



Physics

UNIVERSITY OF TORONTO

*Fall 2019*

# INTERACTIONS

*The Department of Physics Newsletter*



## MESSAGE FROM THE CHAIR



**Welcome to the Fall 2019 issue of Interactions, the Department of Physics newsletter!**

I hope you enjoy reading about recent and upcoming events in Physics. This issue is the first in my new role as Chair of the Department, which I began on July 1. It is a great privilege to have been offered this position and I look forward to serving the Physics Department over the next five years.

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I am particularly pleased to have the opportunity to work closely with Young-June Kim, our Associate Chair for Graduate Studies, and with Peter Krieger, our new Associate Chair for Undergraduate Studies, who took over from Jason Harlow in July. I would like to thank Jason for his tireless efforts on behalf our undergraduate students, particularly during a time of significant growth in the enrolment in our major and specialist programs. I would also like to thank Mike Luke for generously agreeing to return to the third floor last year to serve as Acting Chair, which he did in his usual style, serving with good humour and dedication.

We have a diverse, collegial, and thriving Physics Department, one that is notable for both the breadth and depth of its research. Our faculty are leaders across multiple disciplines, from condensed matter physics, high energy physics, and quantum optics to atmospheric physics, biological physics, and geophysics. Our students and postdocs have access to many resources, including state-of-the experimental and computational infrastructure. With this issue of Interactions, you can catch up on some of their research activities, as well as other accomplishments and events that have taken place in the Department recently.

The fall issue usually introduces some members of the Department. Here you can read about physics major Rica Cruz, graduate student Adarsh Patri, and alumnus Julius Lindsay. Our editor has also included an interview with the new Chair by way of introduction for those who don't know me. We are also very pleased to recognize alumnus Anthony Moots, the recipient of a UofT Arbor Award for his contributions to student mentorship. We highlight Vanier Graduate Scholarship recipient Kristen Cote, Loudon-Hines Gold Medalist Bryce Wu, the van Kranendonk Awards, and many other award winners.

We are delighted to welcome two new faculty members. Nikolina Ilic started in March as an Assistant Professor and Institute of Particle Physics Fellow who works in experimental high energy physics. Thomas Scaffidi arrived in August and is an Assistant Professor and theoretical condensed matter physicist.

The Department has been involved in many outreach activities and public events since the spring, including the annual Welsh Lectures (this year with Anny Cazenave and Nobel Laureate Donna Strickland), citywide events like Science Rendezvous and Doors Open Toronto, as well as high school visits and the annual Science Unlimited Summer Camp. I hope you enjoy reading about these and were able to participate in some of them.

On Nov. 19, the annual Tuzo Wilson Lecture will be given by our new Tuzo Wilson Chair, Qinya Liu. All are invited to attend her talk on "Exploring the Earth's Interior by Full Seismic Waves".

You may notice that we are trying a new format for this issue of Interactions. We welcome feedback at [newsletter@physics.utoronto.ca](mailto:newsletter@physics.utoronto.ca) and also invite our alumni to send us your news. We are always pleased to hear from you!

# Events

## Tuzo Wilson Lecture

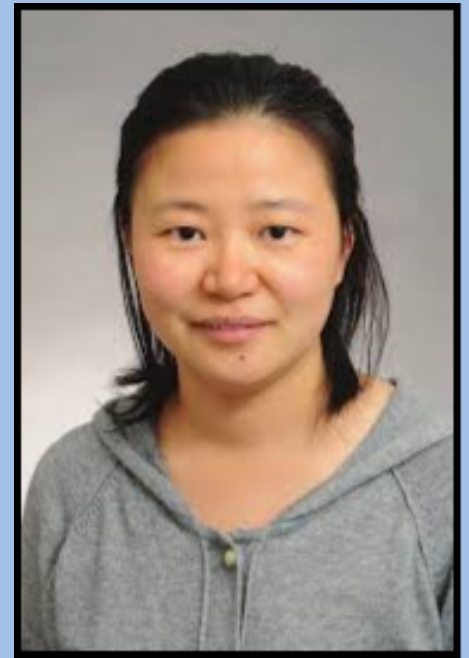
### Exploring the Earth's Interior by Full Seismic Waves

Professor Qinya Liu

November 19, 2019

7:30pm

Isabel Bader Theatre



Professor Qinya is the new Tuzo Wilson Chair. As per tradition, the new chair delivers the first lecture at the start of their professorship.

#### **Interactions asked Professor Liu about what professorship means to her:**

“It is my great honour to be nominated for the J. Tuzo Wilson Professorship (2019-2024). I never had the opportunity to meet J. Tuzo Wilson in person, but his fundamental contributions to plate tectonics and our understanding of the geological evolution of our planet have had a long-lasting impact for this department and the wider Earth Science community. I will continue on to promote both fundamental and applied geophysical research in this department, and engage in strengthening our connections with geophysicists in other departments, institutions and across campuses. I will help organize the annual J. Tuzo Wilson Lectures and bring in distinguished speakers on the forefront of advances in Earth Sciences for the UofT community and the general public.”

# Faculty Profile

## Professor Kimberly Strong

Professor, Experimental  
Atmospheric Physics  
Chair, Department of Physics



**Hi Professor Strong, congratulations on your appointment as Chair of the Department of Physics and thank you for taking the time to speak to Interactions. I am sure it is a busy time for you.**

**You did your undergraduate degree in physics at Memorial University of Newfoundland. What was your inspiration to study physics?**

I had a terrific high school physics teacher, Mr. Williams at Prince of Wales Collegiate in St. John's, who taught in a very entertaining way and made physics interesting. However, I was interested in many subjects as an undergraduate student and did not choose physics as my major until the third year of a five-year degree. I liked the underlying logic of physics, its ability to explain the world around us, and the fact that problems could be solved by applying basic principles. The high quality of the teaching and the support of my physics professors at MUN (several of whom were UofT graduates), and at St. Francis Xavier University, which I attended in first year, also reinforced my decision to study physics.

**Your DPhil from Oxford was in Atmospheric Physics. Why did you choose this branch of physics specifically?**

When I started looking into possible topics for graduate studies, I was most attracted to fields that related physics to the wider world: atmospheric physics, geophysics, astrophysics, and even archaeology and physics. I chose to specialize in atmospheric physics because it was both fascinating and so important to life on Earth. My DPhil dealt with planetary atmospheres, particularly that of Jupiter, but my subsequent research has focused on Earth's atmosphere. It's essential that we understand what's happening in our atmosphere now, and how both natural causes and human activities may lead to future changes.

