Interactions

Message from the Chair

Welcome to the Fall 2014 issue of *Interactions*! Inside you can catch up on what's been happening in the Department of Physics. Some highlights: We are all very proud that Professor Sajeev John of the Quantum Optics Group has won the 2014 Killam Prize for Natural Sciences. This is one of the top prizes in Canadian academia and, remarkably, this is the second year in a row that a member of our Department has achieved this recognition (Richard Peltier of the Earth, Atmosphere and Planetary Physics group was the 2013 winner). You will see that our students continue to excel academically, but equally outstanding is their engagement beyond the classroom, both in research and in outreach – bringing science to the public and helping to excite the next generation of physicists. Every year we have many public events, and you can read about our successful Welsh Lectures program last spring, and the upcoming Tuzo Wilson lecture to be delivered by Professor Stephen Morris on October 22nd – we hope to see you at Stephen's lecture!

September is my favourite month of the academic calendar. It's great to see my colleagues again as they re-emerge after a summer of research in their labs, offices, or abroad. We are delighted to welcome 34 new graduate students to our Department. And last but not least, it's great to get back to teaching. This year we have record numbers of undergraduates in our program: our lecture rooms and labs are full to overflowing.

Indeed, across North America undergraduate physics is undergoing a renaissance, driven by a number of factors: increased emphasis on STEM (science, technology, engineering and mathematics) subjects; growing recognition that physics is a great degree in an increasingly entrepreneurial and technological world; advances in physics pedagogy; and of course we can't ignore the popularity of The Big Bang Theory. This growth in student numbers is one of the drivers behind the renovation that we are planning for the Physics Library (described in the article by our Librarian, Dylanne Dearborne). This renovation and our plans for the undergrad labs have the same goal: to create modern collaborative spaces where undergraduate students, graduate students and faculty can interact more effectively.

Finally, our purpose in producing these newsletters is to keep you informed about what is happening in our Department. To make this even easier we are starting a twitter account (follow @uoftphysics). But the best thing, for us, is when we hear back from you! Let us know how and what you are doing. If you have time, get involved, for example by joining our mentorship program. To share your experience, start by contacting Sheela Manek, the Interactions editor, at newsletter@physics.utoronto.ca.

Yours sincerely,

Stephen Julian

Rao J. Polavarapu International Graduate Fellowship in Physics

Fifty years ago, atmospheric physicist Rao Polavarapu left his home in India to come to Canada as an NSERC post-doctoral fellow at Environment Canada and to collaborate with Professor Emeritus Ted Munn at what was then U of T's Institute for Environmental Studies. His daughter, Saroja Polavarapu, would attend U of T, earning her MSc and PhD in—you guessed it!—atmospheric physics. She would go on to become an adjunct professor in the Department of Physics and now also works for Environment Canada.

Thanks to a generous donation of $150,000, bolstered by $50,000 from the Provost's PhD Enhancement Fund (PPEF), he has established the Rao J. Polavarapu International Graduate Fellowship in Physics.

Left to right: Saroja Polavarapu, Norman Donaldson, Vijaya Polavarapu, Rao J. Polavarapu, Chair of Graduate Studies William Trischuk and Professor Richard Peltier (director of the Centre for Global Change Science at U of T)

"U of T gave me the opportunity to come to Canada to get the best education possible, so it is only right that we do what we can to make that opportunity possible for other students who have a desire to study atmospheric physics", Polavarapu said during a ceremony in the Department of Physics to celebrate the occasion. He was joined by his wife, Vijaya, as well as his daughter and her husband, Norman Donaldson, who earned his PhD in—you guessed it again—physics from U of T.

"International students enrich the University, enrich the community and strengthen the country with their contributions to their chosen field," says Professor William Trischuk, the associate chair of graduate studies in Physics. "Recruiting them is always a challenge. But this fellowship that Mr. Polavarapu has established will certainly make the job easier."

For the entire story, visit http://www.artsci.utoronto.ca/main/newsitems/physics

Outreach in Action - Lasers Beyond Pointers

"Dancing to Michael Jackson is the solution to all the conceptual errors!"

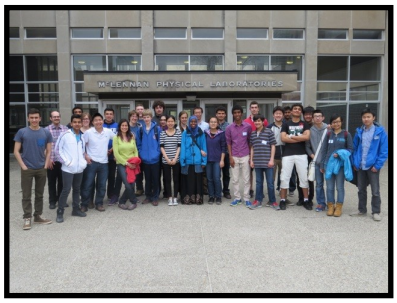
As part of its Outreach activities to engage high school students in physics, the Department supported a workshop called Lasers Beyond Pointers, an initiative by a group of graduate students and postdoctoral fellows.

The workshop was held on March 30th, April 6th & 13th and the intention was to teach the students how the scientific method works and to show them real life, everyday applications of optics, while strengthening their leadership skills. The three day workshop was spearheaded by graduate student Nicolás Quesada and Dr. Yasaman Soudagar from Attodyne Inc. (a spin off laser technology company from the Department).

