attend university*," says Fraser, who graduated with his doctor of medicine in 1980 after earning a bachelor of science in 1977 as a member of St. Michael's College.

"*The St. George campus is a beautiful setting in the heart of one of North America's best cities.*"

David and Louise Fraser (centre) in 2005 with children (L to R): Carolyn Whelan, Sharon Holt, Linda Jacobsen, Grant Fraser, Laura Fraser and David Fraser Jr.

Make a gift to the David and Louise Fraser Scholarship:
https://engage.utoronto.ca/site/SPageServer?pagename=donate#/fund/1710

Research Spotlight

Professor Kent Moore

The Arctic and the “Last Ice Area”

Can you tell us a little bit about the "Last Ice Area” in the Nares Straight and its importance?

The Arctic is experiencing a dramatic reduction in sea ice extent. During the 1980s, the area covered by sea ice in September was ~7 million square kilometers. Now it is ~4 million square kilometers. In addition to the loss of sea ice cover, the Arctic is also experiencing a trend towards a younger and thinner ice pack. This loss of the thick multi-year ice, that is ice that has survived at least one melt season, is particularly troublesome for ice dependent species such as polar bears.

Climate models forecast that during the summer, the Arctic will be ice free, defined to be less than 1 million square kilometers of ice cover, sometime in the middle of this century. When this happens, all the ice that is remaining will be situated north of Canada and Greenland. This area is now referred to as the Last Ice Area and it is of vital importance as it will act as a refuge for ice dependent species until we can hopefully cool the planet down allowing sea ice to expand in the Arctic. The Last Ice Area is a region of thick multi-year ice that has not been extensively studied. There is increasing evidence that the sea ice in the Last Ice Area is more dynamic and may not be as resilient to the loss of sea ice as previously thought.

Nares Strait, situated between Ellesmere Island and Greenland, is the main pathway along which ice leaves the Last Ice Area. Our work has shown that the flux of thick multi-year ice along the Strait has doubled over the past 20 years.

Why did you want to study this area and what is happening to the ice there?

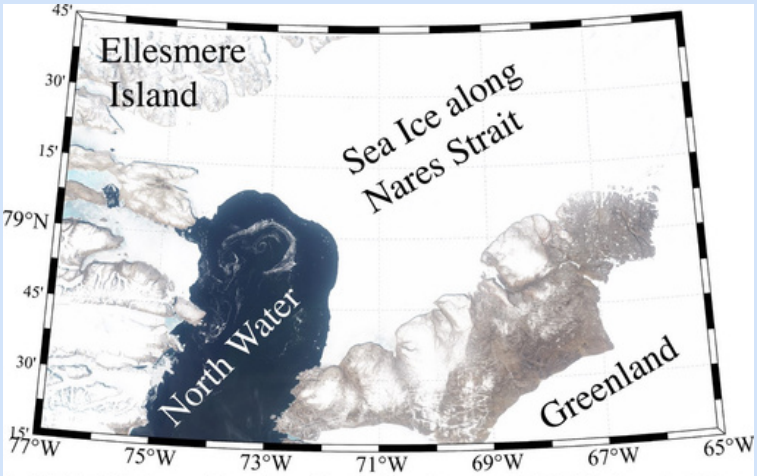
This area has not been extensively studied and it has a number of interesting features, such as ice arches and polynyas, that may be contributing to the loss of sea ice from this region. Ice arches form along Nares Strait most winters and when they are present, they block sea ice from exiting the Last Ice Area along the Strait. They can be up to 100 km in length and remain in place for up to 6 months. There is evidence that the thinning of the ice in the region is resulting in weakened arches that are now collapsing earlier.

Continued on next page.

This is one mechanism that is contributing to the increase in ice export along Nares Strait. Polynyas are regions of open water embedded in the ice pack. They are regions of incredible biodiversity as a result of the presence of open water. The exit region of Nares Strait has the largest and most productive polynya in the Arctic, the North Water Polynya. For centuries Indigenous peoples have used this polynya as a food source during the winter. It was also a popular region for whaling and sealing during the 19th Century. The existence of the North Water is also dependent on the presence of ice arches along Nares Strait and so there is also concern that the changes we are seeing in the arches may impact this polynya. My research group has also identified new polynyas that are now forming in the Last Ice Area. This may also point to a reduction in the resiliency of sea ice in the region.

What is the long term impact of the diminishing ice?

Sea ice plays a number of roles in the climate system. Because it is bright, it reflects a lot of sunlight back to space. As such it acts as an 'air conditioner' for the planet. It also plays an important role in many Arctic ecosystems as well as being essential for traditional ways of life for the Indigenous peoples of the Arctic. The Last Ice Area is of particular importance as it will, most likely, be a refuge for ice dependent species after the Arctic becomes ice free sometime this century. If it is not as resilient as previously thought, then this refuge is at risk as are the species that depend on it.



Sentinel-2 satellite image of the southern Nares Strait region on June 10 2021. The ice arch that can be seen along the northern boundary of the North Water formed in December 2020 and subsequently collapsed at the end of June 2021.

Is there anything that can be done to slow down the process?

Unfortunately the only way to slow down this ice loss is to reduce our emissions of the greenhouse gases that are causing the planet to warm. The last report from the Intergovernmental Panel of Climate Change has estimated that we have only 20-30 years to act before the warming leads to irreversible impacts. One of which would be the loss of Arctic sea ice.

Continued on next page.

What else is your group working on?
For many years, my group has been part of an international collaboration looking at how the ocean and atmosphere exchange heat, moisture and energy in the presence of sea ice. We have undertaken 3 large-scale field experiments involving research ships and aircraft around the sub-polar North Atlantic studying this exchange. This research is helping to improve our understanding of a major ocean current system known as the Atlantic Meridional Overturning Circulation.

Read more:
https://www.nature.com/articles/s41467-020-20314-w
https://phys.org/news/2019-11-arctic-ice-refuge.html
https://phys.org/news/2021-01-ice-arches-arctic-area.html

June 2021 PhD Graduates

Anderson, Rhys - Conductivity of Ultracold Fermions in an Optical Lattice. (Supervisor J.H.T. Thywissen)

Bognar, Kristof - Studies of Stratospheric and Tropospheric Ozone, NO2, and BrO Using UV-Visible Spectroscopy in the Arctic and at Mid-latitudes. (Supervisor K. Strong)

De Benedetti, Marc - The Decorrelation Length and Time Scale Diagnostic Tools to Visualize Spatial and Temporal Variability in Geophysical Fields. (Supervisor G. W. K. Moore)

Fernandes, Dennis - Mapping the Conformational Landscape & Spatial Organization of G Protein-Coupled Receptors using Single-molecule Fluorescence. (Supervisor C. C. Gradinaru)

Goldberg, Aaron - Disquisitions on Quantum-enhanced Polarimetry. (Supervisor D.F.V. James)

Langemeyer, Sean - The Feedback Between Core Heat Flux, Compositional Heterogeneity, and the Dynamics of a Rheologically Obtained Plate-like Surface in Numerical Mantle Convection Models (Supervisor J. P. Lowman)

Li, Dongzi - Radio Propagation Effects and Coherent Sources. (Supervisor U-L. Pen)

Yamanouchi, Shoma - Long-term Analysis of Toronto-Area Atmospheric Composition. (Supervisor K. Strong)

2021 Incoming Graduate Students

Welcome to our newest PhD and MSc candidates

Deepayan Banik - IIT Kanpur, India
Zhuoran Bao - University of Toronto, Ontario
Mason Buchanan - Pennsylvania State University, USA
Ahmet Burak Catli - University of Washington, USA
Elspeth Cudmore - Carleton University, Ontario
Ivana Marie Drapeau - University of Toronto, Ontario
James Luke Fraser-Leach - Dalhousie University, Nova Scotia
Alexander Jesse Bessner Friedlan - Queen's University, Ontario
Harmanjot Singh Grewal - IIT Kharagpur, India
Jeremy Guenza-Marcus - University of Oregon, USA
Matthew Hagan - University of Washington, USA
Aaron Howe - University of Toronto, Ontario
Michael J. Howorucha - McMaster University, Ontario
Xinyu Jiao - University of Toronto, Ontario
Graham Johnstone - University of British Columbia, British Columbia and McMaster University, Ontario
Michelle Lau - Imperial College, United Kingdom
Robyn Learn - University of Alberta , Alberta
Lukas Lesniak - University of Ottawa, Ontario
Eesha Lodhi - Queen's University, Ontario
Khaled Madhoun - Carleton University, Ontario
Jon-Paul Mastrogiacomo - University of Waterloo, Ontario
Kaitlin Christine McNeil - Royal Military College and University of Toronto, Ontario
Amin Moharramipour - Sharif University, Iran
Julian A. D. Nickel - University of British Columbia, British Columbia
Matthew Luke Pocrnic - McMaster University, Ontario
Vasilii Pustovoit - University of Toronto, Ontario and Moscow Institute, Russia
Andrija Rasovic - Cornell University, USA
Thomas Ricciotti - University of Waterloo, Ontario
Griffin E. Schwartz - McGill University, Quebec
Michael Sloan - Carleton University, Ontario
Doga Tolgay - Middle East Technical University, Turkey
Joscelyn Van der Veen - University of Waterloo, Ontario
Zixuan Xiao - University of Science & Technology of China, China
Haoting Xu - Sun Yat-sen University, China
Zhihan Yuan - Imperial College, United Kingdom
Zhi Zhang - McGill University, Quebec
Riley Zurrin - University of British Columbia, British Columbia

Awards

2020-2021 Loudon-Hines Gold Medal and Scholarship in Physics

The Loudon-Hines Gold Medal and Scholarship in Physics was established in 2018 through the generosity of two anonymous donors.

