Physics
UNIVERSITY OF TORONTO

Spring 2020

INTERACTIONS

The Department of Physics Newsletter

MESSAGE FROM THE CHAIR

Welcome to the Spring 2020 issue of Interactions, the Department of Physics newsletter!

Dear Physics community,

I write this message as the winter term is winding down and the summer term is about to start. Trees and flowers are blossoming around campus, but with UofT largely closed, few people are there to enjoy them.

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It has been an extraordinary two months for the Physics Department, as it has been everywhere. Congratulations to all of our students for making it through despite all the challenges they faced this term!

And a heartfelt thank-you to everyone who has worked so tirelessly to keep the Department's teaching, research, and operations going under complex and rapidly changing circumstances.

We began contingency planning in early March, and on Friday the 13th, President Gertler announced that the University was cancelling all in-person classes in response to the outbreak of COVID-19. Over the next few days, instructors converted more than 6000 courses to an online format, while the week of March 16th saw a rapid transition to working at home and preparations for the shut-down of lab-based research operations on Friday the 20th.

Here in the Department, our course instructors did a fantastic job in moving nearly all of our 44 winter courses online, and teaching remotely for three weeks, ensuring that our students were able to complete the term. They were joined by our teaching assistants who ably continued to play a vital role in many of our courses. They were also supported very effectively by our dedicated technical and administrative staff.

While the closure of our labs is certainly having an impact on research in the Department, our graduate students, postdocs, RAs, and faculty have been adapting. The Physics Graduate Office successfully moved PhD qualifying exams online and we've had a record number of graduate offers accepted for September. Summer undergraduate research students are "arriving", joining supervisors who have been able to offer projects that can be done remotely.

Our staff are doing an excellent job in supporting the smooth operation of Departmental business while working from home. I would especially like to thank our CAO Peter Hurley for the tremendous work he has done to transition the Department to the "new normal". We have offered to make some of our technical services available for COVID-19-related research, and were pleased to have been able to contribute 20,000 pairs of disposable gloves as part of a University-wide effort to provide protective equipment to hospital partners.

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As we head into the summer term and start looking ahead to the fall, there remains much uncertainty. However, the University is moving from crisis management mode to "restart and recovery" and a lot of thought is going into next steps, for health and safety, undergraduate teaching, graduate student support, research, operations, and more. I am sure we will continue to work together to address the complexity and challenges that still lie ahead. COVID-19 information and resources for the U of T community can be found at https://www.utoronto.ca/message-from-the-university-regarding-the-coronavirus.

Even without all the additional activity associated with COVID-19, much has been happening in the Department since the fall, including quite a few arrivals and departures.

This issue includes an interview with our newest faculty member, condensed matter physicist Thomas Scaffidi, who arrived last August. We are now looking forward to the arrival of Zhan Su, a new Assistant Professor in theoretical and computational ocean dynamics and climate who will join us on June 1st; his profile will be featured in a future newsletter.

We are delighted to welcome Carolyn Sealfon and Brian Wilson as Lecturers; both started on May 1st and bring extensive experience in physics education and physics education research. Two staff members have also joined our ranks: Bob Amos as the Department's newest machinist, and Michael Manley as the Department's new Manager, Finance and HR Administration.

The arrival of a new staff member usually results from the departure of another, in this case, the retirements of machinist Mark Aoshima and Finance Officer Ilda Cunha. After 45 years in the Department, Ilda's retirement marked the end of an era. She worked with ten Chairs – not quite as many as the Queen with her Prime Ministers, but close! We also said good-bye to Raul Cunha, who anchored our Graphics Support Services for many years, and to Librarian Dylanne Dearborn, who is starting a new job as Research Data Management coordinator for the UofT Library.

We were deeply saddened by the sudden and unexpected passing of Natalia Krasnopolskaia in January. Natalia was a valued member of our teaching staff for 18 years and is greatly missed. You can read about Natalia and her accomplishments in an accompanying tribute written by Jason Harlow. We are renaming the Summer Undergraduate Research Fellowship (SURF) in her honour.

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To introduce you to some other members of the Department, the newsletter includes profiles of Physics Specialist Eegene Clara Cheung, PhD Student Shira Jackson, and Post-Doctoral Fellow Karola Dette. Our Alumni Profile highlights Kirsten Vanstone, class of 9T4, who is a custodian of the Royal Canadian Institute archives.

There was a wealth of research news to choose from for Interactions and in the end, we decided to include all of our recent stories. We hope you enjoy reading about everything from icicles to neutrinos, a quantum start-up to a satellite instrument, hydrodynamic electrons to quantum spin liquids, and much more.

While COVID-19 resulted in the cancellation of Physics Colloquia, the Welsh Lectures, and on-campus activities planned for the spring and summer, there were plenty of events in the fall and winter. These included the Physics Mentorship Program, our Physics Career Accelerator Program, the 2019 J. Tuzo Wilson Lecture, and visits from several high school classes. One highlight was the 2020 Canadian Conference for Undergraduate Women in Physics, which our undergraduate students hosted in January. It was great to see 130 enthusiastic delegates from across the country attending talks and workshops and visiting our labs. Congratulations to all of the UofT undergraduate students involved in making this such a successful event!

With this issue, we have moved Interactions to an electronic format that is accessible and (we hope) more visually appealing, linked to the new Physics website that is currently under construction. However, the PDF version is still available for those who prefer it. Please send us your feedback and your news at newsletter@physics.utoronto.ca. We are always happy to hear from you!

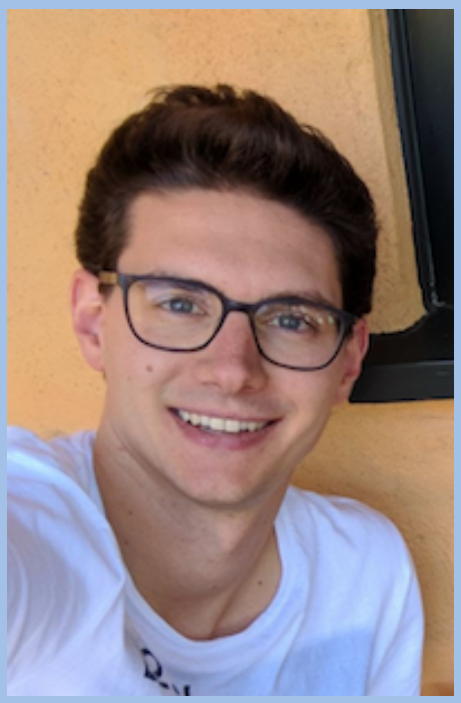
With very best wishes,
Kimberly Strong
Professor & Chair

Faculty Profile

Thomas Scaffidi

Assistant Professor

Theoretical Condensed Matter Physics



Welcome to the Department of Physics Dr. Scaffidi! Your undergraduate degree is in engineering we hear, what made you decide to switch to physics?

During the last year of my Bachelors Degree, I realized that I wanted to learn more about fundamental physics, and Quantum Mechanics in particular. So I decided to switch to Physics, and I have never regretted it. The transition was made easy because I was admitted into the "Selection Internationale" at Ecole Normale Superieure in Paris, a scholarship for international students which gave me a lot of freedom in terms of curriculum.

You did your PhD in Theoretical Physics at Oxford University. Can you tell our readers a little bit about your time there?

I had a great time in Oxford. One of the perks is that all students are members of a college, and that is a great way of meeting students from other departments. Research-wise, it was a fairly productive time for me, and several of my current areas of research started there, like superconductivity and topological phases of matter.

Your current area of research is in theoretical condensed matter physics, can you tell our readers what that is and some of its practical applications?