Fourteen Students and postdocs volunteered to help with the effort. The workshop had the administrative, financial and moral support of the Department, as well as funding from SPIE (the International Society for Optics and Photonics). The department hosted 25 students who came back for all three Sundays. The students were from: Avondale Alternative Secondary School, Central Technical School, Emery Collegiate Institute, Riverdale Collegiate Institute, St Theresa of Lisieux and York Mills Collegiate Institute.

The students had the opportunity to learn how optics are related to rhythm, music and dancing, which is a rather unorthodox manner to teach physics that was devised by Yasaman. Nicolás told us, "*They learned wave motion with different amplitudes, frequencies and phases by participating in a dancing exercise".*

One student commented *"The dancing was definitely an unusual method of learning but, surprisingly, the concepts taught through dancing are still in my mind because this method of education was unique and exciting"* and another student said *"Dancing to Michael Jackson is the solution to all the conceptual errors".*



Lasers Beyond Pointers group photo

They also used an educational kit called the Optics Suitcase (devised by Dr. Stephen Jacobs at the University of Rochester and donated from the Optical Society of America) to demonstrate the various properties of light. The students used Jello-optics to learn about the scientific method by deducing Snell's Law using experimental data from waveguides and optical fiber couplers.

As the main part of the workshop the students built a telecommunication device to demonstrate certain aspects of how the internet works. Through this activity, students learned the basics of electronics in an interactive and hands-on manner, while deducing Ohm's Law from experimental data.

The telecommunication kit was designed by a former group of graduate students at École Polytechnique de Montreal, and included an emitter side and a receiver side. The emitter side of the device was connected to a music player, such as a cell phone. The voltage modulation of the music player was used to modulate the intensity of a small laser pointer. The light of this laser pointer traveled through the air and was collected by a photoresister in the receiving station. The resistance of the photoresistor changed depending on the intensity of the laser beam. This modulation of the resistance was picked up and changed back to sound by a speaker. Hence, students could transmit their music using a laser. Students felt that this was a really fun and interactive way to learn.

At a later date, to strengthen their leadership skills, the students had the opportunity to present the device they made to their classmates at their respective schools, with the help of a mentoring grad student from physics.

According to Nicolás, the students were very motivated and asked lots of questions, forcing him and other volunteers to think about what they do and how to explain it in simple and engaging terms.

Lasers Beyond Pointers exposed students to concepts beyond the typical high school physics class. They were shown that the science of physics is useful for many real world applications, such as electronics and optics. All of this while having fun.

Thank you to all the volunteers, Yasaman and Nicolás for making Lasers Beyond Pointers a huge success!

Welsh Lectures 2014 - CERN and Superconductors!

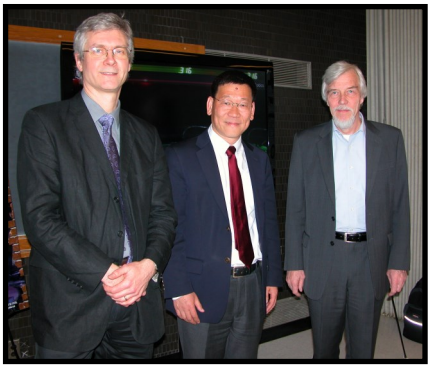
The Welsh Lectures are an annual highlight in the life of the Department of Physics. They are held in honour of Harry L. Welsh, a former faculty member.

These lectures focus on a variety of discoveries in physics and their impact, making these lectures very popular and highly attended.

This year, the lectures welcomed two distinguished speakers, Dr. Rolf Heuer and Professor Zhi-Xun Shen. Both speakers provided a technical seminar on April 30th and public lecture on May 1st. Both were well attended by current faculty and staff, emeritus faculty, students, alumni and members of the public.

The May 1st program was preceded by a lunch in the graduate lounge at the Department of Physics and followed by a reception at Knox College, providing an opportunity for the attendees and speakers to mingle and talk physics.

Dr. Rolf Heuer is a particle physicist and is Director General of CERN, the European Organization for Nuclear Research. Based in the suburbs of Geneva, CERN is the largest particle physics laboratory in the world. Dr. Heuer's technical seminar, titled "CERN – Update and Perspectives", provided an introduction to CERN, its ongoing scientific program and future projects. Particular emphasis was on the European Strategy for Particle Physics and its implications for the particle physics program at CERN and around the world. The public presentation was titled "Breaking the wall of the hidden universe – What the discovery of the Higgs boson tells us about Physics, Mankind and the Universe". (The Higgs boson is the elementary particle whose discovery was recently announced at CERN to widespread acclaim)



Chair of the Department of Physics Stephen Julian, Professor Zhi-Xun Shen & Dr. Rolf Heuer

Professor Zhi-Xun Shen, a condensed matter and materials physicist, is the Paul Pigott Professor in Physical Sciences and senior fellow of the Precourt Institute for Energy at Stanford University. Professor Shen's technical talk, titled "Novel Materials Properties at the Atomically Thin Limit" was about recent progress in novel material properties, with a focus on monolayer superconductor FeSe and semiconductor $MoSe_2$. The public lecture was titled "High Temperature Superconductivity – Insights from Einstein's Electrons". High temperature superconductors have led to dramatic new insights into the physics of materials, and they are expected to have a major impact on electronics, communication, power, medical technology and materials processing.