Awarded by the Faculty of Arts & Science on the recommendation of the Department of Physics, the Loudon-Hines Gold Medal and Scholarship is presented annually to a top graduating student in the Specialist or Major program in Physics who also demonstrates creativity and a clear promise in the discipline of physics.

The recipient this year is **Mathew Bub** and we asked him some questions about receiving this award.

Congratulations Mathew. What does being the recipient of this prestigious gold medal mean to you?

"Receiving this medal is a great honour and a significant encouragement to continue my efforts in my studies. I am grateful to my professors, supervisors, and family who have guided me along the way, and without whom I could not have made this achievement possible. This recognition will no doubt refresh my energy and vigour in the next phase of my education."

You recently completed your degree, what are your future plans?

"Having completed my Bachelor's degree in Mathematics and Physics here at U of T, I will next be pursuing a one-year Master's degree in Theoretical Physics at the nearby Perimeter Institute for Theoretical Physics. Following that, I plan to attend a PhD program where I would like to conduct research in high-energy physics. Eventually, I hope to build a career in academia, where I can contribute to the growing body of physics knowledge and help to train future generations of physicists."

More information on the Loudon-Hines Gold Medal and Scholarship

This preeminent undergraduate award is connected to a long-standing history at the University of Toronto. The original James Loudon Gold Medal was a gift of the Toronto Committee of the American Association for the Advancement of Science in 1890, in recognition of the valuable services of James Loudon, M.A., LL.D., Professor of Physics. The late Professor James Loudon was President of University College (1892-1901) and President of the University of Toronto (1892-1906). Over the past 128 years, the gold medal has been awarded to celebrated and esteemed physicists including Colin Hines, Ph.D., Professor of Physics, after whom this new medal is co-named. The Loudon-Hines Gold Medal and Scholarship in Physics honours both Professor James Loudon and Professor Colin Hines, and celebrates the best and most promising young physicists who will carry on an important legacy.

Awards

Van Kranendonk TA Awards

Named in honour of Jan Van Kranendonk, the Van Krandendonk Award is given every year to four graduate students who have done the best job as Teaching Assistants during the current year. Jan Van Kranendonk (above) was also recognized as an outstanding teacher - his brilliant lectures inspired generations of graduate students to excel in their own teaching. The variety of scientific areas in which Jan's former students and postdoctoral fellows are presently working is a living testimonial to his talents as a teacher. His legacy is commemorated with these awards.

The 2020-2021 recipients were:

Ramina Alwarda - PHY151F - *"Has been working hard to create a relaxing environment for the tutorial. She explains the physics question clearly and provides additional help if needed. I just have so much gratitude for her."*

Sean Colford - PHY131F, PHY131S - *"An exceptional TA. He is amazing at what he does and strives to make students in his class to reach for the best. He's one of the best TAs I've had in all my three years here, He understands the current situation and is actively empathetic for the students. He is also an extraordinary person showing kindness and smiling throughout the whole session."*

John Feng - PHY131F, PHY224S - *"A really understanding and fair TA. During practical sessions, he is very helpful and a very engaging person. He tries his best to keep us engaged during our practical sessions by connecting with us using memes, etc. He always gives proper feedback and wants us to do really well. He explains what he wants clearly. He is always ready to answer our questions. He is a really kind TA."*

Timothy Samuel* - PHY151F, PHY152S - **(Department of Medical Biophysics) "The most wonderful TA I have had in my first year at UofT. He was extremely helpful and generous with the Practicals especially with respect to helping us understand uncertainties, methods, plots using Python, etc. Over and above, he has always been the most accessible of all my TAs in terms of any help or input that I needed."*

Awards

Staff Awards

Since no awards were made in 2020, and in recognition of the tremendous efforts made by staff during the pandemic, there were four awards this year.

Administrative Staff Awards

Krystyna Biel

"The pandemic struck in the middle of the "Get to Know Us Weekend" and at the start of the PhD exam period. Krystyna did an amazing job of navigating all of the complexities that arose, and keeping the entire graduate program on track. Since then, she has directed a complete recruitment cycle, and the enrollment of a new class of students, all online."

Nominators noted how pleasant she was to work with, and how effective in dealing with issues and solving problem.

Sheela Manek

"Sheela's work spans everything from Outreach to building operations; a nominator observed that she does this with "invariable enthusiasm, optimism, and good cheer". This year she is the driving force behind a new outreach program that has identified a cohort of black youth interested in STEM, and hopes to support and enable them in their academic pursuits over several years. It involves multiple academic departments and central offices of the University, and Physics is at the centre of this great program through Sheela's efforts."

Technical Staff Awards

Pius Santiago

"Pius has been a critical part of our rapid transition to online activities, including quickly mastering Zoom to assist in the delivery of courses, colloquia and seminars. He has been very active in assembling and distributing the many different pieces of equipment that were needed for online course delivery. He also managed to find time to prepare videos of many classroom demonstrations for use in classes. His cheerful willingness to help and careful attention to details were much in evidence in all of his work."

Alex Cui

"Alex has been working on-site since the start of the pandemic. Despite real sourcing challenges, his determined efforts in stores insured that the necessary PPE and sanitizing supplies were in stock for all onsite activities. He also kept the doors open for receiving, and has been an important part of keeping the cryogenics operation running. He has been instrumental in procuring and shipping materials to students for courses and for the new Pursue STEM Outreach program championed by Sheela."

Awards

2021 Physics Student Union Teaching Awards

The Physics Student Union (PhySU) Teaching Award is an annual award intended to recognize exceptional pedagogy in undergraduate courses in the Department of Physics at the University of Toronto.

The award is given to two distinct individuals (one per semester) at the end of each academic year. The winners are selected based on student nominations solicited at the end of each semester.

We asked PhySU President Samuel Li some questions about the award:

Why was this award created?

"The idea for this award was suggested independently by several students in the community. It was brought up during a department inclusivity meeting, and the faculty agreed that it would have a positive impact. I have not talked to all of these students, but it seems that the idea was fed by both the students' gratefulness for excellent instruction, and some degree of frustration for poor teaching. The aim of the award is to recognize excellent pedagogy in undergraduate courses, and hopefully improve the quality of instruction over the long-term. For teaching assistants, the Van Kranendonk award has been quite successful, so we adapted this model for course instructors."

Smoke Stack
(credit: Geremia Massarelli)

Why was it important for PhySU to recognize professors?

"*Before this award was created, there was no highly visible mechanism for students to give feedback on instruction quality. Students can express their feedback through course evaluations and complaints to the department, but neither of these avenues are public, and many students feel that they rarely result in meaningful change. On top of this, there seems to be an unspoken emphasis on research over teaching in academia, which comes at the cost of the students. We hope the award will serve as a public, positive incentive for instructors to improve the quality of their courses.*"

The constitution for this award can be found here:
https://www.physu.org/about-us/teaching-award

Continued on next page.

Fall 2020 Recipient Aephraim Steinberg - for exceptional pedagogy in PHY256

Feedback from PHY256:

"I felt like this professor taught us in a way that was not to be evaluated, but to generate a genuine interest in quantum physics, and I loved that."

"rarely seemed in a rush to get through things and was willing to spend the necessary time on the concepts we struggled with. He made an effort to call on students who did not participate often, when they did raise their hands. He was receptive to feedback and was passionate about helping us learn."

"He taught students how to think as scientists and encouraged me to appreciate science."

Feedback from JPH441

"I had Professor Steinberg for PHY256 in the fall and he did a spectacular job with that course. He brought that same quality of instruction to this ethics course in the winter, even when his specialties lie in QM."

"I expected this course to be a bird course that I wouldn't pay much mind to, especially since it was online and I could simply skip the lectures, but from the first day I found myself enraptured by the course."

Winter 2021 Recipient - Stephen Julian - for exceptional pedagogy in PHY152

Feedback from PHY152:

"Professor Julian was, like in the previous semester, invested in student success. He eased many qualms regarding tests and exams by telling us of his time in undergraduate, and showed that the path to a career in physics is one filled with some defeat along the way."