Physics is all about identifying universal patterns among the seemingly disparate zoology of particles and phenomena existing in Nature. The periodic table of elements and the standard model of particles are good examples of such a unified understanding. Yet, when a large number of microscopic particles interact with each other, like electrons in a solid, their behavior as a phase has to be described by a new, emergent theory. The next logical step is therefore to establish a "periodic table of phases of matter", for example, a classification of all the ways in which a macroscopic number of particles can behave.

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This is essentially what we do in condensed matter physics. Besides its fundamental importance, this classification is crucial for applied science as well, since newly discovered phases often have properties that are highly valuable for applications, from solar cells to superconductivity and quantum computing.The next logical step is therefore to establish a "periodic table of phases of matter", for example, a classification of all the ways in which a macroscopic number of particles can behave. This is essentially what we do in condensed matter physics. Besides its fundamental importance, this classification is crucial for applied science as well, since newly discovered phases often have properties that are highly valuable for applications, from solar cells to superconductivity and quantum computing.

In December 2019, a paper by you and your colleagues called “Visualizing Poiseuille flow of hydrodynamic electrons” appeared in Nature. What is the significance of this research?

In 99.99% of known metals, the resistance arises due to electrons scattering on defects or vibrations of the underlying solid lattice. This leads to the well known Ohm's law. Recently, it was realized that in materials with high purity and strong electron-electron correlations, the electrons instead behave like a fluid which flows down the wire, and for which the resistance is given by the viscosity of the electrons, and has nothing to do with the lattice anymore. This is interesting for several reasons. First of all, for viscous electrons, Ohm's law is supplanted by the much richer Navier-Stokes equation, which is known to lead to a plethora of exotic phenomena, like turbulence for example. Realizing these phenomena for electrons in a solid is not only interesting from a conceptual point of view, but could also have practical applications in electronic devices.

Our contribution was to provide the first direct imaging of such viscous flows of electrons, thanks to a comparison between measurements done in the group of Professor Shahal Ilani at the Weizmann Institute, and calculations performed in my group. These measurements were performed thanks to a single-electron transistor, which provide a way of measuring the electric potential on the sample with an extremely high spatial resolution.

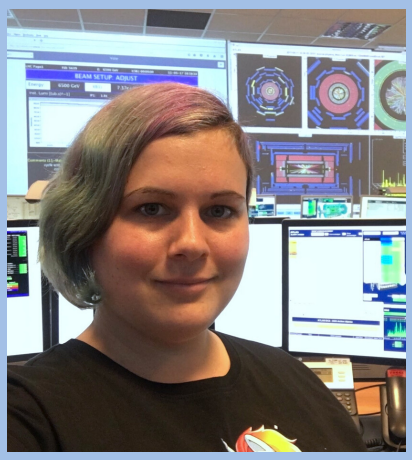
Finally, what can we look forward to seeing from the Scaffidi group this year in terms of research?

My group and I are still working on viscous flows of electrons, and in particular the non-linear regime which appears in the case of large current density. We are also developing a new class of wave functions for electronic systems in the presence of strong disorder and correlations. Interestingly, these wave functions are reminiscent of coupled cluster states, which have been very useful for the study of molecules in quantum chemistry. Finally, we are working on new models for unconventional superconductors, and especially on how to stabilize new superconducting phases by deforming them in various directions.

Post-Doctoral Fellow Profile

Karola Dette

High Energy Physics

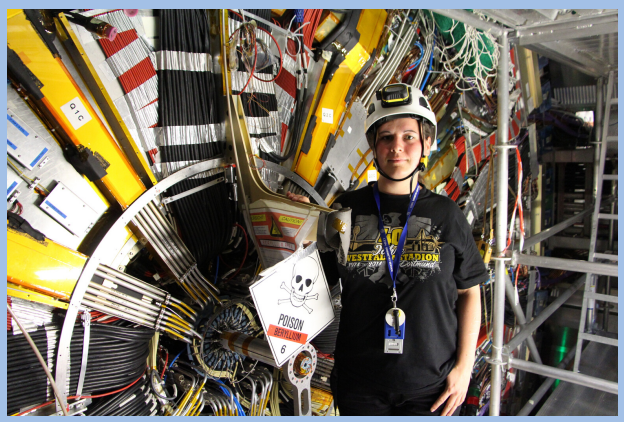


Dr. Karola Dette has been a Post-Doctoral Fellow at the University of Toronto since 2017 working for the High Energy Physics group. She joined the ATLAS collaboration in 2012 as a Master's student with the University of Dortmund, followed by a PhD for which she moved to CERN. During her PhD time she got involved in the operation of the ATLAS detector, acting as shift leader for the whole ATLAS detector for the Large Haldron Collider (LHC) as well as on-call expert for the pixel detector.

She currently works on developing and testing hardware for the next upgrade of the ATLAS tracking system. The more particle collisions the LHC is able to produce, the faster and more precise ATLAS needs to be in order to keep up! "I think it is extremely fascinating to know that tracking modules that I've built with my own hands will be installed inside the ATLAS detector and will gather data for thousands of physicists to work with!"

Karola loves to spark an interest for science in people. She's given talks at the Ontario Science Center that introduced school kids to the work people do at ATLAS and she tries from time to time to provide more insight into her work through her Instagram @particlefairy.

Apart from science, Karola is a huge football fan and has been to matches in over 15 different countries so far. She tries to watch every match of Borussia Dortmund if possible, although living in Canada means she can only watch most of them on TV now.

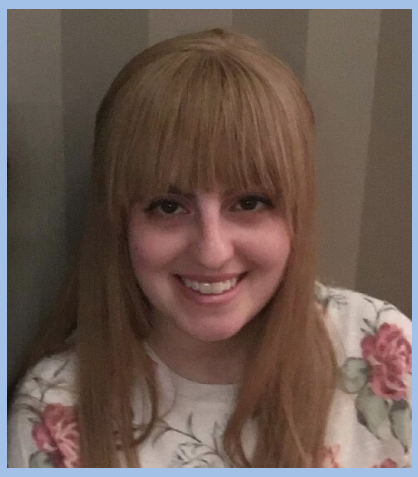


Left: Karola inside the ATLAS detector: This picture was taken in 2014 in the heart of the ATLAS detector 100 m below ground. During that time Karola was involved with the installation of a new innermost tracking layer, the so-called Insertable-B-Layer (IBL). During that time the LHC was shut down, allowing physicists to work inside the huge underground detectors, repairing and upgrading them.

Graduate Student Profile

Shira Jackson

PhD Student



Shira has been fascinated with physics since her first introduction to the subject in high school. She was inspired by the way physics artfully weaves together intuitive science with elegant mathematics.

Shira completed her undergraduate degree in physics at York University. In her second year of undergraduate studies Shira took a part-time job as a supply teacher, teaching Grade 11 and Grade 12 physics for four months. She loved communicating science and enjoyed the challenge of making difficult subject matter understandable to each student. Their joy and wonder as they discovered physics for the first time reinforced her own passion for the subject, but also convinced her that she wanted to pursue physics at a higher level.

Her interest in experimental physics, and in particular in the field of optics, was sparked by a summer research project she did at York University developing a new free-space optical tweezers experiment for use in an undergraduate laboratory. She relished the opportunity to apply her theoretical knowledge by working with her hands to bring physics to life.

Shira is currently working with Professor Amar Vutha, on the development of a compact optical atomic clock. Optical clocks are the most precise measurement device in existence today. Such precise devices are important to find evidence of exotic new physics that is only apparent on a very small scale.

Optical clocks can be used to search for dark matter and dark energy, to detect gravitational waves and to do ultra-precise surveys of the earth's gravitational potential. Precise atomic clocks are also an essential component of the new SI system of units, where almost every physical quantity is related to the precise measurement of time. They will likely be used to form a global network of synchronized clocks and serve as the foundation for the new definition of the SI second in the future. However, the most precise optical clocks that exist today are not ideal for field applications, due to their size and complexity. Shira is working to develop an optical atomic clock that is both precise enough for these applications and compact enough to be portable. Scaling something down from the size of a room (or two) to the size of a box is a fun challenge that requires a lot of ingenuity!