These lectures were a big success and we thank all involved, especially the Welsh Committee: Dylan Jones (chair), Pekka Sinervo, John Wei, John Sipe, Kaley Walker and Helen Iyer .

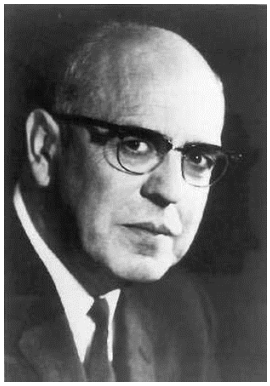
For more information on these lectures, go to: www.physics.utoronto.ca/~welsh/

Who was Harry Welsh?

Harry L. Welsh was a former Chair in the Department of Physics. In the 1960's, during his years as chair, Professor Welsh helped guide a period of rapid growth in the Department of Physics.

The Welsh lectures began in 1975 to honour his 65th birthday.

Professor Harry Welsh's research in molecular spectroscopy at the University of Toronto spanned forty years.



Harry L. Welsh

Outreach in Action - School Visit from Danforth Collegiate & Technical Institute

Physics at U of T and beyond……

Paul Kushner presenting "Physics at U of T and Beyond"

As part of the Department's Outreach activities to engage high school students in physics, on May 8th, twenty five grade 11 students from Danforth Technical School were treated to an educational afternoon at the Department of Physics.

They were given presentations by Paul Kushner (Undergraduate Chair), Prof. Peter Krieger, and Prof. Stephen Morris.

Prof. Paul Kushner talked about "Physics at U of T and Beyond". Students were told that at U of T, they would learn how physics governs particles, forces, cosmology, climate change, biological processes, quantum mechanics/computation and exotic quantum materials. Prof. Kushner discussed the physics undergraduate program and explained that U of T physics graduates are employed in a wide range of fields.

Prof. Peter Krieger presented "Experimental Particle Physics in 15 minutes". He discussed particle physics, the Higgs boson and CERN. The students were shown pictures of the ATLAS calorimeter which was built at U of T with the help of undergraduate students. Prof. Krieger talked about subatomic particles and everyday life, giving examples of x-rays, microscopes and beam therapy for cancer. The students were curious about medical isotopes and Prof. Krieger told them how they work and how they are used by hospitals.

Prof. Stephen Morris talked about the continuum limit and the convection of the sun, ocean and earth. He discussed fluid mechanics and temperature gradients and showed a double pendulum to demonstrate chaos.

After the presentations, they were then taken on a tour of the department. First, Steven Butterworth (manager of Physics Computing Services), showed them the "Big Mac" computer cluster, then they were shown the two cold atom labs belonging to Prof. Aephraim Steinberg and Prof. Joseph Thywissen. The tour ended in Chair Stephen Julian's Low Temperature Lab.

We hope to continue these types of activities and inspire a future generation of physicists!

Students from Danforth Technical School

Emeritus Reunion Lunch

On Wednesday, May 21st Chair Stephen Julian and Undergraduate Chair Paul Kushner hosted 10 of our Emeritus Faculty for the first "Emeritus Reunion" luncheon.

The Emeriti had the opportunity to catch up, have some lunch and get updates on what is happening in the Department.

Back row from left: Tony Key, Dick Bailey, Malcom Graham, Fraser Code, Henry Van Driel, Paul Kushner, Sabine Stanley
Front row from left: Roland List, George Luste, Stephen Julian, John Perz, Ted Litherland, Nigel Edwards

Thermoelectrics Summer School 2014

The second annual Thermoelectrics Summer School took place at the University of Toronto on July 11th and 12th. Organized by the NSERC CREATE (Collaborative Research and Training Experience) HEATER (Highly Effective Applications of Thermoelectrics Research) Program, which is housed here in the Department of Physics, the School brought together experts from academia and industry with students and PIs, providing a unique training opportunity in this growing field. The field of thermoelectrics aims to develop and exploit the ability of some solids to generate an electric current when placed in a temperature gradient.

HEATER Program Director, Professor Young-June Kim, opened the School and welcomed five distinguished speakers to give scientific talks on thermoelectrics and recent research. Professor Joseph Poon from the University of Virginia was joined by Dr. Yu-Chih Tseng of Natural Resources Canada, Dr. James Salvador of General Motors, Dr. Qiang Li of Brookhaven National Laboratory and by Professor George Nolas of the University of South Florida.

The program also focuses on imparting the professional skills needed for success in a variety of fields, from academic research to industry. Every year, the Thermoelectrics Summer School addresses this by holding a student lunch and Professional Development session to complement the scientific talks. This year, Candice Stoliker of the Career Centre discussed communication in the workplace.