"He is one of the reasons I, among others, have decided to continue my studies of physics."

"Fun, engaging lectures, got to know his students, always looking to help."

"Much greater appreciation for physics because of him"

"Very patient professor, explains everything in great detail."

Awards

The Canadian Meteorological and Oceanographic Society Annual Awards Ceremony

The Canadian Meteorological and Oceanographic Society (CMOS) held its annual awards ceremony on June 9, 2021 and members of the Department of Physics were honoured.

Debra Wunch - CMOS President's Prize:

For her 2017 paper "Comparisons of the Orbiting Carbon Observatory-2 (OCO-2) XCO2 measurements with TCCON", published in the Atmospheric Measurement Techniques. Dr. Wunch's paper was a data-evaluation technical tour-de-force, with 45 scientists from 19 institutions around the world, allowing for the measurement of CO2 from the OCO-2 satellite with sufficient precision and accuracy to unlock our understanding of greenhouse gas emission sources and natural sinks.

Kristof Bognar and Jesse Velay Vitow -
CMOS Tertia MC Hughes Memorial Graduate Student Prize
Russell Blackport - CMOS Roger Daley Post-Doctoral Publication Award
Kimberly Strong - CMOS Fellow

More:
https://www.physics.utoronto.ca/news-and-events/news/physics-news/the-canadian-meteorological-and-oceanographic-society-annual-awards-ceremony/

2020 and 2021 Canadian Association of Physicists University Prize Exam Results

University of Toronto students had stellar results, taking a number of the top spots for two years in a row.

The final results of both the 2020 and 2021 Canadian Association of Physicists (CAP) University Prize Exam were released in early September 2021.

The Canadian Association of Physicists University Prize Examination, normally held in February or March of each year, is a national competition open to students across the country who are studying physics and are enrolled in an undergraduate program at the time of the examination. All eligible students are encouraged to participate.

The CAP Foundation awards cash prizes to the top three students and when the CAP Congress is held in person, prize winners who attend are presented with their awards during the annual award ceremony at the end of the Congress.

Continued on next page.

2020 CAP University Prize Results:
The 2020 examination was held on February 4, 2020. The examination was written by 51 students from 11 universities/colleges.
The top four out of ten students were from the University of Toronto and two were from U of T Physics.

1st – **Samuel Li**, University of Toronto, Physics Specialist
2nd – **Hanzhen Lin**, University of Toronto, BASc in Engineering Science
3rd – **An Zihe**, University of Toronto, Incoming Exchange with APSC from Peking University
4th – **Kehui Li**, University of Toronto, Physics Specialist

More:
https://www.cap.ca/programs/medals-and-awards/prizes-students/university-prize-exam/2020-cap-upe-results/

2021 CAP University Prize Exam Results
The 2021 examination was held on March 9, 2021. The examination was written by 61 students from 14 universities/colleges. Five of the top ten students were from the University of Toronto and four of them were from U of T Physics.

1st – **Samuel Li**, University of Toronto, Physics Specialist
4th – **Tony An**, University of Toronto, Physics Specialist
6th – **QiLin Xue**, University of Toronto, Engineering; BASc in Engineering Science
8th – **Jay Epstein**, University of Toronto (tie), Physics Specialist
8th – **Ryan Ripsman**, University of Toronto (tie), Physics Major

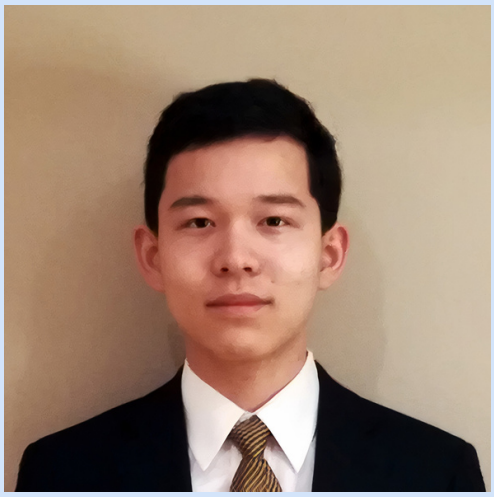
More:
https://www.cap.ca/programs/medals-and-awards/prizes-students/university-prize-exam/2021-cap-university-prize-exam-results/

Continued on next page.

Foxes on the McLennan Physical Labs Walkway
(credit: Sheela Manek)

Awards

Samuel Li, who is in the Physics Specialist Program at U of T, took the top prize in both years. We caught up with him to ask a few questions.



What does taking the top spot two years in a row mean to you?

I am honoured to have achieved first place in 2020 and 2021. I certainly did not go into the exam expecting to do this well; I viewed it mainly as a fun opportunity to spend a few hours thinking about some out-of-the-box physics problems. Many of the questions combine knowledge from disparate topics in a way that would be difficult to put on a normal problem set. The exam results were a nice surprise on top of this.

What would you tell other students who are considering writing the exam next year?

I would avoid spending too much time preparing for the exam itself. The questions are written in a way that tests physical intuition, so it's difficult to "drill" the past tests. Instead, expose yourself to a broad range of physics topics, and take note of any interesting ideas you find. In the long run, this will help you with both the exam and your future research career.

Samuel also says "If you have fun learning physics and doing physics, everything else will follow."

Congratulations to all the winners!

More:

https://www.cap.ca/programs/medals-and-awards/prizes-students/university-prize-exam/2021-cap-university-prize-exam-results/

2021 Cohort of UCAR Next Generation Fellows Announced

Graduate Student Liz Cunningham among the Earth system science students from underrepresented communities selected for this prestigious University Corporation for Atmospheric Research (UCAR) program.

More:

https://www.physics.utoronto.ca/news-and-events/news/physics-news/2021-cohort-of-ucar-next-generation-fellows-announced/

Awards

David Dunlop Awarded the 2021 AGU Union John Adam Fleming Medal

The 60,000 member American Geophysical Union (AGU) this week announced its medals and awards honoring excellence in scientific research, education, communication, and outreach.

The honorees—scientists, leaders, educators, journalists, and communicators—have made outstanding achievements and contributions by pushing forward the frontiers of science. Each embodies AGU's vision of a thriving, sustainable, and equitable future powered by discovery, innovation, and action.

They have worked with integrity, respect, and collaboration while creating deep engagement in education, diversity, and outreach. Among them is U of T Physics Professor David Dunlop.

Professor Dunlop is the recipient of the John Adam Fleming Medal. The Fleming Medal is awarded for "original research and technical leadership in geomagnetism, atmospheric electricity, aeronomy, space physics and related sciences" and Dunlop is being recognized for his achievements in scientific research, specifically in geomagnetism.

Dunlop's best-known research has been in the fundamental magnetic properties of rocks and minerals and in Precambrian paleomagnetism and plate tectonics. His book "Rock Magnetism: Fundamentals and Frontiers", co-authored with his long-time colleague and wife Özden Özdemir, remains the standard text in the field and students refer to it as "the bible".

Dunlop served AGU as president of the Geomagnetism, Paleomagnetism and Electromagnetism section from 1992-94, was the Edward Bullard Lecturer in 2011, and sat on the Union Officers Nominations Committee (2004-05) and the Honors and Recognition Committee (2006-08). He was elected a Fellow of AGU in 1987.

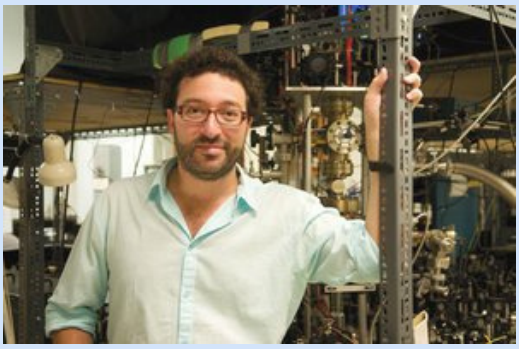
He supervised many graduate students and postdoctoral fellows who have gone on to rewarding careers. Dunlop also taught and mentored numerous undergraduates and summer students.

Continued on next page.

When asked what this medal means to him, Dunlop says
"As I tell my non-scientific friends and family, it is the Olympic gold of geophysics. Naturally I am thrilled and delighted to be recognized for my work over a long career. I started as an Assistant Professor at U. of T. in 1970, retired in 2006 and I am still publishing, this includes two papers in 2021. As one of my colleagues and supporters wrote to me: "Whoopee!!!! This is the top; can't go any higher, like Everest!""
AGU will formally recognize this year's recipients during the AGU Fall Meeting in New Orleans.

Congratulations!
More:
https://eos.org/agu-news/congratulations-to-the-2021-agu-union-medal-award-and-prize-recipients

Aephraim Steinberg appointed as a 2021 University Professor



The title "University Professor" is the University's highest and most distinguished academic rank.