**Your current research involves studying the atmosphere, specifically, ozone depletion, climate change and tropospheric pollution. Can you tell our readers a little bit about the importance of this research?**

The overall goal of my research is to improve our understanding of the chemical and physical processes that determine atmospheric composition and drive atmospheric change, knowledge that is needed for informed policy-making. We often hear about climate change, air pollution, and ozone depletion in the media; these are all important global issues facing society, with impacts on our environment, health, and economy.

Scientific research into the causes and consequences of these issues is essential for society to understand what's happening to our environment, why it's happening, and how we might respond. To investigate these topics, my group develops and uses spectroscopic instruments and data analysis tools to measure atmospheric trace gas concentrations. Our research is highly collaborative as we often combine our measurements with those of international observing networks and satellites and work with atmospheric modellers, such as Professor Dylan Jones, in the interpretation of our data.

**You are one of the founders of CANDAC – the Canadian Network for the Detection of Atmospheric Change, which has established the Polar Environment Atmospheric Research Laboratory (PEARL) at Eureka, Nunavut (80°N) (see pic). Can you tell our readers a little about the research that your group does there?**



I began research at Eureka in 1999, with a program of spring campaigns that still continue (now led by Professor Kaley Walker and supported by the Canadian Space Agency); these have generated a unique dataset for the study of processes and long-term trends in the high Arctic. CANDAC established PEARL in 2005, and I am currently Co-PI with Professor Emeritus James R. Drummond. There are more than 20 instruments installed at PEARL, and my students and postdoctoral fellows run four of these.

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My group measures a suite of trace gases, contributes these measurements to international observing networks, and uses them to validate new data products from satellite missions and to study the Arctic atmosphere. For example, in 2011, we captured the largest stratospheric ozone depletion event seen in the Arctic. We have tracked biomass burning plumes, and recently published the first long-term time series of ammonia in the Arctic, showing that the 2017 North American wildfires resulted in large spikes in the concentrations of ammonia and other trace gases in the high Arctic. We also use our PEARL measurements to study a variety of other phenomena, including tropospheric bromine explosions, Arctic water vapour, the carbon cycle, long-term trends, and clouds.

### **What is coolest thing about working at PEARL?**

The low temperatures, of course! Visiting PEARL is a truly unique experience.

PEARL is not in a community – Eureka is the location of an Environment and Climate Change Canada (ECCC) Weather Station, where we stay, and we have to charter an airplane or hitch a ride on an ECCC charter to get there. It's a two-day trip, and once there, you feel like you are in a very special place, knowing that it is the most northerly permanent outpost in Canada after Alert, which is about 500 km closer to the North Pole. In summer, there is 24-hour daylight and a surprising abundance of small Arctic wildflowers, while in winter, the 24 hours of darkness and temperatures of minus 50°C really make visiting PEARL a polar adventure.

### **On July 1, 2019, you filled the role of Chair of the Physics Department. What are you most excited about in this role?**

I am honoured to have been asked to serve as Chair for the next five years. Since arriving here as an Assistant Professor in 1996, I have benefitted greatly from being a member of the Department, and so I am excited to now have the opportunity to contribute to its future development and success. We are blessed with excellent students and postdocs, dedicated staff, and outstanding faculty who work at the forefront of physics across many fields. Over the summer and into the fall, I have been meeting with many Departmental citizens to learn about what people do and to hear their thoughts on how we can further strengthen the Department. We are scheduled to have an external review in the next year or so under UofT's Quality Assurance Process, which will give us a formal mechanism to take stock of the Department and its programs and to plan for the future.

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## **You are also the first female Chair of the Department of Physics, what does that mean to you?**

UofT has many capable female academic administrators, some of whom I worked with while I was Director of the School of the Environment. Joining their ranks as Chair therefore doesn't seem particularly momentous. On the other hand, I've been told that there have only been a very few female physics chairs in Canada, so I feel a certain responsibility to do a good job! I was the only female professor in the Physics Department when I was hired; I'm glad that we have managed to increase this by about an order of magnitude over the last two decades, as well as increasing diversity more broadly, but there is still room for improvement. As a female Chair, I hope that I can bring a new perspective to the role and directly or indirectly, provide encouragement for others. Over the course of my undergraduate, graduate, and post-doctoral studies, I was taught and supervised by dozens of professors, but only a few were female and none of those was in physics. However, the support, encouragement, and mentorship that I received from male professors was profoundly important. All of us, regardless of gender, have a role to play in ensuring that the Physics Department is a positive and supportive environment for everyone.

## **What else do you have on the agenda for this year?**

One ongoing priority is maintaining the success of my research program, working with all the terrific students and postdocs in my group. Another is securing continued funding for PEARL. In addition, I became President of the Canadian Meteorological and Oceanographic Society in July, for a one-year term. I had committed to this before taking on the role of Department Chair, and served as Vice-President last year while Professor Paul Kushner was President. I was also recently appointed to the Board of Directors of the SNOLAB Institute and am looking forward to learning about the science and operations of this amazing facility. Both of these positions are relevant to my role as Chair, and I'm sure that they will provide experience and insights that will be useful over the next five years.



*Left: Students working at PEARL (photo credit: Dan Weaver)*

# Graduate Student Profile

**ADARSH PATRI**  
**PHD**

**THEORETICAL CONDENSED  
MATTER**

Adarsh S. Patri is entering his fourth year as a direct-entry PhD student in theoretical condensed matter physics working under the supervision of Professor Yong Baek Kim.



From a young age, Adarsh found observing symmetries and patterns in the natural world a stimulating and fulfilling endeavor. This early interest was cultivated into a strong passion as he progressed through high school. He started reading popular physics books, notably *The Elegant Universe* by Brian Greene, and drew inspiration from the scientific achievements of Sir Isaac Newton. With the patient encouragement of his parents and his high school physics teacher, Adarsh was able to explore his interest further and develop a firm foundation in physics during his high school years. He was intrigued by symmetry and had a burgeoning interest in elegant mathematics, therefore, physics became a natural pathway to take.