Students analyzed communication scenarios, learned valuable networking skills and active listening techniques.

Trainees were also given the opportunity to present their research at the welcome reception and poster session. The eight posters presented came from students and post-doctoral fellows from the University of Toronto, McMaster University, the University of Waterloo and York University. The posters showcased novel techniques and approaches to making, modeling and measuring thermoelectric materials.

Postdoctoral fellows, undergraduate and graduate students from the Department of Physics were joined by trainees from the Departments of Chemistry and Engineering, as well as from many universities across Canada and the world.

If you are interested in seeing more details about the talks, please email our Program Coordinator for abstracts: heater@physics.utoronto.ca

The HEATER Program encompasses three universities and 8 principle investigators, and trains students of all levels, focusing on thermoelectric materials research. For more information, please visit our website at https://heater.physics.utoronto.ca

By: Erin Macnab - CREATE HEATER Program Coordinator

The Tuzo Wilson Lecture - Wednesday, October 22nd, 2014

Cracking the Giant's Causeway with a Tabletop Experiment

Stephen Morris, J. Tuzo Wilson Professor of Geophysics, University of Toronto

Location:
Isabel Bader Theatre, Victoria College
93 Charles St. West, Toronto
Museum Subway: East Exit

Date and time:
Wednesday October 22nd, 2014, 8:00 pm

Cost: Free and open to the public

Abstract:

The Giant's Causeway, a World Heritage Site, is a spectacular outcrop of uncannily regular lava columns on the coast of Northern Ireland. How did it form? This question has deep roots in the history of geology and geomorphology. The mostly hexagonal columns were carved out by cooling cracks, which became more regular as they advanced. A similar ordering process is found in the permafrost cracks, driven by freezing and thawing, that decorate large swathes of the polar regions of Earth and Mars. Surprisingly, these effects may be captured by a simple laboratory experiment you can (almost) do in your kitchen. This talk will examine the pleasures and pitfalls of such "tabletop geomorphology" experiments.

For more information visit: www.physics.utoronto.ca/tuzowilson

To add yourself to the mailing list for this and all future Wilson lectures visit: http://www.physics.utoronto.ca/wilsonlecturelist

7th Annual Science Rendezvous

This year marked the 7th annual GTA Science Rendezvous, and the region came together to celebrate and rejoice in the name of science and technology.

The University of Toronto downtown campus put a lot of effort into making sure the love and beauty of the sciences was thoroughly enjoyed by all, and even gave behind the scenes access to some of their best scientific facilities.

Hundreds of students, children, and parents crowded St. George Street on Saturday, May 10th, eager to learn and expand their knowledge from the exhibitors and student volunteers.

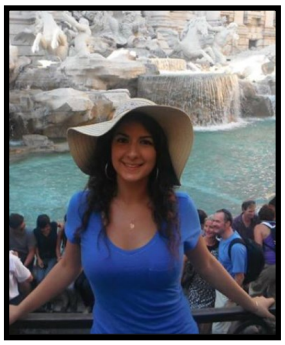
As I was a volunteer, I did not get a chance to visit every booth and presentation from the other faculties, but the atmosphere was full of joy and excitement. Every category and scientific field of study was represented in a fun and practical way, giving a very hands-on and unforgettable experience.

The same spirit flowed through the McLennan Physical Laboratories, where most of the physics exhibits were, and where I was stationed for majority of the day. I stood alongside several experiments that showed how physics revolutionized the way the world was seen, and that helped to educate a new generation of scientists.

We had everything from a double pendulum, displaying the beauty of chaos, to bending light with water, which wowed the wide-eyed audience. One of the crowd favorites, was the seemingly gravity defying Newton's beads, whereby a 50 foot string of metal beads poured out of an upright stationary beaker, in 5 seconds! The physics behind it was explained, and the audience learned about inertia and potential energy in a way that they will never forget.

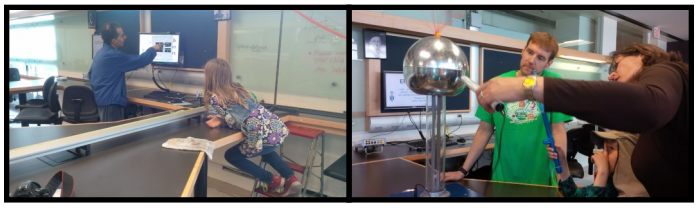
Overall, Science Rendezvous was a huge success, and I believe it thoroughly accomplished what it was meant to do: to inspire and excite students and the general public and show them the relevance of science in our every day lives.

By: Sarah Manea - Undergraduate Student



Sarah Manea

About Sarah Manea: Sarah is a 3rd year undergraduate student, completing a specialist in physics and astronomy. She has been volunteering at as many physics outreach events as she can.



Photos from Science Rendezvous

Graduate Student Summer Colloquium

One of the most important aspects of being a scientist is being able to communicate your findings to your peers. For this reason the Department encourages grad students to attend conferences where they can present their research. While conferences are a great way to learn how to present research and engage with other scientists, they unfortunately tend to have a narrow spectrum of peers. As a grad student, there aren't many opportunities to present your findings to a wider selection of physicists outside of the ones in your chosen field...at least until this last summer.