Professor Aephraim Steinberg currently serves as Director of the Quantum Information Science program at the Canadian Institute for Advanced Research.

He has been working on the foundations of quantum mechanics (experimental quantum optics and ultracold atoms) for over 30 years.

After obtaining his B.Sc. at Yale University in 1988, he spent a year working with future Nobel laureate Serge Haroche at the École Normale Supérieure before moving to Berkeley to do graduate work with Ray Chiao. Completed in 1994, Steinberg's thesis would become famous for experimentally showing that a single photon could tunnel across a quantum barrier seemingly "faster than light," and he was awarded the American Physical Society's 1996 prize for best doctoral thesis in atomic, molecular, or optical physics.

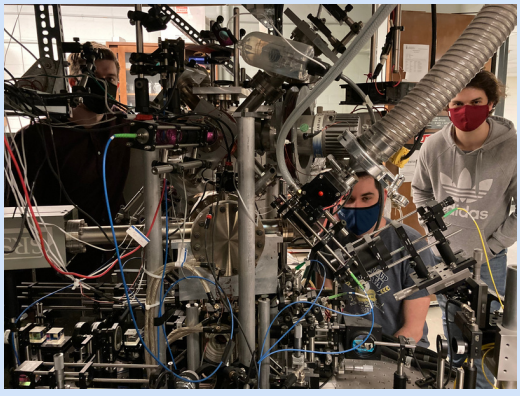
Professor Steinberg has since pioneered multiple applications of entangled photons and developed novel theoretical approaches to understand quantum tunneling times (the principal experimental paper from his thesis has been cited over 1,000 times, and his main, sole-authored, theory result over 300 times). Following completion of his doctorate, Professor Steinberg held two post-doctoral positions, one with Elisabeth Giacobino and Claude Fabre at the Université de Paris VI and one with Bill Phillips, another future Nobel laureate, at the National Institute of Standards and Technology.

Continued on next page.

These posts allowed him to expand his research portfolio to include laser-cooled atoms as well as entangled photons. In 1996, Professor Steinberg joined the University of Toronto and subsequently won several awards, including a Polanyi Prize in 1997, a Premier's Research Excellence Award in 1999, the CAP Herzberg Medal in 2006, the Rutherford Medal of the Royal Society of Canada in 2006, and a McLean and Steacie fellowship in 2007. Professor Steinberg has been a visiting professor at the Universität Wien, the Collège de France, the University of Queensland, Sapienza Università di Roma, and Hokkaido University; and has delivered numerous invited lectures and keynotes at around the world.

Professor Steinberg's research group is known for their accomplishments using both entangled photons and ultracold atoms to study foundational quantum physics, quantum metrology, and quantum computation. Their 2001 Nature paper on generating multi-photon entangled states for interferometry helped usher in a new wave of excitement over quantum metrology. Professor Steinberg has been at the heart of the international community studying novel paradigms of quantum measurement relevant to post-selected systems, along with their applications to precision measurement. His group's work on quantum information and related topics has been recognized with numerous accolades, including a 2011 Science paper on measuring the trajectories of single photons, which was listed as Physics World's top breakthrough of the year. Additionally, their 2014 paper in Physical Review Letter on quantum data compression made Physics World's top-ten list for the year. Most recently, Professor Steinberg has returned to the question of tunneling times, using atoms at some of the coldest temperatures ever achieved (below one-billionth of a degree above absolute zero) to directly measure how much time particles spend within classically "forbidden" regions of space. His first results on this were published in Nature, and were chosen as one of Physics World's top-five "Quantum Highlights" for 2020. His work has excited great public interest and has been featured in an episode of Morgan Freeman's "Through The Wormhole" as well as in a documentary about David Bohm.

More:
https://www.physics.utoronto.ca/news-and-events/news/physics-news/aephraim-steinberg-has-been-appointed-as-one-of-two-2021-university-professors/



"Masked Marauders" in the Steinberg Lab
(credit: Aephraim Steinberg)

Awards

Professor Sajeev John receives the 2021 Herzberg Gold Medal

By:Chris Sasaki, Arts & Science News

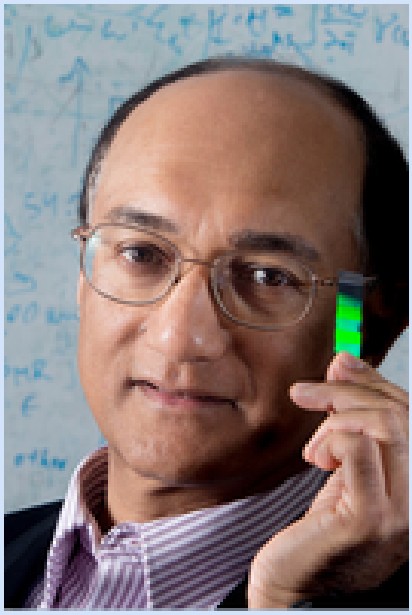


Photo credit: Glenn Lowson

Theoretical physicist Sajeev John has received Canada's highest science and engineering honour, the prestigious Gerhard Herzberg Canada Gold Medal.

John is receiving the award for his ground-breaking research and fundamental advancements in confining and harnessing the flow of photons of light in a manner analogous to harnessing the flow of electrons.

The medal also recognizes John for his leadership in efforts to transform this research into groundbreaking applications in optical micro-chips, optical communications and information processing, laser technologies, solar-energy harvesting and clinical medicine — including life-saving surgical tools and techniques.

"*I am profoundly honoured and feel singularly energized to bring to broader fruition the work I began on light-trapping crystals,*" says John, a University Professor in the Faculty of Arts & Science's Department of Physics.

"*The Herzberg Gold Medal offers a unique opportunity for creativity and unfettered pursuit of essential applications such as the world's most efficient, lightweight silicon solar cells; light-trapping to enhance artificial photosynthesis for solar fuel production; development of the most compact lab-in-a-photonic-crystal sensors for early-stage disease detection and diagnosis; and much more.*"

Named after the Canadian physicist and Nobel laureate in chemistry, the Gerhard Herzberg Canada Gold Medal is given in recognition of the excellence and impact of a recipient's research. It is awarded annually by the National Sciences and Engineering Research Council of Canada (NSERC).

John's research provides a solution to the problem that photons do not tend to flow along confined pathways like electrons but instead disperse or are absorbed.

According to Kim Strong, chair of the Department of Physics, "Professor John's research laid out the theoretical foundation for special materials — called Photonic Band Gap (PBG) materials — that allow confinement, or localization, of photons to a microscopic region with the size of the wavelength of light.

Continued on next page.

"*Once you know how to confine photons to a single location*," she says, "*you can confine their motion along prescribed microscopic circuit paths, analogous to the way the motion of electrons is controlled on the nanometer scale in semiconductors.*"

Following up on his theoretical work, John and his collaborators built the first large-scale silicon PBG material out of a synthetic opal and have created PBG materials that are even easier and cheaper to manufacture.

The groundbreaking work has sparked the development of novel micro-structured materials known as Photonic Crystals, now referred to as 'semiconductors of light.' Ultimately, the breakthrough will enable computer chips to operate with photons instead of electrons.

Among many impacts beyond the lab, research into PBG materials has already produced life-saving advancements in clinical medicine. In 2004, laser surgery was performed on a patient to remove a tumour which had been treated previously but which kept recurring and remained life-threatening. A final surgery was carried out using a hollow-core photonic band gap fiber and was successful. Thousands of similar procedures have been performed using PBG fibers and several major medical centres are now testing PBG-fiber-based laser surgery tools.

n 1984, John received his PhD in physics from Harvard University where he published the original paper on light localization. He was an assistant professor at Princeton University where he pioneered the concept of photonic band gap materials. He joined the University of Toronto in 1989.

John's research and scientific leadership earned him the 2001 King Faisal International Prize in Science (with Nobel Laureate C.N. Yang). In 2007, the Institute of Electrical and Electronics Engineers (IEEE) awarded him with the International Quantum Electronics Award for "the invention of and development of light-trapping crystals and the elucidation of their properties and applications."

He is holder of a Canada Research Chair in optical sciences and was named an Officer of the Order of Canada in 2017.

More:
https://www.physics.utoronto.ca/news-and-events/news/physics-news/sajeev-john-of-physics-receives-the-2021-herzberg-gold-medal-for-his-work-with-photonic-crystals/

Awards

Professor Emeritus Henry van Driel receives the 2021 CAP-COMP Peter Kirkby Memorial Medal for Significant Service to Canadian Physics

By: Sean McNeely, Arts & Science News

Henry van Driel, professor emeritus in the Department of Physics, has been awarded the prestigious 2021 Peter Kirkby Memorial Medal for Outstanding Service to Canadian Physics by the Canadian Association of Physicists (CAP) and the Canadian Organization of Medical Physicists (COMP).