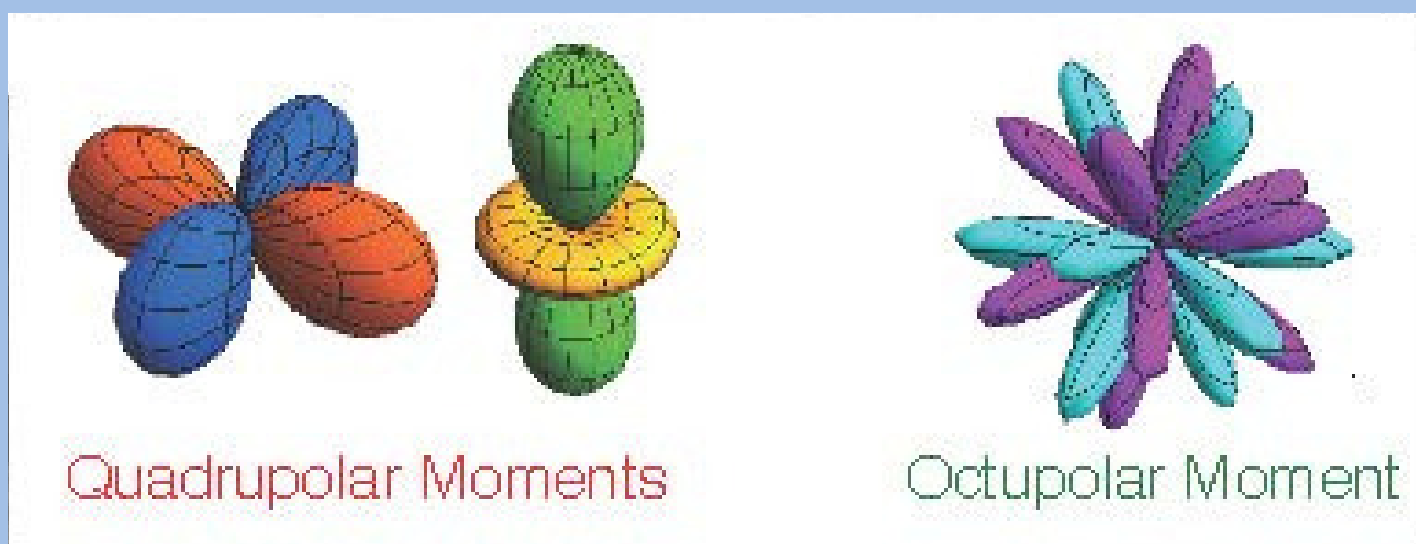
Adarsh completed his undergraduate degree at the University of Waterloo in the Honours Physics Co-operative program. The co-op program was a rewarding experience as it exposed him to a variety of research fields in both industry and academia. During his co-op term working at Harvard University, Adarsh was exposed to the fascinating field of condensed matter physics while working on superconducting nanowire single photon detectors. A subsequent co-op term on a NSERC USRA scholarship working on theoretical condensed matter physics under the supervision of Professor Michel Gingras, and a culminating research term at the Perimeter Institute for Theoretical Physics guided Adarsh to work on theoretical physics.

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Adarsh's studies primarily involve the study of multipolar moments in condensed matter systems. Amongst the variety of multipolar moments, we are perhaps most familiar with dipolar moments. These arise as friendly bar magnets that we use on refrigerators. These dipole moments (or 'magnets') are a macroscopic manifestation of the quantum mechanical spin of electrons. In some crystals, however, due to a combination of spin-orbit coupling (where the spin of an electron interacts with its own orbital angular momentum) and neighbouring electric fields, the electron wave functions are constrained to specific, localized shapes. As such, electrons in crystals are able to host more complicated and exotic moments, known as multipolar moments, which are complicatedly shaped magnetization and charge densities. Intriguing questions Adarsh tackles involve: how are multipolar moments different from the usual bar magnet (dipoles)? How could we even detect such exotic moments? Do multipolar moments affect the properties of metals if they are added as impurities? To whet one's intellectual appetite, the answer to the final question is affirmative: multipolar moments can result in very unusual metals, where the carriers of charge (or currents) are no longer mere electrons...

Away from his PhD studies, Adarsh enjoys watching and playing soccer and tennis. He is an avid fan of Arsenal FC and of Roger Federer. Adarsh also enjoys reading graphic novels in his free time, as well as playing the violin.



*Multipolar Moments in Pr-based heavy fermion compounds:  
PrV<sub>2</sub>Al<sub>2</sub>O*

# Undergraduate Student Profile

**RICARDO CRUZ**

PHYSICS MAJOR  
MATHEMATICS MINOR,  
EDUCATION & SOCIETY MINOR



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

Ever since I could remember, I have always had an inherent fascination with how our world works. From understanding why the magnets on my refrigerator would stay on but my shoe would not, why I could rub my sock-covered feet on the carpet to produce a jolt of electricity, or why I could throw a tennis ball as far as I could yet it would not continue its trajectory infinitely – these were the issues that my younger self was so perplexed by. Was it magic? Was it the mysterious elves my sister so desperately tried to make me believe?

Unfortunately, the answer was no.

Yet as I got older, the answers to my questions started to become more apparent: my shoe was not made of a magnetic material, rubbing my socks on carpet created static electricity, and all objects on earth experience a gravitational force downwards. But those answers were not enough for me. I wanted to understand why – physics gives me that. By studying physics, I unearth a greater understanding of the fundamental principles that dictate how the world around us works – everything my younger self wholeheartedly desired.

## **What do you enjoy most about the physics program?**

Instead of mindlessly memorizing a couple of formulas and drawing free-body diagrams, the physics program allows us to apply the theories we've learned in class in a laboratory setting. It is truly an incredible feeling to observe the Photoelectric Effect or the concept of Blackbody Radiation for yourself. I believe one gains a greater understanding of physics from doing than from reading about it in a textbook.

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

I am VP Secretary of the Physics Student Union (PhySU), as well as an executive member of the planning committee for the Canadian Conference for Undergraduate Women in Physics (CCUWiP) which is being held at the University of Toronto in January 2020.

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Outside of Physics, I am one of the student coordinators for VicReach with Victoria College. VicReach is a volunteer outreach program that offers students valuable experience in a classroom setting.

### **What are your research interests?**

This past summer, I worked under Professor Debra Wunch analyzing methane emissions within the Greater Toronto-Hamilton Area. Although prior to this, I had no experience with atmospheric physics, this project has introduced me to a whole new world of physics I had no idea about. I would like to pursue further studies in atmospheric physics but am also open to learning about other fields like quantum optics, condensed matter physics, and the list goes on. Physics is incredibly rich in many fields, and I owe it to myself to learn more about each one.