When Shira is not in the lab playing with lasers, vacuum systems, and electronics, she is very busy at home with her two little children! Her daughter Devora is 3 years old and her son Akiva is 2 years old. Their favourite book is Goodnight Lab (by Chris Ferrie) where they get a glimpse into what it’s like to be an experimental scientist!

Undergraduate Student Profile

Eegene Clara Cheung

Physics Specialist

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

It was a decision kind of out of nowhere. I went to an arts-specialized high school and seriously considered pursuing a degree in music but I wanted to try something new.

I've always been interested in the origin of the universe, what things are made of, the Big Bang, special relativity etc. My scope of physics knowledge wasn't quite wide back then. I was mostly inspired by my father, who does physics education and my brother, who went to U of T for math and physics. I guess I wanted to know what all the fun was about in physics.

What do you enjoy most about the physics program?

I just love the physics itself. But the rigor that the physics courses are taught and the wide range of undergraduate research opportunities that are available were really what made me realize this. It may be stressful during the school year, but when I take a step back and think about how much I have learned, it gives me the chills. I also love doing physics research, and without so many opportunities that were accessible to me through the department and the program, I would have had a harder time realizing this. In particular, I really value my first research experience through the SURF program founded by
Prof. Natalia Krasnopolskaia, who was also my supervisor for the project. As a first year student, it was an incredible first exposure to physics research that I would have not been otherwise able to experience elsewhere with such little physics knowledge.

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What other extra-curricular activities are you involved in during your degree?
In my first year, I became in charge of organizing a high school physics competition called the Canadian Young Physicists' Tournament (CaYPT), which was a newly formed national platform for the much more renown International Young Physicist's Tournament (IYPT). Founded in 1988, the IYPT garnered the attention of many European physics education communities by its unique approach to a research-based physics competition. Leading up to the actual tournament which resembles a cross between a debate, a PhD defense, and a strategic game of some sort, the high school students form teams of 3-5 and tackle 17 open ended everyday physics problems.

They spend several months coming up with mathematical models investigating these relevant parameters, designing and carrying out experiments, analyzing the data, and putting together a presentation of their solution. During the tournament, the teams present their solutions and critique other teams', and the level of understanding and the quality of the debates are graded by a Jury of international physics experts.

This year I had a new commitment in hosting the Canadian Conference for Undergraduate Women in Physics (CCWUiP) 2020 here at the Department of Physics. Along with the two co-chairs, Kaitlyn Liang and Emily Knuckey, and the rest of the executive team, we worked tirelessly for almost an entire year to make this conference come to life. The conference had a special meaning to us, because it put forward the issues that were important to us such as the struggles that we personally face as women and a minority in physics. The conference was designed to provide a safe and inclusive environment for the underrepresented members in the physics community including women, LGBTQ+, persons of colour, and those with accessibility needs to discuss ways of combating issues such as sexism, racism, mental health, and imposter syndrome. Of course, physics was, by nature, the most prominent topic: the delegates attended plenary lectures and panel discussions focused on physics and careers that one can pursue with a physics degree, as well as have the opportunity to present their research via a poster presentation or a talk. In addition, to fully commit to the safety and inclusive concerns, we implemented a strict single-bed policy for the hotel accommodations we provided, which was not in place before nor is present at most conferences. However, being in downtown Toronto, this was not cheap – the committee is incredibly grateful for the Dunlap Institute in helping us to actually achieve this goal without compromising the quality of the conference.

Organizing this conference was by no means a smooth ride. From smaller things like registration troubles and juggling school work with conference work, to bigger things like our special guest, the Minister of Science and Education, suddenly being unable to attend the conference, booking rooms for the wrong date, and Toronto's weather which seemed to have saved up all its snow for that particular weekend. But compared to the past years' CCUWiP troubles which include flooding, the troubles we have faced were quite minimal and were handled extremely well by the competent committee.

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The conference was all in all, a complete success, with delegates personally coming up to us to tell us how much they were enjoying it and how much they've learned from it. (Please see page 20for more on the CCUWiP)

Apart from these rather large scale extra-curricular activities, I like to volunteer for the outreach events held at the department, such as Science Rendezvous and Doors Open Toronto.

Outside of physics, I played the flute with the Wind Symphony at the Faculty of Music in my first year, played the flute and piccolo as the Assistant Principal of Hart House Orchestra in my second year, and in third and fourth year, taekwondo with the UTTO. I have been meaning to get my ARCT in flute performance, sporadically getting lessons from Prof. Camille Watts (Faculty of Music & TSO). Though lately, it has been put on hold indefinitely.

What are your research interests?

I am interested in condensed matter physics.

What is your favorite course and why?

I absolutely loved Prof. Hae Young Kee's Atoms Molecules and Solids (PHY358) course. I was already extremely interested in quantum mechanics, but what made me truly appreciate it was its applications to the everyday life. Through this course I realized I was interested in the quantum mechanics of objects around me, but how these abstract theories have real and observable consequences, such as a material's electric or magnetic properties, was what really got me into condensed matter physics.

What are your future plans? Where do you see yourself in 10 years?

I am going to pursue a PhD in physics then we'll see from there! I love research, so whether it be researching as a professor at a university, as a researcher at an institute or a national lab, or in industry, I see myself doing research in or related to condensed matter physics in the near and far future. Hopefully in 10 years, I have figured out which of these I am doing.

Alumni Profile

Kirsten Vanstone

9T4

Kirsten followed her interest in science and, in particular, all things space, to pursue undergraduate studies in physics and astronomy. During this time, she was drawn to communicating science, taking opportunities to participate in departmental public outreach events. After first year, she got a job as a Host at the Ontario Science Centre that cemented her career path. A few years after graduating, she took a job as the Astronomy Educator at the California Academy of Sciences' Morrison Planetarium in San Francisco.

During this time, she began a Masters degree in Science Communication, then returned to Toronto, working in energy communications, math education, museum education and in non-profit management. She is now the Executive Director of the Royal Canadian Institute for Science, Canada's oldest, public scientific society. In this role, she oversees one of the longest-running science outreach programs in Canada, running since the early 1900s.

Studying physics provided Kirsten with a perspective that differed from that of a lot of her peers. Physics degrees aren't as common, or weren't at the time, so it stood out and gave her an advantage dealing with certain topics, especially energy and electricity. On a higher level, solving problems by breaking them down to their component parts is a skill she uses every day. As is the collaborative problem-solving that she learned as a physics student. Lab skills made her comfortable setting up equipment, using tools, coding and learning from failed experiments. Also, the Physics & Astronomy Departments did a lot of public outreach events which helped start Kirsten on this career path.

In her current job, Kirsten is the custodian of the Royal Canadian Institute's early publications, dating back to the 1850s. She enjoys combing through them, piecing together the physics of the time as it appeared in those public-facing journals, including during the Presidency of Sir John Cunningham McLennan, in 1916-17, and of course, Helen Sawyer Hogg in 1964-65.

Interactions encourages all alumni to reach out and tell us what they are up to.
Email: newsletter@physics.utoronto.ca
Let us know where your physics degree took you!

Research in the News

2019 William T. Pecora Team Award

Professor Emeritus James R. Drummond is a member of the Terra satellite team which received the 2019 William T. Pecora Team Award in early October. The Pecora award is sponsored by the U.S. Department of the Interior and the National Aeronautics and Space Administration. It is presented annually to recognize outstanding contributions by individuals or teams using remote sensing to understand the Earth, educate the next generation of scientists, inform decision makers or support natural or human-induced disaster response.