Since 1966, CAP-COMP Peter Kirkby Memorial Medal winners have been recognized for strengthening the Canadian physics community, enhancing the profession of physical scientists, effectively communicating physics to the non-scientific community, and making physics more attractive as a career.

The award is a joint initiative from CAP, representing over 1600 physicists and physics students in Canada, the U.S. and overseas; and COMP, comprising over 700 medical physicists and graduate students working in areas such as medical imaging, cancer therapy and medical biophysics.

The two groups announced van Driel as the winner for "*his outstanding service to the Canadian physics community over a period of more than forty-five years, which has included international efforts, great service to the CAP, work with the Natural Sciences and Engineering Research Council of Canada (NSERC) on behalf of Canadian physics, and editorial service to distinguished journals in North America*."

"*It is a humbling honour to be recognized for efforts to serve the physics community in Canada and abroad," says van Driel. "This award represents a truly welcome bright spot during this interminable pandemic*."

"*This is a well-deserved recognition of Henry's long and distinguished record of service to physics, both in Canada and internationally*," says Department of Physics chair Kimberly Strong.

Continued on next page.

"*His leadership of the physics department, multiple physics societies, advisory and editorial boards, and conference committees, as well as his mentoring of many students and postdoctoral fellows, has significantly strengthened physics in Canada*."

According to CAP-COMP, van Driel's international impact has been widespread, helping Canada "punch above its weight" within the International Union of Pure and Applied Physics (IUPAP), where he served from 1993 to 2002, and was vice-chair of a commission for three years.

As chair of the Canadian National-IUPAP liaison committee, he helped elect nine Canadian scientists who served on 17 commissions, which is considered an outsized contribution for Canada.

Back in Canada, van Driel helped to restore funding for condensed matter physics and general physics from NSERC, as well as promoting a CAP liaison committee with NSERC to strengthen CAP's input into NSERC decisions.

While on the CAP executive, he played a crucial role establishing the first CAP graduate scholarship, which then led to the creation of the CAP Foundation and the endowment of further graduate scholarships.

As president of CAP, van Driel recruited representatives of eight natural science societies to work with the Professional Engineers of Ontario (PEO) to enhance natural scientists' opportunities in industry.

As an academic, van Driel joined the faculty in 1976 at U of T Mississauga where he taught and conducted research until 1988. He then transferred to the physics department on the St. George campus, serving as department chair from 2000-2004, before retiring in 2014.
At UTM in the 1970s and 1980s there were only six physics faculty members and van Driel taught nearly every department course, from first-year physics to advanced classical and quantum mechanics.

On the St. George campus, he mainly taught first-year physics courses and was inspired by the students' energy and enthusiasm. He especially enjoyed conducting scientific demonstrations. Some worked, and some didn't, but regardless of the outcome, both he and the students enjoyed the experience immensely.

He also taught modern optics to third- and fourth-year year students and laser physics to graduate students, giving him the chance to get to know his students within these smaller classes.

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Van Driel's teaching career is also filled with fond memories of working with graduate students and postdocs. He's especially proud to have helped 30 PhD students graduate, and see them launch their own careers in academia, industry and government labs.

After he retired, van Driel had no intention of losing contact with young scholars, so he continued to support undergraduates by mentoring third- and fourth-year students in the Physics Mentorship Program.

How has van Driel managed to accomplish so much academically, while simultaneously making tremendous contributions to the larger physics community?

"*The canonical answer is that I never learned to say 'no,' and perhaps that's not far from the truth,*" says van Driel.

Grateful to have worked with talented graduate students, postdoctoral fellows and collaborators, he says "*Once I provided them with rough ideas to pursue, along with good equipment, they didn't need me in the lab very much; they wanted to solve research problems and experience the joys of discovery themselves. The independence served them well since many went on to prominent positions in industry, and even more with faculty positions in Canada and internationally. As they were establishing their independence as young researchers, I found time to serve the wider physics community.*"

More:
https://www.physics.utoronto.ca/news-and-events/news/physics-news/professor-emeritus-henry-van-driel-wins-prestigious-national-physics-award/

PhD Candidate Griffin Schwartz is Recipient of a 2021 TLCERF Grant

The Tyler Lewis Clean Energy Research Foundation (TLCERF) announced their three 2021 grants. Among them is U of T Physics' PhD candidate Griffin Schwartz whose work is on Inverted Pyramidal Pores in Polycrystalline Silicon Solar Cells. Griffin's supervisor is Professor Sajeev John.

More:
https://www.physics.utoronto.ca/news-and-events/news/physics-news/phd-candidate-griffin-schwartz-is-recipient-of-a-2021-tlcerf-grant/

New Scholarships

Introducing three New Scholarships for Undergraduate Students

Momentum Builders Scholarship

The Department of Physics is launching the new Momentum Builders Scholarship for Black and Indigenous students to help break down barriers and develop the next great minds in physics. Diversity is one of U of T's strengths, and supporting it is our priority. We know we can do better.

We are creating opportunities for Black and Indigenous students to achieve their educational goals and contribute their ideas, insights and knowledge to the field, thereby enriching our collective understanding of physics and the universe.

We know that many Black and Indigenous students face systemic barriers in pursuing their educational goals. These barriers are multifold and complex, rooted in histories of colonialism and oppression. As one of the premier departments for the study of physics globally, and as part of the University of Toronto, we have a responsibility to address systemic barriers — including financial need — that prevent Black and Indigenous students from pursuing STEM careers.

The Momentum Builders Scholarship will be awarded based on academic merit and financial need. Similar scholarships are already making a tremendous impact across Arts & Science. Riley Yesno graduated with an Honours Bachelor of Arts in political science and Indigenous studies in June — and was honoured with the President's Award for Outstanding Indigenous Student of the Year Award. She credits scholarships for her success.

"I am not exaggerating when I say the only reason I have been able to make it through my undergrad was because of financial support. I am extremely grateful for the opportunities these scholarships helped afford me," Yesno says.

Continued on next page.

Please join us in making a donation toward these scholarships. Gifts will be matched dollar-for-dollar, up to a total match of $100,000.

Click Here to Support exceptional Black and Indigenous students in physics.

Every gift — no matter the size — has an impact in the lives of our students. We encourage you to give at the level that makes sense for you. Two faculty members so strongly believe in the importance of this fund for our students that they have each donated $12,500. We are already off to a great start!

Excellence flourishes in an environment that embraces the broadest range of people and empowers them to achieve their full potential. Please join us in supporting the next generation of physicists and build momentum for greater diversity in physics.

More:
https://engage.utoronto.ca/site/SPageServer?pagename=donate#/fund/1752

David and Louise Fraser Scholarship

This scholarship is awarded to undergraduate students completing a Major or Specialist program in Physics or Biological Physics as well as a Major or Minor in another science program. The award is given on the basis of academic merit to support interdisciplinary study.

More:
https://www.artsci.utoronto.ca/news/gratitude-inspired-arts-science-alumnus-david-b-fraser-mentor-students-and-colleagues

Azuma Summer Fellowship

The Richard E. Azuma Summer Fellowship hires outstanding undergraduate students, from one of TRIUMF's member universities in Canada, who are considering a career in research fields associated with TRIUMF's science program.

More:
https://www.physics.utoronto.ca/news-and-events/news/physics-news/introducing-the-azuma-summer-fellowship/

Announcement

Joseph Thywissen was appointed to a three-year term as the new Associate Chair for Graduate Studies on July 1, 2021. He takes over from Young-June Kim, who completed his term on June 30. Joseph is a Professor in the Experimental Quantum Optics Group.

Physics News

Taming Fluctuations for Gaussian States in Loop Quantum Cosmology

Undergraduate student Patrick Fraser's 2020 summer project published in Physical Review D.

More:

https://www.physics.utoronto.ca/news-and-events/news/physics-news/taming-fluctuations-for-gaussian-states-in-loop-quantum-cosmology/

Black high school students explore STEM with the Faculty of Arts & Science

Since March 2021, 38 Black students from high schools in the GTA have been taking part in science workshops provided by science departments in the Faculty of Arts & Science through a program called Pursue STEM.

More:

https://www.physics.utoronto.ca/news-and-events/news/physics-news/black-high-school-students-explore-stem-with-the-faculty-of-arts-science/

Enormous Balloon Could Help Astronomers get a Clear View of Space

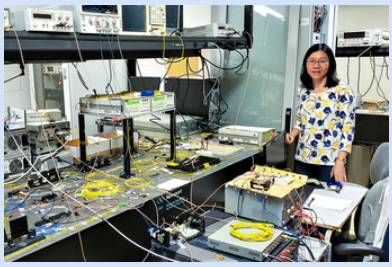
PhD Student Mohamed Shaaban is one of the researchers involved in the superBIT project

More:

https://www.physics.utoronto.ca/news-and-events/news/physics-news/enormous-balloon-could-help-astronomers-get-clear-view-of-space/

Physics News

U of T researchers develop new quantum 'fingerprinting' protocol to improve information exchange



Suppose you and your cousin are about to inherit some money and you each have a version of the will on your computer.