With the traditional colloquium series on break during the summer, this year the department decided to give the grad students the opportunity to present their research to the physics department at large. The result was a successful summer colloquium series that ran roughly bi-weekly and featured an equal balance of PhD students and Post-docs trying their hand at presenting to a general audience. The series was organized by the graduate student liaison committee with the supervision of Dr. David Bailey.

The talks ranged from atmospheric modeling to quantum cryptography; truly showcasing the wide breadth of research being conducted at U of T.

With the success of this summer's colloquium, you can expect to hear more talks from the department's grad students next summer.

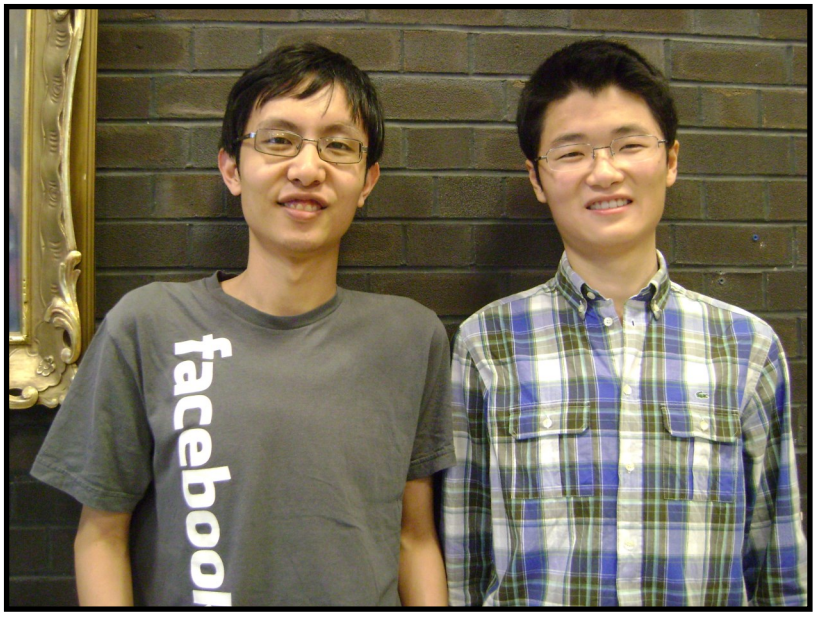
By: Paul Godin - Chair of the Summer Colloquium Committee

Paul Godin

2014 CAP University Prize Exam Results - U of T takes 3 of the top 10 Spots in Canada!

Physics Students at the University of Toronto proved once again that they belong to one of the top educational facilities in Canada.
The 2014 CAP University Prize is a national competition open to students across the country who are enrolled in an undergraduate program at the time of exam. This year, the exam was written by 77 students. Students from the University of Toronto took 3 of the top 10 spots.
Congratulations!

2nd – Brian Bi
3rd – Chao Wong
5th – Oguzhan Can



Left to right: Brian Bi and Chao Wong

The Boris P. Stoicheff Memorial Graduate Scholarship

The Boris P. Stoicheff Memorial Graduate Scholarship was established by the CAP foundation and OSA (OSAF) foundation to honour Boris P. Stoicheff, an internationally renowned laser spectroscopist and former Professor in our department who also served as President of OSA (1976) and CAP (1983-84).

The scholarship is awarded annually to a graduate student who demonstrates research excellence and significant service to the optics and physics community.

The 2014 CAP-OSAF Boris P. Stoicheff Memorial Scholarship was awarded by the CAP Foundation to Nicolás Quesada of the University of Toronto for his innovative work in quantum tomography and quantum optics. Nicolás serves the physics community in mentoring high school students in optics and in his science outreach work to the community at large (please see the article on page 2 for Nicolás' work on Lasers Beyond Pointers). Nicolás is a young scientist that has a passion for communicating science to people of all ages. Congratulations Nicolás!

Nicolás Quesada

Sajeev John - Recipient of 2014 Canada Council Killam Prize

Sajeev John is the recipient of the 2014 Canada Council Killam Prize for his work on the localization of light and the invention of new Photonic Band Gap (PBG) materials. The Killam Prize was created to honour eminent Canadian scholars and scientists actively engaged in research. We sat down with Sajeev and asked him some questions about his background, research and being the recipient of this prestigious prize.

When did you first realize that you wanted to pursue physics as a career?
I was told that Physics is more a calling than a career. I enjoyed physics as a high school student but my grade 11 Physics teacher, Mr. Duncan, administered a terribly tough midterm test that I barely passed. This was not an auspicious start for the son of a physics professor. My biochemist mother, who preferred me to pursue a "real" career in medicine, would nevertheless not let me ignore any misstep and ensured that I more than compensate for this by the final exam. Perhaps, she overdid it. However, mastery of high school physics at Banting Secondary School in London, Ontario offered no surety that I could succeed internationally at the next level. I would unexpectedly discover this after my first year of studies at MIT.