The citation for this award (https://www.usgs.gov/news/pecora-award-honors-excellence-earth-observation-0) notes that "Terra is arguably one of the most successful Earth-sensing satellites ever deployed." Terra was launched in December 1999 carrying a suite of instruments to study the Earth-atmosphere system. One of these is the Measurement of Pollution in the Troposphere (MOPITT) instrument (https://mopitt.physics.utoronto.ca/).

MOPITT was conceived by Prof. Drummond, funded by the Canadian Space Agency, built by four Canadian companies, and tested in the Space Instrument Characterization Facility in the basement of the Physics Department with the help of a small army of students, postdocs, and technical staff. As noted in the citation, MOPITT was the first instrument "designed to observe the distribution and transport of tropospheric carbon monoxide and, along with other sensors, has helped advance our understanding of air quality and biomass burning emissions."

MOPITT – Measuring Pollution in the Troposphere for 20 Years

"Most scientific projects run for a few years and then the people involved move on to something else. The Measurements Of Pollution in The Troposphere (MOPITT) project has been running for over 30 years and on December 18th, 2019 we are celebrating the 20th anniversary of the launch of the MOPITT satellite instrument.

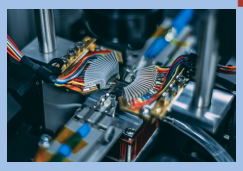
This is a Canadian story since the instrument was designed and built in the country. It was then passed to NASA who put it into the Terra satellite and launched it on December 18th, 1999, 18:57:39 UTC.

On that day we had all hoped that ten years of planning were going to successfully pay off. There were five instruments on the satellite, ASTER (Japanese), CERES, MISR, MODIS and MOPITT (Canada). The mission was expected to last five years – and I have always wondered whether the planning people were Trekkies ("These are the voyages of the Starship Terra. Its five-year mission: to explore strange new worlds....")...."

Read the full article written by Professor Emeritus James R. Drummond for the Canadian Meteorological and Oceanographic Society Bulletin:
https://bulletin.cmos.ca/mopitt-20-years/

Research in the News

A Toronto startup with roots at U of T hopes to catch the next big wave in computing



One Toronto-based startup, Xanadu, is betting on a branch of quantum computing known as “photonics,” which harnesses particles of light, or photons, to manipulate quantum information. In its lab on the 29th floor of a downtown Toronto office tower, the company’s scientists work at dust-free tables chock-a-block with lenses, mirrors and fibre-optic cables, manipulating light at the quantum level to encode and process information. More than a dozen physicists at Xanadu have links with the Department of Physics. Some are former graduate students, undergraduate students, or postdoctoral fellows. Others are current graduate students involved in Xanadu’s research. Professor John Sipe is one of the company’s technical advisers.

Read the full article here:
https://www.physics.utoronto.ca/a-toronto-startup-with-roots-at-u-of-t-hopes-to-catch-the-next-big-wave-in-computing

Visualizing Poiseuille Flow of Hydrodynamic Electrons

In a theory-experiment collaboration, Professor Thomas Scaffidi and colleagues observed for the first time a completely new regime of transport in which the electrons behave like a viscous fluid, flowing down the wire.

The story was also featured in a News and Views in Nature.

The experiments were done at the Weizmann institute in the group of Shahal Ilani, and the theoretical calculations were performed at the University of Toronto in the group of Thomas Scaffidi.

Read the full article here:
https://www.physics.utoronto.ca/visualizing-poiseuille-flow-of-hydrodynamic-electrons

Research in the News

Professor Morris was featured on the CBC on Jan 28, 2020 for building an outdoor icicle machine in the backyard of artist Ron Wild

Operating the machine is a project of Ron Wild — a digital artist who considers himself a "citizen scientist" — and his friend and collaborator Stephen Morris, a University of Toronto physics professor who has been studying icicles for many years and compiling findings in an icicle atlas.

Morris typically grows his icicles in his lab, but has also been growing them on his porch for the last two winters, using an outdoor version of the lab machine. This year Morris is away in British Columbia, so Wild has been babysitting — and experimenting.

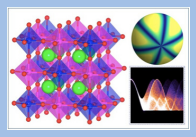
Read the full article here
https://www.cbc.ca/news/canada/toronto/icicle-machine-toronto-1.5439862

Professor Aephraim Steinberg Explains Quantum Mechanics to Macleans Magazine

Department of Physics Professor Steinberg was interviewed by Macleans magazine in January 2020. After decades of experimentation, billions of dollars in investment across the globe and gut-wrenching uncertainty about whether it was even physically possible, we've proven a quantum computer can work.

Read the article here:
https://www.physics.utoronto.ca/professor-aephraim-steinberg-explains-quantum-mechanics-to-macleans-magazine

Professor Paramekanti and Collaborators Discover New Octupolar Magnets

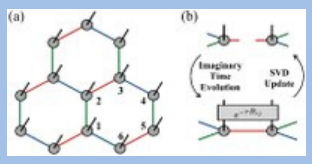


Magnetic solids derive their properties from the magnetic dipole moment of the electrons in the crystal. However, when many electrons interact, they can lead to new types of ordering arising from higher-rank multipole moments.

Read the full article here:
https://www.physics.utoronto.ca/professor-paramekanti-and-his-collaborators-work-on-memories-and-information-storage-published-in-two-recent-papers

Research in the News

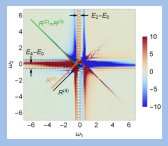
Magnetic Field Induced Quantum Phases in a Tensor Network Study of Kitaev Magnets



In a recent published article in Nature Communication, a team of researchers from University of Tokyo and University of Toronto led by Professor Yong Baek Kim reported the discovery of a novel quantum ground state in theoretical models designed for the so-called Kitaev magnets in external magnetic field. They used the tensor-network approach, a quantum-information inspired method, to demonstrate the existence of the nematic paramagnet. Such novel ground states break the lattice rotational symmetry spontaneously and may be relevant to a series of remarkable recent experiments done on this class of materials.

Read the full the article here:
https://rdcu.be/b3mMG

Theory of Two-Dimensional Nonlinear Spectroscopy for the Kitaev Spin Liquid



Mr Wonjune Choi and his Ph.D. supervisor Professor Yong Baek Kim proposed a new two-dimensional non-linear spectroscopy method for unambiguous detection of fractionalized particles in quantum spin liquids.

Using the exactly solvable model of quantum spin liquids, they demonstrated that higher-order two-dimensional non-linear susceptibilities would show sharp signatures of Majorana fermions, elusive particles that exist in quantum spin liquids, in contrast to conventional spectroscopic methods. This work is recently published in Physical Review Letters.

The link to the paper is as follows:
https://journals.aps.org/prl/abstract/10.1103/PhysRevLett.124.117205

Do Neutrinos Crack Nature's Mirror?

Emeritus Professor John Martin, former professor Hiro Tanaka (now at Stanford) and his senior UofT PhD student Trevor Towstego are among the nearly 500 authors of a Nature paper from the T2K experiment published today, which presents results giving the strongest constraint yet on the so-called CP phase governing the breaking of symmetry between matter and antimatter in neutrino oscillations.

Read the full article here:
https://www.physics.utoronto.ca/t2k-experiment-published-in-nature

Research

Measuring Atmospheric Trace Gases Near the Top of the World

By Ellen Eckert

For just over two decades,students and postdocs working with Professors Kimberly Strong and Kaley Walker have traveled to Eureka, Nunavut, in the Canadian High Arctic (80˚N) each spring to collect unique measurements of atmospheric trace gases.