### **What is your favorite course and why?**

PHY256. Instead of simply regurgitating the content of Quantum Mechanics: A Paradigm's Approach by David McIntyre, Prof. Steinberg would connect the course content to the ground-breaking quantum research and technology of today. Sometimes, I would catch myself discussing concepts and conundrums like quantum seeing-in-the-dark or quantum teleportation to my friends even after the course was over. Professor Steinberg introduced us to the exciting, yet confusing, world of quantum mechanics, and I loved every single minute of it.

### **What are your future plans?**

At this point, I am currently unsure of my future plans. I love teaching and being in a classroom setting, but this summer research project has introduced me to an exciting world of physics research yet to be explored. Right now, I would like to take it one step at a time and just continue to do what I love – physics and education.

### **Where do you see yourself in 10 years?**

Fingers crossed, I hope I will be done graduate school – whether that be physics or education graduate studies has yet to be determined.

### **Tell me something interesting about yourself.**

I am absolutely in love with dogs and hope to have 3 dogs in the future named: Bok Choy, Siopao (pronounced show-pow), and Riceball. Why are they all named after food? No reason! I just thought the names were cute.

# Alumni Profile

Julius Lindsay

OT6



## **Why or how did you become interested in physics?**

I was a huge Sci Fi/Star Trek/Star Wars Fan as a kid. I also got involved in some projects when I was in Elementary school that investigated fusion reactors, which led me to want to become a rocket scientist. In high school, I gained a love of investigating the theoretical and mathematical proofs. It was a natural choice to study Physics in University.

## **What you are doing now?**

I work as the Project Manager, Climate Change and Sustainable Development at the City of Richmond Hill. I am leading the CITY's Climate Change Mandate which includes developing a Corporate Climate change Framework and a Community Energy and Emissions Plan.

## **You are also a mentor in the Physics Mentorship Program. Why did you decide to be a mentor?**

I am at the stage in my career that I feel like I have knowledge to share. Coaching is one of my strengths and something I really enjoy as well. In addition I wanted to be more connected to the University of Toronto generally and the Physics Department. Specifically, I decided to become a mentor because it was a way to combine all of those.

## **What are your other interests?**

I am an extensive reader and you will always find me with my Kobo on me. I am also an amateur potter, been doing it for almost 4 years now. Football has been a big part of my life for a long time, I played for U of T during my years there; subsequent to that I coached for many years, and am currently a player/coach on a recreational flag football team.

**Interactions encourages all alumni to reach out and tell us what they are up to.**

**Email: [newsletter@physics.utoronto.ca](mailto:newsletter@physics.utoronto.ca)**

**Let us know where your physics degree took you!**

# Alumni News

Anthony Moots  
OT3



## Arbor Award

Recognizing  
exceptional volunteers

**Department of Physics Alum Anthony Moots was recognized with an Arbor Award for his contribution to student mentorship.**

Anthony has been a mentor in the Physics Mentorship Program since its inception in 2013 and has spoken at various Backpack to Briefcase (b2B) events and the Next Steps Conference. Our volunteers personify the very best attributes of the University's motto, *Velut Arbor Aevo* – “May it grow as a tree through the ages.” Their work represents both our roots and our branches, which have served to anchor our traditions and spread the mission of this University – to meet global challenges and prepare global citizens.

We are proud to honour and celebrate the contributions of the University's exceptional and longstanding volunteers with the prestigious Arbor Award. This award is the highest honour granted by the University and is given for sustained contributions to specific academic units, such as faculties, colleges or institutes, or for broader contributions to the University at large. Nominations open annually in mid-February. An award ceremony, sponsored by University Advancement, takes place each fall.

<https://alumni.utoronto.ca/events-and-programs/awards/arbor-award>

# Research

## GTA Urban Emissions Project -

## Investigating Methane Gas Emissions in the Greater Toronto Area



*(Left to Right) Post doc Sebastien Ars and students Jaden Phillips and Colin Arrowsmith getting ready to take some measurements (Photo Credit: Debra Wunch)*

Lead by Professor Debra Wunch of the Earth, Atmospheric and Planetary Physics Group, this project aims to investigate methane gas emissions in the Greater Toronto Area (GTA). Professor Wunch's group is interested in quantifying the total methane emissions from the GTA as well as studying the nature of individual point sources throughout the GTA.

To do this, they use a combination of mobile in-situ gas measurements and remote sensing gas measurements. To make remote sensing measurements, they use two EM-27/SUN Fourier Transform Infrared Spectrometers (FTIRs) to measure the composition of the atmosphere above the GTA.

The in-situ measurements are made using a mobile laboratory consisting of a weather station and gas analyzer mounted on a bicycle trailer. They cycle around the city with the lab and update their website with real-time atmospheric data.

Please visit their **website** (<http://www.atmosph.physics.utoronto.ca/GTA-Emissions>) for more information and to make suggestions on where they should measure next!

# Conferences

## The 29th International Symposium on Lepton Photon Interactions at High Energies August 5-10, 2019



The 29th International Symposium on Lepton Photon Interactions at High Energies took place in Toronto between August 5-10, 2019 and had 262 attendees. The Conference followed the tradition of a long series of high energy physics conferences. The program featured plenary and poster sessions covering topics of major interest to the particle physics community.

The local organizing committee included faculty from U of T Physics, York and Stanford University.

U of T Physics faculty on the committee included Professors David Bailey, David Curtin, Miriam Diamond, Peter Krieger, Pekka Sinervo, Richard Teuscher and William Trischuck (co-chair).

# Awards and Scholarships

## Graduate Students

### **Kristen Cote**

### Recipient of a 2019 Vanier Graduate Scholarship



The Government of Canada launched the Vanier Canada Graduate Scholarships (Vanier CGS) program in 2008 to strengthen Canada's ability to attract and retain world-class doctoral students and establish Canada as a global centre of excellence in research and higher learning. Vanier Scholars demonstrate leadership skills and a high standard of scholarly achievement in graduate studies in the social sciences and humanities, natural sciences and/or engineering and health. These prestigious 3-year scholarships are valued at \$50,000 per year.