Tell me about where you did your undergraduate degree.
MIT collected high school valedictorians from around the world and immersed us in a crucible aimed more to dissuade the naive than to persuade the masses to a career in physics. My freshman physics instructor at MIT was Bob Birgeneau, who later came to be President at the University of Toronto. I remember him calling freshmen such as I, sitting unnoticed near the back of the classroom, to come forward and extemporaneously attempt to solve difficult problems, in front of the entire class, from the classical mechanics textbook of Kleppner and Kolenkow. As I stood unprepared in front of my peers, I wondered how I could pull off such a feat!
I went to MIT expecting that my naive idealism for physics would finally be laid to rest and that my mother's more practical wisdom about medicine would prevail. Instead it was an exceptional educational experience that reinforced both for me and my parents that a future in physics was not out of the question. I went on to do my undergraduate thesis in nuclear theory in MIT's Center for Theoretical Physics and then apply to graduate school. I was surprised one day, while waking up in my MIT dormitory room, to receive a personal call from Nobel laureate, Philip Anderson, asking what he could do to convince me to accept Princeton's Putnam Graduate Scholarship over equally appealing offers from Harvard, MIT, Stanford, Berkeley, and Caltech.

At Harvard, your PhD thesis outlined the theoretical framework for light localization PBG materials. What drew you to this topic?
The resounding achievements of Solid State Physics drew me to the subject of condensed matter theory. At Harvard, I discovered to my dismay that I was late to that party. The feast was wrapping up and the remaining research topics seemed insignificant by comparison. Against this backdrop, the condensed matter theory group offered only mixed encouragement. In retrospect this was a great blessing in disguise. It led me to interact with Michael Stephen, a Visiting Professor at Harvard, who would become my PhD thesis advisor. Professor Stephen was a genuine theorist of unpretentious humility, with a warm smile and a kind spirit. He treated me from the outset as a scientific colleague rather than a student. He encouraged me to find my own field, unencumbered by previous footsteps. I was soon able to develop a theory for the localization of classical waves, based in part on analogy with electronic Anderson localization, which would constitute my PhD thesis. I published, on my own, the idea of trapping light. Two years later, Philip Anderson invited me to join the Physics Faculty at Princeton where I was able to confirm my idea and introduce the concept of light-trapping photonic band gap materials.

Tell me some real world applications of PBG materials that our readers would find really cool and interesting.
Photonic band gap (PBG) materials have applications in information technology, energy conversion, and clinical medicine to name a few. The PBG provides the basis for microscopic circuits of light on a chip. Since one beam of Laser light can pass freely through another, a given circuit path can simultaneously convey hundreds of independent wavelength channels of optical information. This is an improvement over electronic circuits that carry only a single channel of information. As electrons flow through a circuit path, they encounter resistance and their energy is dissipated in the form of heat. Electronic supercomputers require large cooling systems to carry this heat away and prevent the system from melting down. In an optical computer, based on PBG materials, light would not encounter such resistance nor generate such heat.

Photonic band gap fibres are presently used for delivering high intensity laser light through a flexible endoscope for cancer therapy. Here light is guided through a hollow fibre core using the light-localization, wave interference effect. In a standard solid core fibre, the high intensity of light would damage the fibre itself. The first life-saving procedure was performed in 2004 and today over 10,000 similar procedures have been carried out.

On the horizon is another application of the photonic band gap chip in medical diagnostics. Optical "lab-on-chip" biosensors are poised to replace traditional time-consuming laboratory testing of human protein samples and can diagnose disease in an instant.

A potential large scale application of photonic crystals is for solar light trapping in ultra-thin silicon solar cells. These next generation solar cells are poised to surpass previous power conversion efficiency records, using roughly a factor of 500 less silicon than present-day cells.

When you joined U of T in 1989, you (along with U of T chemistry professor Geoffrey Ozin, U of T physicist Henry Van Driel and a team of scientists from Spain) built a silicon based PBG material. Tell me more about this and its implications.
While many photonic band gap materials had already been synthesized in labs around the world, this multidisciplinary collaboration demonstrated a new approach to microfabrication using the methods of self-assembly and chemical vapor deposition. This means that certain types of PBG materials can be manufactured on a large scale at very low cost. This also shows that important and unexpected milestones are made possible when scientists from diverse backgrounds work in concert with each other.

What do you find most fulfilling about your research?
It is exciting to start with a fundamental concept in physics and bring it to fruition in a variety of vital application areas. Sometimes cutting edge physics requires extremes, either extremely high energy, extremely low temperature, extreme isolation, or extreme abstraction. It is fulfilling to work in a subject that breaks free of such limitations and can make a difference in more people's lives.