This year's campaign team included six early career scientists from U of T, namely graduate students Ramina Alwarda, Kristof Bognar, Beatriz Herrera Gutierrez, and Tyler Wizenberg, and postdoctoral fellows Ellen Eckert and Ali Jalali. Joined by U of T Senior Research Associate and PEARL Site Manager Dr. Pierre Fogal, Operator John Gallagher, Research Associate Dr. Alexey Tikhomirov from Dalhousie University, and Professor Emeritus Tom McElroy from York University, they had the extraordinary opportunity to work with a wide suite of instruments at the Polar Environment Atmospheric Research Laboratory (PEARL). The intensive phase of the campaign took place from 21 February to 12 March this year, and yielded many valuable measurements that are being used to validate satellite data products and to investigate a variety of atmospheric phenomena. This year was particularly interesting, as we observed record low Arctic ozone; the team is currently analyzing these results to understand why conditions were so different this year.

The team stopping at the 80˚N sign on the way from Eureka to the Ridge Laboratory: in back row (from left): Pierre Fogal, Alexey Tikhomirov, Kristof Bognar, Tom McElroy, Ali Jalali, Tyler Wizenberg; in front row (from left): John Gallagher, Ellen Eckert, Ramina Alwarda, Beatriz Herrera Gutierrez (photo credit: Pierre Fogal).

But why go to this remote location and why do it at this time of the year? PEARL in a sweet spot for atmospheric research for several reasons: it is located in an area of the world that is crucial for understanding the global atmosphere and there are no other stations anywhere near, as the polar regions are severely under-sampled. Another reason is that satellites that have high inclination orbits, like the Canadian-led Atmospheric Chemistry Experiment, frequently pass over this area, which makes it a great location for validation studies. The spring campaigns coincide with when the transition from polar night to midnight sun occurs. This transition only takes about seven weeks at Eureka. Since some of the instruments operate at night and some need sunlight to operate, this time of year is ideal for comparisons between the different instruments to determine if there are biases between their measurements.

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When the team arrived at Eureka this year, the Sun was only above the horizon for about two hours, while when they left, daylight hours had exceeded nine hours. The team lives at Environment and Climate Change Canada's Eureka Weather Station, where they enjoy the hospitality of the permanent staff, the amazing food and recreational activities. To do their research,the team members head up to the PEARL Ridge Laboratory each day, where most of the instruments are located, to take measurements. They also perform maintenance and repair tasks when necessary. This work can be interrupted by poor weather such as storms, so the team must always be aware of the meteorological conditions.

Ramina Alwarda and Kristof Bognar troubleshooting the PEARL-GBS suntracker, located on the roof of the PEARL Ridge Lab (photo credit: Ellen Eckert).

Working in the high Arctic is challenging but very rewarding. Temperatures of -40°C and lower mean that seemingly simple tasks such as tightening screws and adjusting components need to be done quickly and carefully, with fingers well protected.

The cold takes its toll on the instruments as well, but the lab is well stocked with tools and spare parts so things can often be fixed on site. On rarer occasions, specific spare parts are shipped up north and instruments are sometimes taken south for major repairs. This year's campaign was a great success, as the team was able to get all the instruments running and to keep them collecting data that will provide insight into Arctic atmospheric phenomena.

Visiting Eureka is a unique and fantastic experience,not only for the scientific research, but also for the mind-blowing scenery and the wildlife that sometimes crosses the team's path. This year,we were lucky to encounter a couple of foxes close to the Ridge Laboratory, a musk ox that had made itself comfortable around the Eureka Weather Station, and even a pack of wolves that strolled through the station on the last day of the campaign.

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Wildlife in Eureka (left to right): Arctic fox, musk ox, and wolf (photo credits (left to right): Ellen Eckert, Guillaume Gamache, and Ramina Alwarda).

In addition, the students and postdocs got the chance to learn about amateur radio as Pierre and Alexey, who are both licensed amateur radio operators, participated in a contest this year and happily shared their knowledge with the rest of the team.

For more details on the campaign, please check out our website:
https://eureka.physics.utoronto.ca/index.html

The spring 2020 measurements at PEARL were made during the Canadian Arctic ACE/OSIRIS Validation Campaign, supported by the Canadian Network for Detection of Atmospheric Change (CANDAC), the Canadian Space Agency, Environment and Climate Change Canada, NSERC, and the Northern Scientific Training Program.

View from an iceberg stuck in the fiord at Eureka. The optical phenomenon on the right of the Sun is called a sundog and is caused by ice crystals in the atmosphere (photo credit: Ellen Eckert).

UofT team members joining Dr. Pierre Fogal in the radio room at PEARL (photo credit: Ramina Alwarda).

Conferences

2020 Canadian Conference for Undergraduate Women in Physics

The Canadian Conference for Undergraduate Women in Physics (CCUWiP) is an annual conference that has been running since 2014. This year, it was hosted here at the University of Toronto from January 17-19, gathering participants from all over Canada. With 130 registered delegates, the conference bustled with physics undergraduates of all genders participating in the various panels, lectures, and workshops offered.

Delegates had the opportunity to network with fellow undergraduates, physicists hailing from various disciplines, and industry professionals. Through the physics and career panels, delegates explored the possible options open to them with their undergraduate physics degree.

Workshops ranging from cloud chambers to research presentation skills to mental health provided a diverse range of topics for the delegates to explore in smaller groups. As many physics conferences focus on just the physics, CCUWiP aimed to also provide time to discuss many issues that minorities in physics communities face. For many delegates in attendance, this was their first opportunity to meet others like them as they come from much smaller colleges or universities.

Running with tradition, a guided discussion on imposter syndrome was led by Renee-Michelle Goertzen; the representative from the American Physical Society (APS). This topic came up multiple times throughout the conference with people in all stages of their careers expressing the feelings associated with imposter syndrome. One of the main steps in overcoming imposter syndrome is having discussions like these that help to foster a supportive environment.

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The CCUWiP is a part of a series of conferences in the United States, respectively called the Conference for Undergraduate Women in Physics (CUWiP).

On Saturday January 18 at 2pm, all thirteen sites connected via teleconference for a keynote lecture from Professor Andrea Liu. Professor Liu is a theoretical soft and living matter physicist at the Department of Physics and Astronomy at the University of Pennsylvania. She discussed her work and the waving path that brought her to her current position.

The Saturday of the conference came to an end with a banquet dinner held at the MaRS Discovery District. Here delegates ate and chatted away with new friends they had made while also taking advantage of another opportunity to connect with speakers and guests from the conference one-on-one. Professor Kim Strong delivered the banquet talk on some of her own work in studying the atmosphere, sharing tales of a certain pesky stratospheric balloon that ran a course much different than expected.

This conference was run by undergraduates from the University of Toronto St. George and Mississauga campus. The hard work of Aimen Malik, Avani Bhardwaj, Azima Trannum, Baria Khan, Fayez Habach, Hazen Lin, Julia Louis, Kuunal Mahtani, Lucy Liu, Masha Novoselova, Myia Rose, Rica Cruz, Serene Shum, Sue Kim, Summer Lim, and Yan Li made this conference possible. The co-chairs Clara Chung, Emily Knuckey, and Kaitlyn Liang were incredibly proud to see how the physics community at the University of Toronto came together to make this conference such a success.

Kimberly Strong speaking
at the CCUWiP conference banquet

Rica Cruz, Summer Lim, Baria Shafiq, Clara Chung, Emily Knuckey, Kaitlyn Liang, Masha Novoselova, Yan Li, Lucy Liu and Kuunal Mahtani

Events

Physics Mentorship Program Launch Party
November 13, 2019

The launch party for the Physics Mentorship Program was held in November 2019.

The Physics Mentorship Program pairs up undergraduate physics students with alumni, faculty or graduate student mentors. Mentors provide students with career and academic advice throughout the academic year.

Photos from the Mentorship Program Launch Party

The 2019-2020 Physics Mentorship Program wrapped up in March 2020 and 49 pairs of mentors and mentees participated in the program.