Kristen holds a Bachelor's in astrophysics from the University of Alberta, a Master's in earth and space science from York University, and started her PhD in physics (specifically experimental quantum optics) here at the University of Toronto. She specializes in space-based optical systems. Having designed a balloon-borne x-ray detector, deployable imaging systems, and a laser-based analytical instrument for future Mars rovers, she is now focused on compact, portable optical atomic clocks towards space-based gravitational wave detection, geodesy, and deep-space navigation in Dr. Amar Vutha's lab. Specifically, she built a Stratospheric Optical Rubidium Clock Experiment (SORCE) that launched on a high-altitude balloon in August with the Canadian Space Agency's STRATOS mission. In her spare time, Kristen volunteers with the Students for Exploration and Development of Space (SEDS) Canada to organize projects (like parabolic flights and stratospheric balloon launches) for Canadian postsecondary students.

Congratulations Kristen!



# Awards and Scholarships

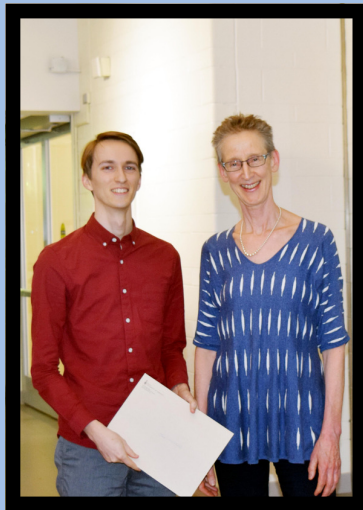
## Graduate Students

### van Kranendonk Awards for Teaching Assistants

Named in honour of Jan van Kranendonk, the Van Kranendonk Award is given every year to four graduate students who have done the best job as Teaching Assistants during the current year. Teaching assistants are nominated by the students for this award. This year the awards were presented to teaching assistants by Jan's daughter, Olga van Kranendonk, on June 12, 2019 at the departmental end of year party.

#### The 2019 winners were:

Olinka Bedroya, Jesse Cresswell, Jacob Gordon and Wenyuan Wang (photos below).



*Olga van Kranendonk with graduate students (left to right): Olinka Bedroya, Jesse Cresswell, Jacob Gordon and Wenyuan Wang*



Jan van Kranendonk (left) was 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.

# Awards and Scholarships

## Graduate Students

### **2019 Centre for Global Change Graduate Awards - Jan-June 2019**

Yiling Huo  
Nasrin Pak  
Sebastian Roche  
Kirsten Tempest  
Jesse Velay-Vitow

### **2019 NSERC Awards**

Matthew Basso  
Shira Jackson  
Alexandre Audette  
Jared Barron  
Frank Corapi  
Alistair Duff  
Seshu Iyengar  
Robert Valente  
Emily Zhang  
Shayne Gryba  
Duncan Kirby  
Austin Lindquist

### **2019- 2020 David Naylor University Fellowship**

Seshu Iyengar

### **2019 Centre for Global Change Graduate Awards - July-Dec 2019**

Nasrin Pak  
Paul Jeffrey  
Jesse Velay-Vitow

### **2019 OGS Awards**

Eli Bourassa  
Jonathan Clepkins  
Andrew Cox  
Hazem Daoud  
Dennis Fernandes  
Haruki Hirasawa  
Dylan Jow  
Christopher Nunn  
Laura Saunders  
Ilan Tzitrin  
Mohit Verma

### **2019- 2020 Connaught International Scholarship**

Caleb Gemmell

# Awards and Scholarships

## Undergraduate Students

### **2019 Summer Undergraduate Research Fellowships (SURF)**

Mitchell Barrett  
Rica Christina Cruz  
Grace Li  
Yiyan Luo  
Michael Poon  
Anthony Roitman  
Jingwen Zhu

### **2019 CGCS Summer Research Training Program**

Juliette Lavoie - supervisor Debra Wunch  
Heng Li - supervisor Nicolas Grisouard  
Alice Wang - supervisor Kim Strong

### **Statt-Luste Award**

Valerie Luo

### **2019 Loudon-Hines Gold Medal and Scholarship in Physics**

Bryce Wu

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 will be presented annually to the graduating student in the Specialist or Major program in Physics with the highest cumulative grade point average and who also demonstrates creativity and a clear promise in the discipline 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.

Thanks to the creativity and vision of our two anonymous donors, this prestigious gold medal has been given new life, and is accompanied by a generous financial award.

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.

# Undergraduate Research Awards

Awards for undergraduate research projects were given out on Sept 26, 2019 at the Physics Undergraduate Research Fair

## First Prize: Rica Cruz

Analysis of Methane Emissions in Greater Toronto-Hamilton Area

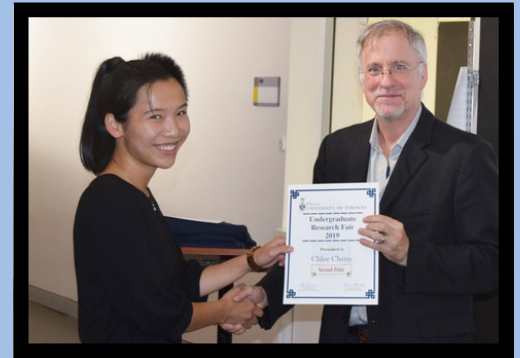
**Supervisor** - Debra Wunch



## Second Prize: Chloe Cheng

Probing shape coexistence in  $^{192}\text{Hg}$  through combined electron and gamma-ray spectroscopy

**Supervisor** - Adam Garnsworthy, TRIUMF



## Third Prize: Anna Hwang

Synthesizing a Sampling Scope Trace of a Pulse from an Asynchronous, Digital Scope Trace of a Repetitive Waveform to Generate a Fitting Function for a Laser Pulse

**Supervisor** - Robin Marjoribanks



# Announcements



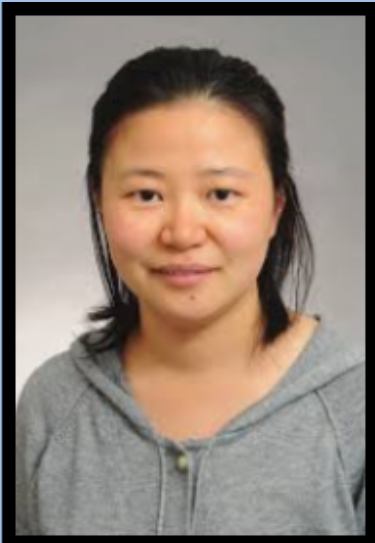
## **Chair of the Department of Physics**

Professor Kimberly Strong officially assumed the role of Chair of the Department of Physics on July 1 for a five-year term. Professor Strong took over from Professor Michael Luke who was Acting Chair from July 2018-June 2019. Also, Professor Strong was named fellow of the Royal Society of Canada in September 2019.