Tell me what this Killam Prize means to you?
I am grateful to the Canada Council for the Arts for recognizing my scientific efforts and I am indebted to the Killam family for the legacy they leave to Canada's intellectual growth and future prosperity. The Killam Prize is an encouragement for me to continue my endeavour and bring the subject of photonic crystals to further fruition. It is an inspiration to perpetuate the kind and generous spirit of Izaak and Dorothy Killam through purposeful science that can serve society.

Congratulations Sajeev!

His Excellency the Right Honourable David Johnston, Governor General of Canada, presented the 2014 Killam Prize to Prof. Sajeev John during a ceremony at Rideau Hall, in Ottawa, on May 26, 2014
Photo credit: MCpl Vincent Carbonneau, Rideau Hall ©Her Majesty The Queen in Right of Canada represented by the Office of the Secretary to the Governor General (OSGG), 2014 Reproduced with permission of the OSGG, 2014

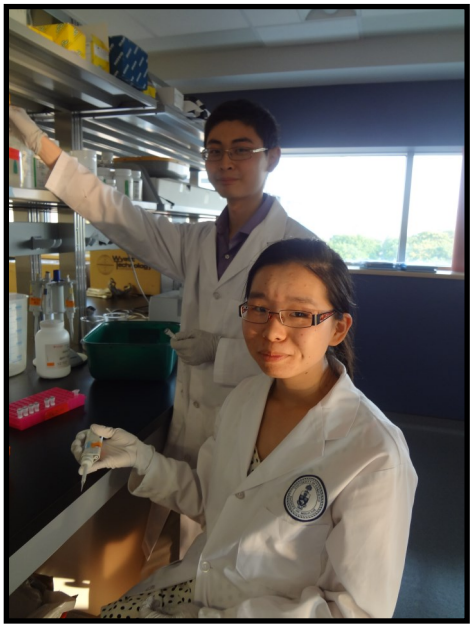
Physics Flashback - From the March 1997 Physics Newsletter

In 1997—Henry Van Driel from the Department of Physics was the recipient of the Killam Research Fellowship

Congratulations to Professor Henry Van Driel. He has won a Canada Council Killam Research Fellowship! This fellowship is one of Canada's most distinguished research awards. Professor Van Driel's area of research is quantum optics and he one of only nine new Killam Research Fellows. This award allows scientists to devote as much as two years to full-time research.

iGEM - Physics Students and Synthetic Biology

The International Genetically Engineered Machine (iGEM) is a worldwide synthetic biology competition for undergraduate and graduate student teams. The purpose is to prepare student leaders in synthetic biology by involving them in project design and hands-on work in a summer lab team. Since 2005, the University of Toronto iGEM team has gathered undergraduate and graduate students to design and execute synthetic biology projects and the team members come from the Faculties of Engineering, Arts and Science and Medicine. This October, the U of T iGEM team will compete in the international iGEM competition held in Boston. There will be approximately 200 teams. We spoke to two students from the Department of Physics about their involvement in iGEM. Meet Cathy Su and Bohan Xing!



Bohan and Cathy working in the lab

What is your role in iGEM as a physics student?

Cathy

iGem is an interdisciplinary undergraduate research team, so everyone has a role suited to their strengths. I help with lab techniques and problem solving on a day to day basis, for example helping to plan the method of attack when an experiment fails, and checking and scheduling protocols.

Bohan

Because I have background in both biology and physics, I am helping with many things from designing the experiment to data analysis.

Tell me about the Synthetic Biology Experiments and how they are applied to your interest in physics?

Cathy

It may not be a physics focused initiative, but I find that skills developed in physics courses are helpful for laboratory work, such as presentation skills, data analysis, programming and tenacity. iGem is also a good method for exploring synthetic biology for people who are not biology majors because you can see the practical applications of the theory right away.

Bohan

Synthetic biology is to design and build useful biological devices and systems.

What is your project this year?

Cathy

I help with overseeing both of the molecular biology projects going on (in Bioremediation and Biocontainment) part time, due to my summer schedule. However my main project is securing sponsorship and publicity for the team. This involves meeting with department heads to talk about fundraising and resources, as well as updating social media.

Bohan

Our project is to create a noble plasmid-loss genetic safeguard system for biocontainment. Our experiment includes creating the system and testing the idea of plasmid-loss genetic safeguard. Since nobody has created this kind of system before, it is hard to predict the outcomes and the long term effects. Therefore, we decided to use mathematical models to simulate outcomes under different conditions.

What is your favorite thing about participating in iGEM?

Cathy

The best part is the interdisciplinary work with other undergraduates who are enthusiastic and talented.

Bohan

iGEM is entirely organized by undergraduate students from various backgrounds. It creates a friendly and yet intellectually stimulating atmosphere. This is my favorite thing. There are times when we have to learn all by ourselves and there are times when one of us solves the problem beautifully.

How does being involved in iGEM help you prepare for a future in the sciences?

Cathy

Practical lab experience is really important to have, as well as the ability to solve your own problems. I've improved on both through iGEM. In addition, sponsorship work has been a great opportunity to meet some of the most important and influential people who work in each department. We are super grateful to have their support.