It was another successful year for the program. Here is what some mentees had to say about what they liked the best about the program:

- *It connects student (at the beginning of a journey) directly to people who have reached the goal. By sharing their experience and giving advice mentors help avoiding the obstacles.*
- *How appropriate the pairing of my mentor and I was. How there were so many opportunities outside of my talks with my mentor in improving other aspects of my job hunting experience (the mentor parties, the LinkedIn workshops, etc.).*
- *The mentor works in the area I am interested in. So he can give me most recent and accurate information that cannot be known from other sources.*
- *I had a mentor to talk to when the academic term got rough and seek advice from, for example, regarding managing time and stress.*

Events

physCAP Career Events

The Physics Career Accelerator Program or physCAP organized two career enhancing events for undergraduate students this past year. The purpose of these events was to show students what they can do with a degree in physics. Physics alumni with various career paths sat on a panel and shared their career stories with students and answered a wide variety of questions.

Professional Schools Event
November 27, 2019

The Professional Schools Event invited speakers with undergraduate degrees in physics who applied to Professional or Graduate School after their physics degrees. For example, in the photo above from left to right David Han (Dental School), Jane Dong (Master in Management and Innovation), Kristen Cote (PhD Experimental Quantum Optics) and Felipe Morgado (PhD in Medical Physics Faculty of Medicine's MD/PhD program.

Career Event
January 30, 2020

The Career Event invited speakers with undergraduate degrees in physics who are working in fields that students may never have thought were possible with a degree in phyics. For example, from left to right, Kirsten Vanstone (Science Communication), Daniel Badali (Consultant), Peter Hurley (CAO of the U of T Physics Department) and Stephen Leonard (Entrepeneur).

Want to be a mentor or sit on a career panel? Contact:
mentorship@physics.utoronto.ca

Events

2019 Tuzo Wilson Lecture

The 2019 Tuzo Wilson Lecture was held on November 19, 2019. The speaker was the new J. Tuzo Wilson Professor Qinya Liu. As per tradition, the newest J.Tuzo Wilson Professor delivers the first talk at the start of their professorship. The lecture was titled: Exploring the Earth's Interior by Seismic Waves.

The Isabel Bader Theatre was full with members of the physics community as well as members of the public.

When asked what it was like to deliver the first lecture of her professorship, Professor Liu told us:
"It was exciting to deliver my first public Tuzo lecture and see our colleagues, students and old friends of the departments come together to hear more about earth science and commemorate the long-lasting scientific legacy of Prof. J. Tuzo Wilson. I will start to organize future Tuzo Wilson Lectures in the next four years. We welcome any suggestions of speakers from our community and will try our best to bring more exciting earth science to UofT."

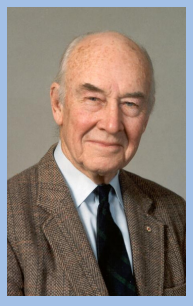
To watch Professor Liu's talk on Seismic Waves, visit:
https://www.youtube.com/watch?v=iW2blH67dIk

Photo left to right - Chair Strong and Professor Liu

About the Tuzo Wilson Lecture

The annual Tuzo Wilson Lecture commemorates the life and work of J. Tuzo Wilson (1908-1993), one of the great earth scientists of his time, and one of the founders of Geophysics in Canada.

The J. Tuzo Wilson Professorship in Geophysics was established in 1995 in his honour.



J. Tuzo Wilson

Outreach in Action

School Visits

Throughout the year, high schools visit the Department of Physics for workshops and tours. The purpose of these visits is to provide students with a day or half day at U of T. Students participate in hands-on activities, lab tours and campus.

We hope these visits inspire some future physicists!

Below are pictures from some of the Fall 2019 visits.

Albert Campbell Collegiate Institute, Scarborough

Garth Webb Secondary School, Oakville

R.H. King Academy, Scarborough

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

November 2019 - PhD Graduates

Convocation, November 2019
Xin Song, Greg Gomes, Andrei Vovk, Jesse Cresswell, Erfan Shalchian, Matthew Badali, Erik Lutsch, Lai Chung Liu

Song, Xin - Seismic Array Imaging of South-Central Alaska Subduction Zone Based on Teleseismic Body Waves: from Finite-Frequency Tomography to Full-Waveform Inversions (supervisor Q. Liu)

Gomes, Greg - An Integrative Modelling Approach for Disordered Proteins Using Single-Molecule Fluorescence Spectroscopy (supervisor C. Gradinaru)

Cresswell, Jesse - Quantum Information Approaches to Quantum Gravity (supervisor A.W. Peet)

Shalchian-Tabrizi, Erfan - A Convergent Continuum Strong Coupling Expansion for Quantum Mechanics & Quantum Field Theory/String Tentions in Deformed Yang-Mills Theory (supervisor E. Poppitz)

Badali, Matthew - Extinction, Fixation and Invasion in an Ecological Niche (supervisor A. Zilman)

Lutsch, Erik - The Influence of Biomass Burning on the Arctic Atmosphere (supervisor K. Strong)

Liu, Lai Chung - Chemistry in Action: Making Molecular Movies with Ultrafast Electron Diffraction and Data Science (supervisor R.J.D. Miller)

In Memoriam

Natalia Krasnopolskaia

July 16, 1955 - January 30, 2020

Natalia started at the physics department at the University of Toronto in September 2002. Over the years she taught many first year physics courses, PHY291H1S “Quantum Mechanics I” for Engineering Sciences, PHY385 “Introduction to Optics”, and she has been a lead instructor in the Advanced Laboratories, including being the Advanced Laboratory Coordinator from 2007 to 2010.

Natalia was also the Physics Olympiad Preparation Program (POPTOR) coordinator from 2003 through 2013. This was our major high school outreach program for many years.

As coordinator, she planned, advertised and ran the program, drawing 10-20 outstanding high school students per year into our department to work on exam problems and laboratory experiments under her supervision.

In 2011 and 2012, Natalia involved a total of 45 first-year undergraduates in the planning and delivery of the POPTOR program. The undergraduate students prepared experiments, created problem sets and conducted classes and practical sessions with the high school students. Results of this two-year project were reported in a talk at the 2013 Canadian Association of Physics Congress in Montréal, “Involving the 1st Year Students in Teaching and Research Activities in Physics.”

Natalia was an Advanced Undergraduate Laboratory Instructor multiple times during the period 2013-2020, and was the course Coordinator in 2016-2017. This is a demanding position that involves one-on-one student mentorship, as well as maintaining and updating over 35 different experiments in condensed matter, optics and high energy physics. Her colleagues speak very highly of her “hard work, outstanding organization, enthusiasm for physics and caring attitude.”

Between 2011 and 2017, Natalia supervised 19 students in the Summer Undergraduate Research Fellowship (SURF) program. These students helped to develop experiments for the Advanced Labs and Second Year Labs. Several of these projects lead to posters at the Canadian Undergraduate Physics Conference (CUPC).

The department is planning to rename the SURF program in honour of Natalia. Natalia will be sorely missed for many years to come around here.

Written by Jason Harlow.

Retirements

Mark Aoshima

Machine Shop

Left to Right : Mark Aoshima and David Rogerson

Congratulations to Mark Aoshima on his recent retirement!

As a long-standing and valued member of the machine shop, Mark made a wide range of scientific instruments for researchers across the Department of Physics.

Mark trained at Hammamatsu Vocational Training Institute in Japan and he then developed his skills at the NTN Bearing Company, where he made the machines that made some of the highest precision bearings in the world. After coming to Canada he continued to work for NTN in Mississauga and then moved on to other machine-manufacturing companies, including Questa Design, where he made equipment for geophysical exploration, and JIT Automation.