## **Associate Chair Undergraduate Studies**

On July 1, Professor Peter Krieger assumed the role of Associate Chair, Undergraduate Studies, for a three-year term. Professor Krieger took over from Professor Jason Harlow, whose term came to an end in June.



## **2019–2024 J. Tuzo Wilson Chair**

Professor Qinya Liu is the new Tuzo Wilson Chair. The J. Tuzo Wilson Professor in Geophysics is appointed for a five-year term. The Chair delivers the annual public J. Tuzo Wilson Lecture in the first year of their appointment and thereafter arranges speakers for the annual lecture.

## **2018-2019 Physics Staff Awards**

Administrative Staff Award: Liz Glover

Technical Staff Award: Galina Velikova

*Congratulations to both!*

# Welcome to Our New Faculty



**Thomas Scaffidi**

Dr. Thomas Scaffidi joined the Physics Department in August 2019 as an Assistant Professor. Dr. Scaffidi completed his DPhil at Oxford University in 2016 and was a Moore Foundation Postdoctoral Fellow at UC Berkeley from 2016 to 2019. His studies involve the emergent phenomena of quantum matter such as electron hydrodynamics, superconductivity and quantum chaos.

**Nikolina Ilic**



Dr. Nikolina Ilic obtained her PhD from U of T in 2015. She joined the Experimental Particle Physics and Astrophysics group in March 2019 as Assistant Professor and Institute of Particle Physics Researcher.

Currently she is working on the ATLAS experiment at CERN on hardware aspects as well as physics analyses. She is sub-convenor of a physics group that searches for a wide range of exotic physics signatures such as Quantum Black Holes, Heavy Neutrinos, Gravitons, Leptoquarks and Excited Leptons. Her current hardware work is focused on electronics and commissioning of the upgraded data acquisition system in ATLAS called FELIX. Dr. Ilic is also looking to expand her hardware involvement to beam-line neutrino experiments such as DUNE.

## **Employee Anniversaries**

**Ilda Cunha** - Financial Officer - 45 years in June 2019

**Lisa Jefferson** - Research Grants and Finance Assistant - 15 years at Physics and 30 years at U of T in April 2019

# 2019 Incoming Graduate Students

Welcome!

## **PhD**

Nathan John  
Carlson  
Andrew Cox  
Alistair Duff  
Jordon Fazio  
Felix Frontini  
Caleb Gemmell  
Chan Gwak  
J. Philip Haupt  
Seshu Iyengar  
Evelyn MacDonald  
Sabrina Madsen  
Nicolas Mantella  
Romina Piunno  
Daniel Schultz  
Omid Tavakol  
Fabiola Jimenez  
Robert Valente  
Yildirim Yilmaz  
Emily Zhang  
Jonathan Zhang

## **MSc**

Ramina Alwarda  
Nicolas Anto-Sztrikacs  
Darby Bates  
Derek Churchill  
Cameron Clarry  
Sean Colford  
Colin Dale  
Shaun Froude-Powers  
Lawson Gillespie  
Jack Hong  
Yasmeen Kamaliddin  
Jason Kattan  
Brayden Kell  
Reem Mandil  
Kayhan Momeni  
Mykhaylo Plotnykov  
Chandler Ross  
Mohit Verma

# Events

## Physics Mentorship Program Closing Party



**The Physics Mentorship Program Closing Party was held on March 27, 2019.**

The Mentorship Program is a valuable program for 3rd/4th year physics students. Students are paired up with alumni, faculty and graduate student mentors to gain career advice. Students and mentors typically meet in person or electronically once a month during the fall and winter terms.

**Students from the 2019 Program commented:**

“I think this program is great and very helpful.”

“I cannot express more gratitude for my mentor to know that there’s a mentor who I can go to anytime”

“I had a chance to know about my mentor who I want to look up to”

“my mentor made me feel like a good person”

Mentors have told us year after year that they love helping students and it feels good to give back.

Want to be a mentor? Contact: [mentorship@physics.utoronto.ca](mailto:mentorship@physics.utoronto.ca)



# Events

## 2019 Emeritus Reunion



*Left to Right: Una Rowe, Tony Key, Ted Litherland, Nigel Edwards, David Bailey, David Curtin, Gordon West, Richard Bailey, David Rowe, John Perz, Kimberly Strong, Michael Luke, Graham Malcolm, Fraser Code and Henry van Driel*

The Annual Emeritus Reunion Lunch took place on May 16th at the Faculty Club. Our emeritus faculty heard about what is the new in the Department and caught up over lunch!

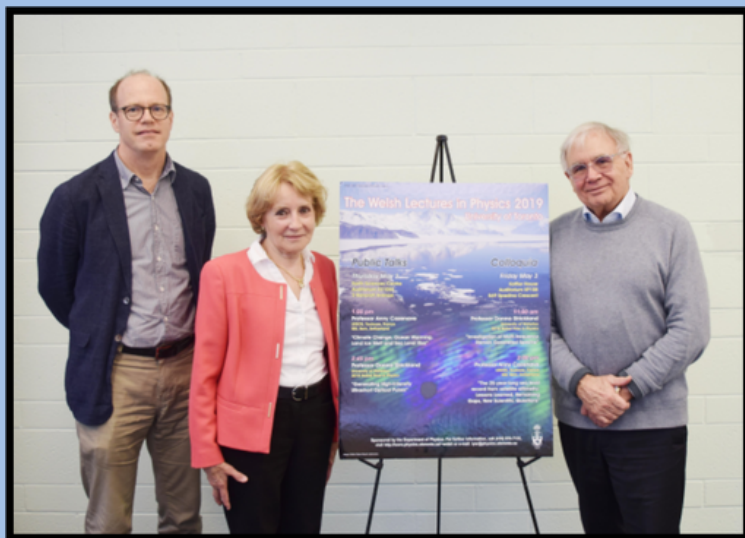
# Events

## 2019 Welsh Lectures

The Welsh Lectures in Physics have been held annually since 1975 in honour of H.L. Welsh, a distinguished former faculty member in the Physics Department. They are the major public event in the life of the Department of Physics and are intended to celebrate discoveries in physics and their wider impact. They are intended to be broadly accessible to an audience drawn from across the university, other academic institutions and the interested public.