More:

https://www.physics.utoronto.ca/news-and-events/news/physics-news/u-of-t-researchers-develop-new-quantum-fingerprinting-protocol-to-improve-information-exchange/

Could the Gulf Stream Collapse?

Professor Kent Moore discusses this on TVO's The Agenda with Steve Paikin

More:

https://www.physics.utoronto.ca/news-and-events/news/physics-news/could-the-gulf-stream-collapse/

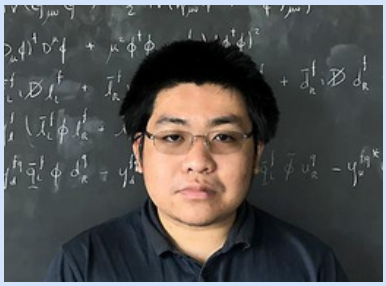
U of T Physics Outreach in Action

U of T Physics' Outreach initiatives featured in the Fall 2021 Issue of OSCA Today - the Ontario School Counselors Newsletter

More:

https://www.physics.utoronto.ca/news-and-events/news/physics-news/u-of-t-physics-outreach-in-action/

After fall convocation, Wentao Cui will live his dream of attending MIT



From as early as the age of eight, Wentao Cui had a keen interest in mathematics and physics.

More:

https://www.artsci.utoronto.ca/news/after-fall-convocation-wentao-cui-will-live-his-dream-attending-mit

After COP26, Professor Kent Moore says the world is on thin ice

For Kent Moore, the excitement of making a discovery is often tinged with sadness.

More:

https://www.utoronto.ca/news/after-cop26-u-t-climate-scientist-says-world-thin-ice

PhysCAP Recap

Preparing your Graduate School Application - October 26 and November 2, 2021

This is a new workshop for 3rd and 4th year physics students who have questions about applying to graduate school.

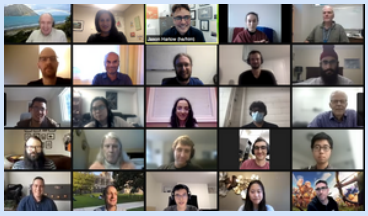
The virtual workshop was facilitated by PhD candidate and mentor in the Physics Mentorship Program, Jesse-Velay Vitow and was attended by about 50 undergraduate physics students.

Students learned about determining which graduate schools to apply to, how to message potential supervisors, obtaining quality reference letters and more.

We asked Jesse why he decided to run this workshop:

"When I was applying for graduate school, I couldn't find any good resources explaining what I should do or how applications were judged. By providing these resources, I hope to make a stressful situation a little bit more manageable for undergraduate students."

Physics Mentorship Program Launch Event - October 14, 2021



The virtual launch event for the Physics Mentorship Program took place on Thursday, October 14, 2021. This year, the program has 49 pair of mentors and mentees and they will meet throughout the academic year. The event was attended by about 50 program participants.

Mentees consist of 3rd and 4th physics students and mentors consist of physics alumni, graduate students and faculty.

Mentees in this valuable program get advice on careers, academics and more. Mentors have the opportunity to meet the current crop of students, stay connected to and give back to the Department of Physics.

When mentors from the 2020.2021 program were asked what they like most about the program, they said:

- *"It is a chance to help undergraduates find their place after they graduate*"
- "*Being able to help a student who at the beginning of this was quite lost on where to go, and by the end, she had a much better idea. I can't take all credit, but I do feel that I helped.*"
- "*A great opportunity to get to know and help a physics studen*t."
- "*Getting to know a talented UofT undergrad.*"

More information on the Physics Mentorship Program can be found here:

https://www.physics.utoronto.ca/undergraduate/physics-career/mentorship/

PhysCAP Recap

Professional and Graduate School Event - October 26, 2021

2nd, 3rd and 4th year physics students heard from a panel of physics alumni who pursued professional or graduate degrees after their bachelors degrees. Students had the opportunity to find out what is possible with their degrees in physics. The panel of alumni took a variety of career paths including: architecture, education, law and PhDs. The panel was moderated by Rory McKeown from the School of Graduate Studies.

Speakers:

Sharon Brown - Assistant Director, Cross-Disciplinary Programs Office, Faculty of Applied Science and Engineering
University of Toronto BSc (1992) – Specialist Environmental Science, Major Zoology, Minor Physics
MEd (2014) – Higher Education, Department of Leadership, Higher and Adult Education, Collaborative Program in Comparative, International and Development Education

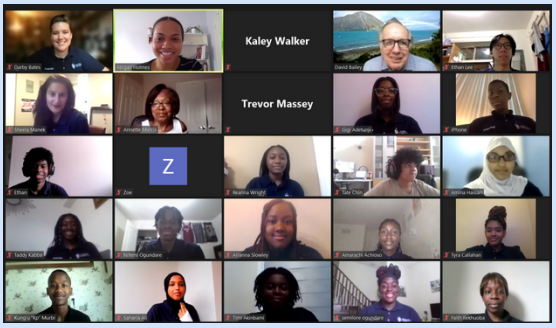
Jonathan Gotfryd - Set Designer - Directors Guild of Canada
HBSc (2004) – Specialist Physics, Specialist Philosophy
MArch (2011) – Master of Architecture

Zvi Halpern-Shavim - Partner, Commodity Tax and Customs - Blake, Cassels & Graydon LLP BSc (2004) - Physics and Literary Studies(U of T)
MA (2006) - Political Theory (Boston College)
JD (2009) - Law (U of T)

Fei Ye - Senior Manager, Model Risk - BMO Financial Group
HBSc (2006) – Applied Physics Specialist & Mathematics Major (U of T)
MSc (2008) – Photonics (U of T)
PhD (2013) – Photonics (U of T)

Outreach in Action

Pursue STEM



In the Outreach in Action section of the Spring 2021 newsletter, we introduced you to Pursue STEM, a new Outreach program that encourages and supports Black students interested in science, technology, engineering and mathematics (STEM).

Since the last newsletter, students have participated in virtual workshops and activities from the departments of: Astronomy and Astrophysics, Chemistry, Computer Science, Earth Sciences, Math, Physics, School of the Environment and Statistics.

Using kits that were mailed to them, the students learned about gravitational waves, artificial intelligence, kitchen chemistry, the rock cycle, water filtration, clouds, climate change and more. Student enjoyed the hands-on activities and hearing about the career paths of the presenters. One student commented "*One thing I learned was that you can find a career that interests you through different paths. There are so many careers in the STEM field that I hadn't heard of until I did Pursue STEM*".

They also worked on a Capstone Project and presented their results at the closing event on August 7, 2021. The students were asked to use their Arduinos and what they learned through activities from the various physical sciences to develop a tool, gadget or technology to aid in their survival and/or to make living through a pandemic easier. The winning groups designed a "smart mask" and a "re-fill itself water bottle" and they will present their results at the Canadian Black Scientist Network conference in January 2022.

You can see the winning presentations here:
https://www.physics.utoronto.ca/physics-at-uoft/outreach/pursue-stem/

A new cohort of grade 10 students will enroll in the program this year and the previous cohort will continue in the program until first year university.

We asked Chair of Outreach Committee David Bailey to reflect on the first year of Pursue STEM: "*After decades as an experimental physicist, I always expect problems with a new project that stretches our experience and expertise, so I am very happy with the success of the first year of Pursue STEM. There are a few things we can improve, but every one of the eight departments involved provided an engaging introduction to themselves and what they study. It was great interacting with so many outstanding Black high school students, and we are very much looking forward to seeing many of the same students in Grade 11 and welcoming a new Grade 10 cohort.*"

Continued on next page.

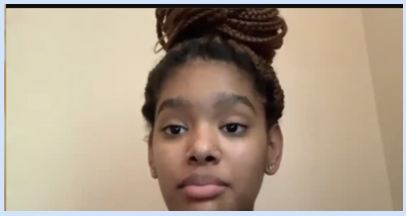
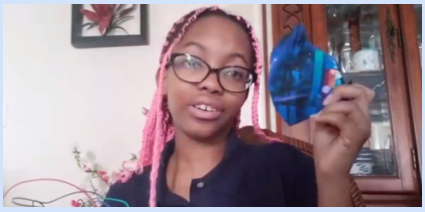
Pursue STEM was developed in partnership with Leadership by Design (LBD), U of T's Office of Student Recruitment and the Department of Physics.

LBD is the signature program of the Lifelong Leadership Institute (LLI). The LLI is an educational organization that exists to inspire leadership and develop leaders, and dedicates its resources to advancing leadership competence and personal success among Canadian youth of Jamaican, Caribbean and Black heritage.