Mark joined the Department of Physics in 2005 and immediately brought his love of precision machining to bear on a wide range of projects. His extensive experience made him an excellent collaborator for students and staff, he was always eager to suggest design improvements and to find better solutions to our problems. Those of us who worked frequently with Mark got into the habit of bringing him rather vague designs, in which the purpose was (hopefully) clearer than the drawing and letting him suggest improvements. This produced much better results than relying on our own design ideas.

In his quest for the ultimate precision, Mark always asked for the best possible tools and his bench in the workshop was a well-organized Aladdin's cave of machine tools, specialized metals and prototypes for projects he had made over the years.

Mark's work contributed to the success of many research projects in the Department and his cheerful smile and machining skills will be missed.

Mark, we wish you the best for a long and happy retirement.

Written by Stephen Julian.

Retirements

Ilda Cunha

Finance

Ilda Cunha, a well-loved member at the Physics Department for 45 years retired in January 2020.

Professor Mike Luke described Ilda and her contributions to the Department at a celebration held during the December Holiday Party. His speech is below.

When Kim Strong announced at a faculty meeting in the fall that Ilda was going to be retiring at the end of the year, an audible gasp arose amongst the assembled faculty. I think the truth is, none of us had really ever contemplated living in a post-Ilda world. Ilda is an institution.

Ilda started at U of T and Physics on July 1, 1975. She initially worked in the Main Office, which at that time handled much more of the Departmental finances. After various promotions in between, in 1986 she took over her current position, and over the following years both she and her position were regularly promoted together - that is, the role of financial officer in Physics got increasingly more complex, and her position was continually upgraded in response.

By the time she retired, Ilda and her team, Aloma and Lisa, processed ten budget plans each year, along with more than 100 research grants, almost $2 million in operating budget recoveries, 7 trust accounts, 7 Canada Research Chairs and payroll for 41 faculty, 45 post docs and research associates, 36 staff, more than 50 summer students and casuals, and over 42,000 financial transactions and purchase orders. Despite this workload, Ilda's budget reports, budget analyses and her supporting documentation were invariably impeccable.

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Most people in the Department know Ilda as the person who makes sure they get paid, solves their grant problems and generally makes sense of their financial life in the Department, but I'd like to especially thank her on behalf of one group who have had a particularly close relationship with her - Department Chairs, past and present. She's been through a lot of us - Dick Azuma, Mike Walker, Derek York, Tony Key, Pekka Sinervo, Henry van Driel, me, Dick Bailey, Stephen Julian and now Kim Strong - you may have noticed in her office she has a poster of all of us, our heads mounted on her wall, like trophies.

She also has a secret door into the Chair's office, which I think is a great metaphor for the relationship. She never let me miss a deadline - even if that meant hovering behind me from her secret door - and I think I speak for all of the Chairs when I say thank you for making our jobs so much easier.

A few years ago we nominated Ilda for a Dean's Outstanding Administrative Service Award from the Faculty of Arts and Science (which, of course, she won). As part of that, I gathered testimonials from people she worked with, and to conclude, I'd like to read a few of them:

"I cannot imagine a better performing Finance Officer … She is simply superb at what she does, and I think the university should continue to do everything in its power to continue to support her in her current role."

"Whenever there is a problem related to my funds, I speak to Ilda first because I know that I will get an explanation – and solution – I will understand … I simply cannot imagine a better performing Finance Officer."

"She has never been anything but generous with her time even when seemingly inundated with pressing deadlines."

"She always keeps her calm and good humour. She has absolute competence in everything I am aware of. I rely on her constantly."

Also, from someone in the Dean's office, "I wish we had someone like her in our office."

I wish Ilda and Raul all the best in their retirement!

Retirements

Raul Cunha

Graphics

March 31, 2020 – End of an era

By Peter Hurley
Chief Administrative Officer - Department of Physics

Today marks the end of an era in graphics services in the Department: this is Raul Cunha's last official day.

Although there are many people in the Department who are BaE (Born after Excel, 1985) and BaP (born after PowerPoint, 1987), in times gone by all of the graphs, figures and illustrations in scientific publications were drawn with pen and ink, and talks were presented with physical slides created by a photographer.

He came to the University as a draftsperson, and started as a graphics artist assisting in the preparation of scientific figures for publication.

Shortly after starting, he was asked to take responsibility for setting up physics experiments and classroom demonstrations as part of a reorganization. Foreshadowing his career-long commitment to meeting the needs of the Department, he took up the challenge, despite misgivings due to his lack of technical training. Demonstrating great perseverance and resiliency, he was soon indispensable to the teaching mission, extending his responsibilities to providing audio-visual support, and eventually to assisting as a laboratory technician in evening sections in teaching laboratories.

Raul never abandoned graphics, and by the early 90's he returned to being a full time graphics artist. Working with cartographer and colleague Khader Khan, he contributed to numerous theses, scholarly publications and books. In the period before desktop computers he used various forms of physical media to create professional illustrations from rough sketches, data, and text, for both printed and live presentations. While attending a geophysical conference as a student in the early 80's, I had a casual conversation with an executive of a major oil company.

Continued on next page.

He commented that geophysics presentations from the University of Toronto were instantly recognizable by the consistent quality and style of the slides and illustrations. He wondered how this was achieved. The answer: the team of Khan and Cunha. Raul's hand-drawn work has appeared at hundreds of conferences around the world and has provided a definitive visual statement about the high standards that are set by the University of Toronto.

The late 90's brought a new and major challenge to Raul. After many years of skillful use of physical media, he was caught up in a wave of desktop computer technology. Raul responded by embracing the new methods and becoming expert in a number of visual arts tools. By Y2K the emphasis had shifted from creating illustrations to refining images created by clients, assisting in providing formats compatible with publishers, and producing teaching materials suitable for electronic distribution and use in electronic classrooms. With the retirement of Khader Khan in the early 00's, Raul became solely responsible for graphics services, and continued to adapt to the changing environment by becoming an expert in producing the large format posters that are now a critical element in the dissemination of research results. He was also quick to grasp the market for poster printing, and took the initiative to offer services to the entire University. In his last full year here, Raul has printed more than 1000 research posters.

While Raul's accomplishments over the years have been very important, his value to the University derives from his attitude and the exemplar he represents to those around him. When the Department asked him to take on technical responsibilities that he felt ill prepared for, he accepted, and became proficient through hard work and ingenuity. When emerging technologies made carefully developed skills obsolete, he acquired new skills to meet new needs. It should be no surprise that such long term commitment has been equally evident in his day-to-day activities. Clients learned that he would do everything possible to help meet their objectives. When editors need a figure changed while he was on holiday, a few emails result in a new figure delivered on time. During conference season it was not unusual for a half-dozen students to show up late on Friday for posters desperately needed by the weekend. They never left disappointed, even if the final poster was printed late into the evening. It was not possible to work with Raul without being inspired by his energy and determination to do the best job possible.

Finally, I believe that Raul's greatest strength has been his demeanor. While always respectful of others, he has a quick wit and cheerful nature that makes him a pleasure to work with. While the quality of his work is beyond reproach, I believe that the repeat business he enjoyed, the testimonials that he has received, and the awards he has earned (Physics Department Outstanding Technical Service Award in 2005, Dean's Outstanding Technical Service Award in 2013) have been due as much to his personality as to his commitment to service.

Departures

Dylanne Dearborn

Library

It is with mixed feelings that we congratulate Dylanne Dearborn, our Physics Librarian, on her new job as Research Data Management coordinator for the University of Toronto Library system. We are of course delighted for Dylanne, because this is a richly deserved promotion, but we are sad to see her leave the Physics Library.

Dylanne has been the Physics Department Librarian since 2011. She come to us soon after completing her Master's Degree in Information Studies at the University of Toronto and brief stints in the Gerstein Library and the A.D. Allen Library in the Department of Chemistry.