The 2019 Welsh Lectures took place on Thursday, May 2, 2019. The speakers this year were Professor Anny Cazenave (French Space Agency, CNES) whose talk was titled: Climate Change, Ocean Warming, Land Ice Melt and Sea Level Rise and 2019 Nobel Laureate Professor Donna Strickland (University of Waterloo) whose talk was titled Generating High-Intensity Ultrashort Optical Pulses.

The 2019 Chair of the Welsh Committee was Professor Arun Paramekanti.



*Left to Right: Michael Luke, Anny Cazenave and Dick Peltier*



*Left to Right: Arun Paramekanti and Donna Strickland*

# Events

## Celebrating the Cray Inc. Fellowships in Physics

On October 1st, former and current Cray Inc. Fellows gathered at the Faculty Club to celebrate more than ten years of fellowships at U of T. In 2007, a donation from Cray was matched through the Graduate Student Endowment Fund (GSEF), resulting in the Cray Inc. Fellowships in Physics.



Since 2007, 56 alumni and 24 current Master's and Doctoral students in the Department of Physics have received fellowship support as a result of Cray's generous gift. These fellowships have truly fulfilled their original objective of "encouraging some of the most promising young physicists from around the world to study at the University of Toronto."

Our Cray Fellows span all the subdisciplines in the Department: Earth, Atmospheric, and Planetary Physics, Biological Physics, Condensed Matter Physics, High Energy Physics, and Quantum Optics. Many Fellows have used, or are using, high performance computing and sophisticated computational methods, algorithms, and resources in their research. Our Cray Fellow alumni have gone on to a wide variety of careers spanning academia, government, and many facets of industry.

Cray's Mike Piraino, Senior Vice President, Administration & General Counsel, and Paul Hahn, Analytics and AI Market Manager, joined us for the celebration, which included 'Three-Minute Thesis' talks by six 2019-2020 Cray Fellows: Stephanie Hay, Jessie Velay-Vitow, Robert Les, Joey Carter, Huan Yu Meng, and Trevor Towstego. While on campus, our Cray guest also visited several labs to learn about research activities underway at U of T Physics. The Department is grateful for our collaboration with Cray, and we look forward to the continued impact of the Cray Inc. Fellowships.

Thank you to Cray for supporting our graduate students.

# Events

## Kids Passport 2019



*Photo Credit: Undergraduate Student Jack Farrell*

## **Kids Passport took place on Saturday, June 1, 2019**

Alumni and their children were invited to Kids Passport to check out "everything physics", from motion to superconductivity to discovering the amazing way the world works by playing with light and colour.

The action-packed morning was organized by Professor Carolyn Sealon and demos were run by undergraduate physics students. Around 100 children participated this year. The event was part of the larger University-wide Alumni Reunion.

# Outreach in Action

## Science Rendezvous 2019

**Science Rendezvous took place on Saturday, May 11, 2019**

Science Rendezvous is a free annual outreach exhibition hosted by over 30 universities and institutions across Canada. Its primary purpose is to spur children's interest in S.T.E.A.M. (Science, Technology, Engineering, Art, and Math) disciplines, and to improve scientific literacy in the general public by making science more accessible and interactive.

The Department of Physics participated again with exciting demos for children of all ages and their parents. Almost 500 people came through the Department between 11am and 4pm.

The demos at the Department of Physics were run by enthusiastic student and faculty volunteers. The event was a success because of their hard work and passion for science.



*Photo Credits: Undergraduate student Jack Farrell, Professor Stephen Morris and Ben Ouyang Photography*

For more information on these events and other Outreach initiatives, visit:  
**[www.physics.utoronto.ca/physics-at-uoft/outreach](http://www.physics.utoronto.ca/physics-at-uoft/outreach)**

# Outreach in Action

## Great Gulf Doors Open



The 20th annual Doors Open Toronto took place on Saturday, May 25 and Sunday, May 26, 2019. Doors Open is presented by Great Gulf and provides an opportunity to see inside some of Toronto's most architecturally, historically, culturally and socially significant buildings across the city.

The Department of Physics took part for the second year in a row and almost 1200 people came through the building to participate in physics demos, experience Matt Russo's Sonic Orbiter Exhibit, see the telescopes and take in a panoramic view of the city from the balcony.

This year the Department also offered lab tours to curious guests. Graduate student Ben Lau showed off Stephen Julian's Low Temperature Lab and Stephen Morris opened up the doors to his Icicle Experiment.

The theme for Doors Open this year was "millennials", so a number of graduate student posters were on display for guests to see. Demos and tours were done by student and faculty volunteers; the event was a success because of their wonderful enthusiasm.



*Photo Credits: Undergraduate student Darya Zanjanpour Mobarhan Fomani and graduate student Haochen Zhang*



 GREAT GULF  
**DOORS  
OPEN**  
MAY 25 & 26, 2019

**Interactions asked Chair of the Outreach Committee David Bailey about what he enjoys most about these large public events:**

What I enjoy most about our large public events is how our visitors are impressed by both our physics and our physicists. Visitors will come up to me and say: “We thought we’d just take a quick look from the rooftop balcony, but we didn’t realize there were so many other interesting things to see.” and “Wow, your volunteers are so enthusiastic.” Even in this day when everything and anything can be watched online, people are still impressed with reality “in the flesh”.

For more information on these events and other Outreach initiatives, visit:  
[www.physics.utoronto.ca/physics-at-uoft/outreach](http://www.physics.utoronto.ca/physics-at-uoft/outreach)

# Outreach in Action

## School Visits



### **Victoria Park Collegiate Institute**

On February 22, 2019, the grade 11 class from Victoria Park Collegiate Institute came to the Department of Physics for a visit. Students attended a workshop on laser interference by Professor David Bailey. This was followed by a tour of the telescopes led by graduate student CJ Woodford and a talk from graduate student Haider Abidi.

**Interactions asked Chair of the Outreach Committee David Bailey about why it is important to have high school students connect with our department?**

"Hosting visiting high school classes helps us connect to both students and teachers. Many students - and even more parents - think of physics as only a stepping stone to becoming an engineer or medical doctor, and not something to study for itself. For many students this may be true, but we want to help students also realize that there is a whole world of exciting physics to learn at university. We'd love to have them join our large community of students and physicists who are passionate about understanding how different bits of the universe work. We want teachers to know that we welcome their students and give them ideas that they might use in their own classes."