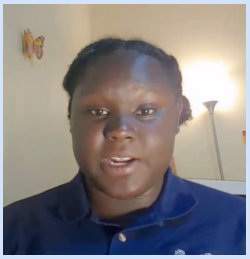
More information on LBD here:
https://llileaders.com/leadership-by-design-lbd/

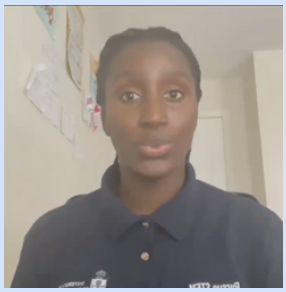
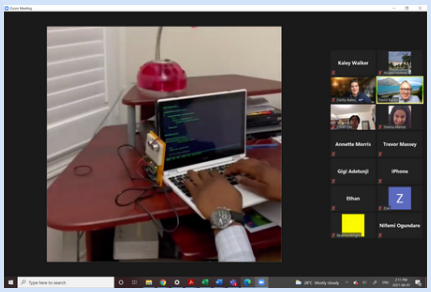
More information LLI here:
https://llileaders.com/

Follow Pursue STEM on Instagram:
pursue_stem



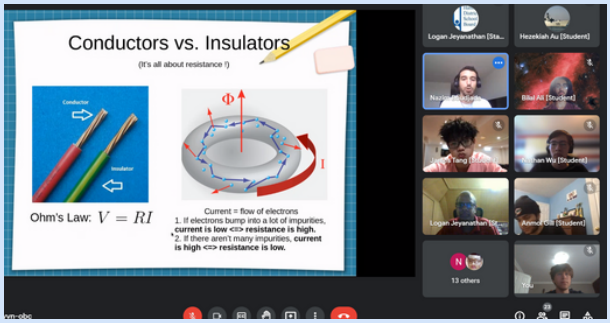


Above: Photos from the Pursue Closing Event on August 7, 2021

Outreach in Action

School Visits



The Department of Physics' School Visit Program went fully virtual in September 2020. In-person school visits to the department were paused due to the pandemic, but our faculty, post-doctoral fellows and graduate students quickly adapted their activities into virtual formats so that high school students could still get a glimpse into the Department of Physics. There were talks on superconductivity and dark matter, tours of CERN, SNOLAB and the Polar Environment Research Lab.

There were also, workshops on computational physics and ocean thermodynamics. The departments of Mathematics, Earth Sciences and School of the Environment contributed to this virtual initiative as well. The Department of Physics also partnered with the Office of Student of Recruitment (OSR) for the first time last year for school visits. By accompanying OSR on their school visits, we were able to reach more schools. 13 school visits took place from November 2020 to June 2021.

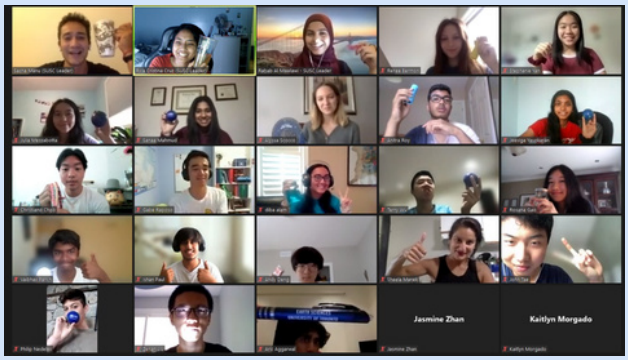
Even with the new online format, the feedback on programs was positive:
"*Thanks for organizing the presentation for our Physics club. It was an excellent presentation and our students really enjoyed it and actively participated in discussions. Thank you Nazim for presenting the complex superconductivity in a simplified way and providing the grade 11 and 12 physics curriculum related examples in your presentation. This indeed helped the students make connections to the topic. I must say these kinds of outreach opportunities to school students indeed motivate them and enhance their interest in STEM programs. I am hoping to have similar opportunities for our Garth Webb students next year and beyond.*" - Logan Jenayathan (Teacher at Garth Webb Secondary School)

Are you a high school teacher and would like to book a visit at the Department of Physics?

- **Take look at the activities that are offered here:**
https://www.physics.utoronto.ca/physics-at-uoft/outreach/school-visits-students/
- Email Sheela at outreach@physics.utoronto.ca to book your visit today!

Outreach in Action

Science Unlimited Summer Camp



"This was great, and I am so glad I applied and was accepted!", "Thank you so much! This was an amazing opportunity!".

These are a few of the comments from students who participated in the Science Unlimited Summer Camp 2021.

Science Unlimited Summer Camp took place August 9-13, 2021 and it was fully virtual this year due to COVID-19. 50 grade 10 and 11 students were shipped a box of supplies so that they could run experiments from their homes.

Students had activities from the Departments of Astronomy and Astrophysics, Chemistry, Computer Science, Earth Sciences, Mathematics, and Physics.

The activities consisted of workshops on gravitational waves, rock cycles, water filtration, chirality, clouds, spectroscopy and talks on TikTok algorithms and more. Students said they really enjoyed doing the experiments because it had been a long time since they did real experiments. One student said "*I recently finished a physics unit about light and optics, so it was cool to learn about the mixture of chemistry and light wavelengths depending on the element*".

The activities were run over Zoom by faculty, postdocs, graduate students and undergraduate students.

The students also participated in a design challenge that involved creating a Rube Goldberg Machine that turned blue water clear and showing their design in a video. The students were asked to incorporate the concepts they learned at camp and the winning videos and photos from camp are posted here:
https://summercamp.physics.utoronto.ca/photos/2021-summercamp-photos/

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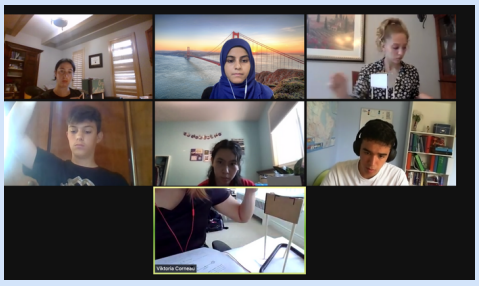


Finally, there were four camp leaders who created the design challenge, ice-breaker activities, moderated the sessions and did an excellent job at engaging students in the online environment. Students said that the leaders were friendly and made camp fun.

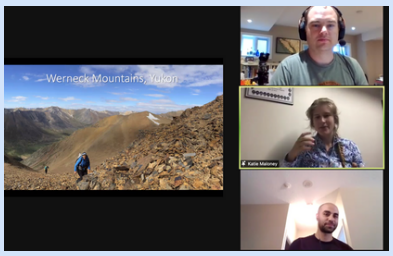
Here is what some of the leaders had to say about why they return as leaders and what their favorite thing about camp is:

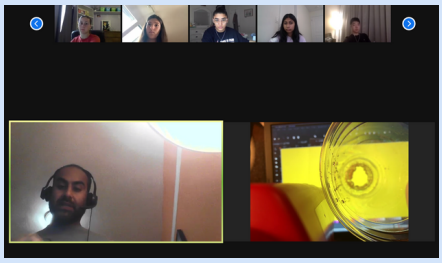
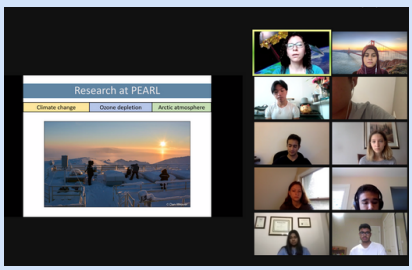
"I returned to be a leader at SUSC because it excites and motivates me to see the talented next generation of scientists discover what they enjoy. The diversity of topics explored at the camp provides a unique opportunity for students to learn outside their comfort zones, and I love seeing how readily they take to each subject. My favourite part of SUSC is the Design Challenge. The students never fail to blow me away with how they take our prompt, apply what they learned over the week, and develop such creative projects. Even with the limitations of a virtual setting for camp this year, they still knocked it out of the park with their video productions." – Felipe Morgado

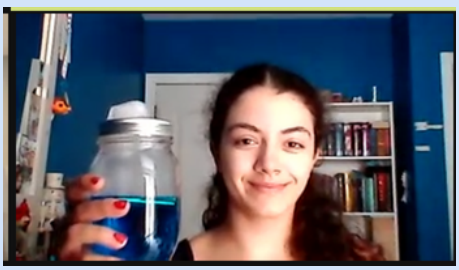
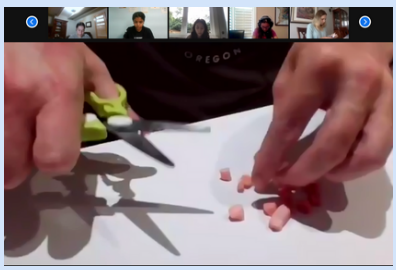
"Despite being based in Hong Kong, returning as a leader to camp this year was an easy decision. My colleagues are always a joy to work with, the passion that the students brings is inspiring, and the care that facilitators put into their workshops is always so evident that I end up learning from the sessions too!" - Sasha Manu

Overall, the first virtual camp went well and hopefully next year camp will be in person.