For the eight years that she has been with us, Dylanne has held dual roles in the University, with a 50% appointment in the Central Library system as Research Data Librarian for Sciences and Engineering, and 50% as Physics Librarian.

During her time as Physics Librarian, Dylanne has overseen major changes. The most visible being the transition from print journals to online journals, as nearly all of our print journals were packed up and sent to storage in Downsview, to make way for new study space within the library. Less visibly, her role has evolved to include many aspects of modern electronic media: helping students and faculty to access online resources; being point-person for online delivery of courses; digitizing our historic collection of PhD theses; and advising and helping research groups to archive their data and publications, which, in the case of Professor Stephen Morris, included the world's largest collection of pictures of icicles. Dylanne introduced new training programs and orientation sessions, in order to enhance information literacy in our undergraduate and graduate students and she modernized the Physics Library website. This was in addition to more traditional roles such as collection building through acquisitions, managing circulation, and supervising library staff.

Dylanne's research focuses on research data management, an emerging field that is rapidly growing as funding agencies increasingly demand that the output of research be permanently preserved, while journals increasingly require that supporting data be made available to the research community.

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Dylanne has published several scholarly articles on research faculty data preservation practices and how journal policies impact these practices. Her expertise in this field will now be available to the wider University.

Dylanne has been a strong advocate for a more central role for the Physics Library within the Department as a hub for learning and interaction and she has been instrumental in developing ambitious new plans for the library as an interactive space.

In her new position Dylanne will be based in the Map and Data Library in Robarts Library.
.
The good news is that Robarts is close enough that we look forward to inviting Dylanne back for the grand opening of the renovated library space, when it happens.

Congratulations once again, Dylanne!

Written by Stephen Julian.

Dylanne has very kindly agreed that staff and faculty can continue to contact her for help during the hand-over to her replacement, a transition that may be quite extended in these uncertain times.

Appointments

U of T Physics Professor Debra Wunch Elected as the Next Chair of the Total Carbon Column Observing Network (TCCON)

TCCON is a global network of ground-based Fourier Transform Spectrometers that record the spectra of the sun in the near-infrared which are used to determine the abundance of gases such as CO2, CH4, N2O, HF, CO, H2O, and HDO in the atmosphere.

According to Physics Chair Kimberly Strong "This is a major leadership role in a very important international observing network that is the gold standard for global measurements of total column abundances of greenhouse gases".

Professor Wunch is taking over from Paul Wennberg at Caltech, who was the founding Chair back in the early 2000s.

More information on TCCON can be found here: https://tccon-wiki.caltech.edu/

A recent report from the European Commission highlights the importance of TCCON:

https://www.copernicus.eu/sites/default/files/2019-09/CO2_Green_Report_2019.pdf

Appointments

Carolyn Sealfon

Has been appointed as a part-time (75%) Lecturer

With more than a decade of experience in innovative post secondary instruction, Carolyn Sealfon's mission is to foster decision making based on scientific reasoning and compassion. After completing her PhD in theoretical cosmology at the University of Pennsylvania, she taught and advised undergraduates as an Assistant Professor of Physics at West Chester University. Her integration of evidence-validated active learning approaches caught the interest of Princeton University's Council on Science and Technology, who then recruited her as their first Associate Director of Science Education. In this role, she consulted for faculty on courses to meaningfully engage all undergraduates in science and engineering. In the past three years, she has deeply enjoyed collaborating with colleagues and TAs here at U of T to scale inquiry-based approaches that foster scientific habits of mind to the hundreds of diverse students in the PHY 131-132 introductory physics sequence. Her current research interests as a Ronin Institute Research Scholar apply her background as a physics education research (PER) practitioner and Bayesian cosmologist to learning analytics. Other interests include singing, theatre, lindy hop and qigong.

Brian Wilson

Has been appointed as a part-time (75%) Lecturer

Dr. Brian Wilson has been a sessional lecturer in physics at both the St. George campus and the Scarborough campus of the University of Toronto since 2010. He received his Ph.D. in physics from the University of Toronto in 2009.

His original research interests were in general relativity, but he is now focused on physics education research. He is currently interested in practicals and laboratory courses and how these can be improved to help students become more confident in their ability to design experiments and more capable of analyzing their data fully.

New Staff Members

Bob Amos

Machine Shop

Bob Amos is the Department's newest machinist.

Bob has many years of experience working in the industrial, automotive and nuclear industries and his skills include CNC programming and operation, mill and lathe work and general machining. He also has over 3 three years of experience supervising and training co-op students and apprenticeships.

The skills and experience he brings will be a valuable asset to the Department, greatly enhancing the machine shop's capabilities.

We look forward to receiving the benefits of his work which will support and enhance teaching and research in the Department of Physics.

Michael Manley

Finance

Michael Manley is the Department's new Manager, Finance and HR Administration.

He joins us from the University of Toronto Scarborough, where he worked for several years as the Research Operations and Financial Officer in the Office of the Vice-Principal Research and he was responsible for the overall financial and operational management of the Office. Prior to that, he worked at the Hospital for Sick Children for eight years, where he was a Business Analyst in the Research Awards and Financial Services division, looking after budgets for research grants and core facilities.

With his experience in the academic, health science, and also the financial sector, Michael is well suited to taking on the management of the Department’s financial and human resources.

Letters to the Editor

"Where did my physics degree lead me?"

A reading 1/2 credit on turbines was appropriate mechanics for my aviation Commercial Pilot License out in Vancouver, an area which is proactively green even though the physics department said renewable energy was dead. I'm a Flight Instructor, so now I get flight hours without handing over my vein. Now, that's what we do for our apartments. Aviation is none too different. You should take up piloting, Prof. Strong, it's so fun.

Meteorology actually matters when you're deciding whether the weather will allow you to live. And then there's flight mechanics. I never learnt how the car worked until the engine went inside a plane. They do a lot of advanced psychology for aviation. It's quite impressive how our 2D brains fool us in the 3D world. You have to rely on your instrument training. You never know where your life will lead. Follow your dreams and don't give up. When you make a different and bold choice you'll turn the corner onto a completely new outlook, something you never predicted.

Elaine Morrison 0T2

Dear Professor and Department Chair Kimberly Strong:

Thank you very much for including me in your mailing of the fall 2019 issue of "Interactions". This establishes a welcomed connection that is inspiring for me and reading this issue has guided me back along memory lane to recall so many of the professors and other people who made my time there quite special. My time there was from 1971 to 1977 (7T5 Trinity and from there to Massey until 1977).

The many newsletter categories cover a memorable assortment of tales and updates that I have enjoyed reading. The Profiles, Alumni News, Conferences, Awards and Scholarships, and Outreach in Action (to name only a few) cover the broad scope that is appropriate for a large active physics department.

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In the newsletter some of the named faculty I recall with great fondness and appreciation such as Professors Stoicheff, Welsh, van Kranendonk and Wilson. Professor Stoicheff was my master's thesis advisor and Professor Welsh taught me what I know about molecular spectroscopy. Professor van Kranendonk taught me the rigor of classical mechanics and classical electromagnetism. I was pleased back in 1975 (having just recently joined Professor Stoicheff's research group) when Professor Wilson showed great interest as he stared at my laser light diffraction display at the Ontario Science Centre where we staged the city's first laser light show. It was an ambitious undertaking then and a fun way to start for a young graduate student.

After seven years in Kyoto, Japan I have been a visiting faculty member in the Physics Faculty of the Ludwig-Maximilian University in Munich, Germany (since 2014). With my travels ongoing since leaving Toronto in 1977, I am delighted that "Interactions" has finally caught up with me. Please keep it going and keep on sending. It is a wonderful and worthwhile outreach undertaking. I much welcome the news.
Best Wishes,
Paul R. Bolton, 7T5

Contact Us

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