# Outreach in Action

## School Visits



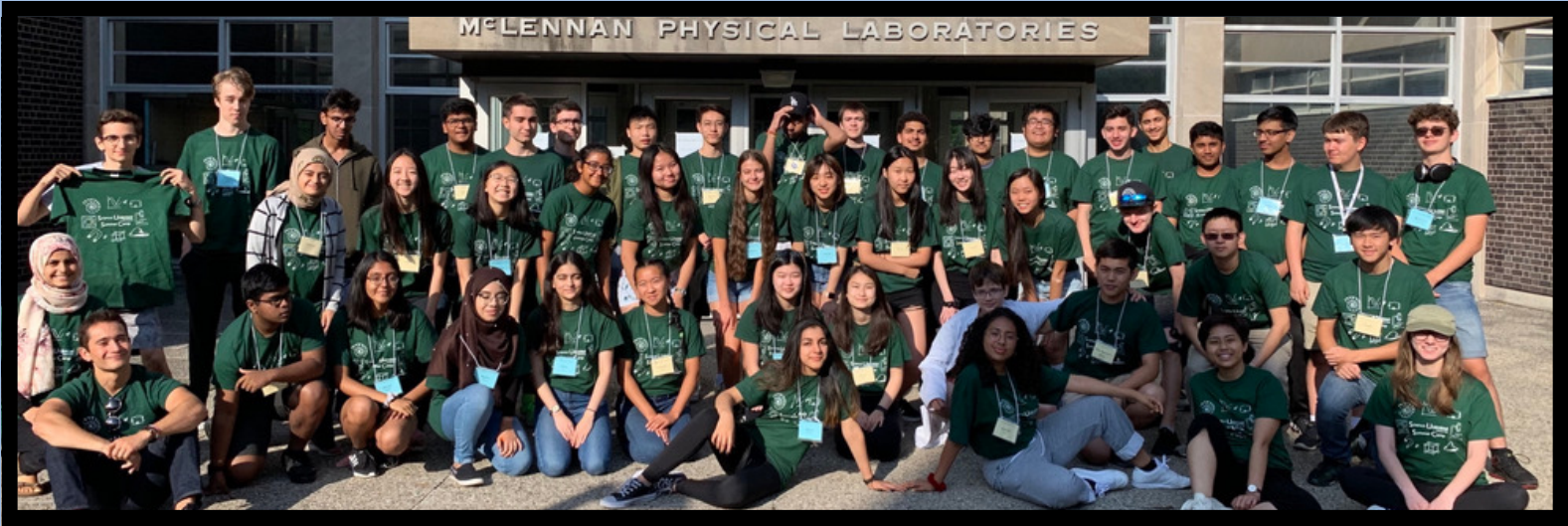
## Albert Campbell Collegiate Institute

On April 18, 2019, 62 grade 11 Physic students from Albert Campbell Collegiate Institute visited the Department of Physics. Students attended a workshop on laser interference by Professor David Bailey and undergraduate volunteer Estelle Tang. After the workshop, the students went on a full campus tour.

Are you a high school physics teacher?  
Do you want to bring your class to the Department for a visit?  
**Email: [outreach@physics.utoronto.ca](mailto:outreach@physics.utoronto.ca)**

# Outreach in Action

## Science Unlimited @utoronto Summer Camp



**Science Unlimited Summer Camp took place August 12-16, 2019**

50 high school students took part in workshops put on by the Departments of Astronomy, Physics, Earth Sciences, Math, Computer Science, Chemistry and the School of the Environment.

Interested in giving your grade 10 or 11 child an unforgettable educational experience? Find out more at:

<https://sites.physics.utoronto.ca/summercamp>

**"It blew my mind!"**

**"It was really fun and cool"**

**" I learned a lot in a fun way"**

**"We saw absolutely incredible things"**

**"The experiments are cool"**

# Letters to the Editor

Greetings! A few personal comments in connection with the latest Interactions...

## 1. Tuzo Wilson Lecture

My earliest interaction with Prof. Wilson was in the summer of 1964, when he organized an industry-sponsored program to attract students to Earth Science. Five of us freshmen (Paul Johnston, Dave Anglin, Tim Leung, Ernie Greenwood, and myself) were privileged to spend the summer touring Earth Science facilities across Canada (government labs, several mines, seismic crew, geology field camp); three of us actually went on to studies in Earth Science. Our budget for the summer was \$750 each; we traveled in the department's VW bus, camping all the way. In my senior year I experienced actual Tuzo Wilson lectures by way of his Geotectonics class. Each Monday morning eight of us would share in the exciting revolution of the unfolding new global tectonics, as Prof. Wilson would report on the latest conferences he was attending, with such revelations as the work of Vine and Matthews on measuring sea-floor spreading through the symmetric mid-ocean patterns of magnetic anomalies. Exciting times! My final interaction with Tuzo Wilson was in 1991, when I was able to attend a symposium he organized in celebration of the 150th anniversary of Geophysics at the University of Toronto. I hope the old monument still stands on the east side of the old McLennan Laboratory building south of Convocation Hall, marking the site of early geomagnetic measurements recorded in support of magnetic theory developments by Carl Friedrich Gauss.

## 2. Dick Peltier

Dr. Peltier came to the Geophysics Laboratory while I was a graduate student. The last time we visited was in the '90s when I was working for Cray Research in Houston; I visited with him in his office to make sure he was happy with Cray's support of his super-computing adventures. Congratulations, Dick, on your IUGG award!

## 3. Roland List

Prof. List was on my PhD committee; he challenged me to move beyond writing ray-tracing software and actually do some geophysical data interpretation. R.I.P. I have returned at last to academia in my semi-retirement, now working half-time as a Research Scientist on staff at Prairie View A&M University near my home in Chappell Hill, Texas. I'm helping the Computer Science department bring Machine Learning technologies to bear on applications in geophysical exploration.

**Ted Clee, 7T3**

## Letters to the Editor

Thank you for sending me a copy of the U of T physics newsletter and updating me on all that interesting stuff that has happened at the physics department. Best wishes to all at the department of physics.

**Parviz Gulshani, 7T8**

*Interactions hopes you like our new format. If you have comments or suggestions, please get in touch.*

## Contact Us

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416-978-3307

**Email:**

**[newsletter@physics.utoronto.ca](mailto:newsletter@physics.utoronto.ca)**



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