More information on Science Unlimited Summer Camp can be found here:
https://summercamp.physics.utoronto.ca/

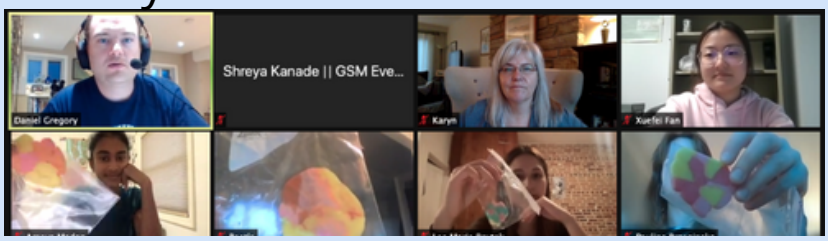


Outreach in Action

Girls sySTEM

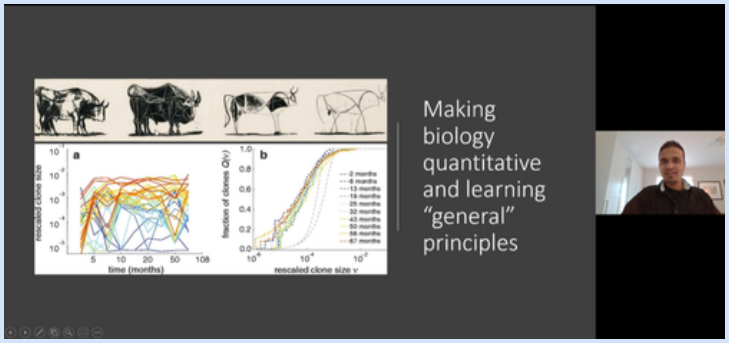


The Department of Physics has worked with Girls sySTEM since 2019. In partnership with the Department of Earth Sciences and Mathematics, the Department of Physics organizes workshops for the grades 7-12 students in this mentorship program for girls interested in STEM.

The first virtual workshop for Girls sySTEM this year was on October 18, 2021. The workshop was facilitated by Professor Daniel Gregory from the Department of Earth Sciences and the girls learned about the rock cycles by using Starburst candy. On November 11, the students took part in a Virtual Museum Tour facilitated by PhD candidate Katie Maloney from the Department of Earth Sciences.

More information on Girls sySTEM can be found here:
https://www.girlsystemmentorship.com/

Fall Campus Week



The University of Toronto's Fall Campus Week was held from October 23-30, 2021. This annual open house is an opportunity for parents and high school students to learn what it's like to make lifelong friends while making life-changing discoveries at the University of Toronto.

The Department of Physics participants every year and this was the second year in row where the event was virtual.

The Department of Physics was represented by Professor Sidhartha Goyal, who is a professor of Biophysics. Professor Goyal explained the field of biophysics to the audience and told them what it is like to study at physics at the University of Toronto.

More on Fall Campus Week here:
https://discover.utoronto.ca/fall-campus-week

More on Professor Goyal here:
https://www.physics.utoronto.ca/members/goyal-sidhartha/

Employee Anniversaries

Peter Hurley

Celebrating 30 years

October 2021 marked Peter Hurley's 30th anniversary as a much-valued staff member in the Department of Physics. He was initially hired as the Manager of Physics Technical Services in 1991. His title changed to Director of Physics Learning and Research Services in 2010, and in 2014, he was appointed Chief Administrative Officer.

Peter's association with the Department goes back even further, as he was a student here, earning both a B.Sc. and M.Sc. in Physics, with a focus on geophysics. After graduating, he took up various research positions in geophysics, including a position at Atomic Energy of Canada working on Nuclear Fuel Waste Management, and was a principle, responsible for Research and Development, at Acuris Geophysical Ltd., a start-up geophysical services consulting and research company, before returning to U of T. He took some leave to earn B.Ed. and M.Ed. degrees and he also has PEO certification as an electronics engineer.

While managing PTS and PLRS, Peter provided mechanical design, project management and administrative support to PTS clients; developed and implemented machine shop and electronics workshop courses for students; enabled undergraduate and graduate student projects; and supported the professional development of technical staff. His superior performance resulted in his receiving a Dean's Outstanding Technical Service Award.

As CAO, Peter is responsible for the administrative, financial and operational management of the Department. He is deeply engaged in keeping the Physics Department running well so that we can achieve our teaching and research goals. This includes hiring and supervising staff, managing building issues, overseeing the budget, assisting with lab renovations and procurement of research equipment, and even providing logistical support for conferences. Peter is a consummate professional who knows the workings of the Department inside and out, and works tirelessly to deal with the myriad of issues that arise in a Department as large and complex as ours. We have also been exceptionally fortunate to have had Peter on our side and on site throughout the COVID-19 pandemic.

I'm sure that we all congratulate Peter on this anniversary and thank him for his 30 years of service to the Physics Department!

By: Kimberly Strong

Employee Anniversaries

Aloma Namasivayam

Celebrating 30 years

This year marks a significant milestone for Aloma Namasivayam in the Department of Physics that we are honoured to celebrate. On November 1, 2021, Aloma will have achieved 30 dedicated years of service with the Department.

Aloma has been an integral member of the Department through the years, providing exceptional financial and procurement services to our faculty, students, and staff.

She started in the Department in 1991 in a casual position and continued to develop her career in procurement and financial administration.
The achievements of our research and teaching programs are attributable to Aloma's efforts in the procurement of the many instruments within our research and teaching labs.

Congratulations to Aloma on her tenure achievement! We applaud the dedication and resilience she has demonstrated during her time with us, and we look forward to her ongoing contributions and prosperous future in the Department of Physics.

Shrubs Outside the Undergraduate Wing
(credit: David Bailey)

Arrivals

Ania Harlick

Assistant Professor Teaching Stream

Dr. Ania Harlick joined the Department on September 1 as an Assistant Professor Teaching Stream. Dr. Harlick has a PhD in condensed matter physics from Memorial University of Newfoundland and was previously a Tenure-Track Instructor in the Department of Physics and Astronomy at the University of Calgary, where she worked since 2017. She has extensive experience teaching undergraduate physics, including lectures at all levels, laboratories, and tutorials, as well as supervision of research assistants, and was the recipient of a Student Union Teaching Excellence Award last year.

Fatima Ijaz

Administrative Assistant of the Earth, Atmospheric and Planetary Physics Group

Fatima Ijaz joined the Department on June 1, 2021, as Administrative Assistant of the Earth, Atmospheric and Planetary Physics Group, taking over from Ana Sousa.

Fatima was previously at the Temerty Faculty of Medicine at U of T, where she was responsible for supporting the Standardized Patient Program as Administrative Assistant. Fatima says "Y*ou can often find me walking around U of T campus, watching the hawks flying over King's College Circle, observing squirrels by University College or following the raccoons that have moved into the campus. I love gardening and will always have plants around and happy to share – reach out to greenify your space*".

In Memoriam

Professor Emeritus Allan Jacobs - 1938-2021

Professor Emeritus Allan Jacobs passed away on June 30, 2021.

Allan Jacobs, Professor Emeritus at UTSC and in the Department of Physics, passed away in Toronto on June 30, 2021.

Allan was an undergraduate student at the University of Toronto, earning a B.A.Sc. in Engineering Physics from UofT in 1960. He then went on to obtain an M.Sc. in Applied Mathematics from the University of Waterloo in 1962, and a Ph.D. in Physics from the University of Illinois, Urbana-Champaign in 1968, where he studied with John Bardeen, the two-time recipient of the Nobel Prize in

Physics. Allan held a National Research Council Postdoctoral Fellowship at the University of Hamburg for a year before returning to UofT as an Assistant Professor in 1969, with his primary appointment at UTSC (known as Scarborough College at that time). He was promoted to Associate Professor in 1973 and to Professor in 1983, and retired in 2004. He also worked at Brookhaven National Laboratory and the Atomic Energy Commission of Canada.

Allan's research interests were focused on elucidating the structure of ferroelastics and frustrated antiferromagnets using theoretical approaches. Allan, Mike Walker, Allan Griffin, and Rashmi Desai, who were all hired into the Physics Department at about the same time, comprised the condensed matter theory group after Jan Van Kranendonk retired in the early 1990s.

For more information about Allan and his many interests, see:
https://www.legacy.com/obituaries/thestar/obituary.aspx?pid=199331472

By Kimberly Strong

Allan's Physics Department web site:
https://www.physics.utoronto.ca/site-archive/jacobs/

Amar Vutha's Lab at High Park (credit: Amar Vutha)

Contact Us

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