Bohan

It is a valuable experience to work with different people and focusing on one goal. It teaches me a lot of things including things that cannot be taught in books. There are always problems before you reach your goal. It is providing me with an experience to solve these problems in creative ways and with the help of others, I think that is very important for a scientist.

iGem would like to thank its 2014 sponsors for the opportunity to carry out the summer research project, including the Departments of Physics, Biozone, Graduate and Life Sciences, Human Biology, Cell & Systems Biology, Molecular Genetics, Biochemistry and Lab Medicine and Pathobiology as well as the Centre for the Analysis of Genome Evolution & Function, EngSoc, Trinity College and University College.

Physics Library Renovation

Some of our readers will remember the Physics Library, located on the second floor of the Burton Tower, as an oasis of calm where - particularly during exams, quiet study and work were possible. If you were to visit the library today you would find it almost unchanged—but not for long!

Renovation plans are underway for the Physics Library with work anticipated to begin during the spring of 2015. In 2010, the current space was examined by a committee with representation from faculty, staff, undergraduate and graduate students. In 2012, a proposed design was drafted for the renovation. During the needs and space assessment, the committee identified a lack of interactive discussion space focused on undergraduate learning as a shortcoming of the current layout of the Physics building. Such space is particularly important in Physics, where much learning takes place collaboratively through technical discussions between students (with or without TA's), often at the chalkboard, and has been successfully incorporated into the design of many of our peer institutions. Integrating collaborative space into the existing space would create a unique environment in the Department; this integrated space would allow for a designated area that incorporates teaching and instruction, research and research materials, as well as individual study and collaborative study areas, with the goal of enhancing the learning and studying experience for students.

In preparation for this renovation, the collection of print journals has been removed from the library and relocated to our storage facilities. Working with the firm Unit A architecture (which also designed the Physics Practical rooms), a plan for the redesigned library was drafted.

The key elements of this design include:

- reopening the long-closed main entrance to the library, making the library both more accessible and more visible to the rest of the building
- conversion of the current journal space into collaborative study space
- construction of three new study rooms to be used for collaborative learning, in particular group study, TA/student meetings and the Physics drop-in centre
- white/blackboards distributed throughout the collaborative space to facilitate group discussion and problem-solving
- a small "lounge"
- updated computing and printing equipment
- bar-style seating at the entrance
- a new arrangement of the stacks with study space interspersed, to ensure secluded and quiet study space
- replacing the cinder block walls along the north exterior corridor with glass to open up the space and make it more visible from the rest of the floor

The proposed new library retains the traditional elements of the Physics Library – quiet study space and access to information and resources – but adds a variety of elements to encourage and enhance interaction and collaboration. The space has been designed to be flexible, allowing individual student needs to be met. The library will be fully integrated into Departmental life, supporting learning and research goals and adding a sense of a community to the building. As such, the new library is intended to play a central role in the Departmental community, acting as a hub for research and providing a learning environment currently unavailable in the Physics building.

By: Dylanne Dearborn - Librarian at the Physics Library

ANNOUNCING THE LIBRARY RENOVATION PROJECT:
This fund will support the Department of Physics' plans to turn the library into a beautiful interactive study space that will enhance its central role in the teaching and learning mission.

A 1:1 match will be provided for donations to this fund (up to a maximum of $50,000).

To donate to this fund, please visit: https://donate.utoronto.ca/physics

You may remember the library looking like this! Watch for the exciting changes.

Retirements

Carrie Meston
Graduate Assistant

Carrie Meston

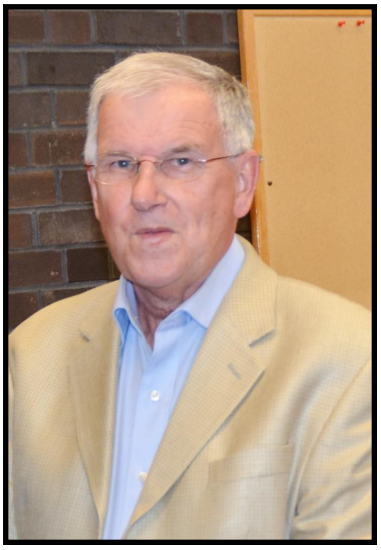
Carrie Meston worked at the University of Toronto for almost 10 years. After a long career in the private sector, Carrie took time to complete a degree in Commerce before starting at the University of Toronto in 2005. Her first position was in the Asian Institute in the Munk School of Global Affairs. Her work there involved both financial administration and graduate program support. In 2008 she moved to the Physics Department and was the Financial Assistant in the Physics Technical Services. In 2010 Carrie accepted the position of Graduate Secretary in the Graduate office and worked there until retirement in June 2014. Carrie's former supervisor Peter Hurley says, "Carrie has always been patient, calm and totally professional, and could always be counted on to provide very reliable assistance to applicants, grad students and faculty members alike". Congratulations Carrie!

John Muto
Chief Administrative Officer

Former Chair Michael Luke and John Muto

For the past eight years, John was an extraordinary Chief Administrative Officer of the Department of Physics. As the manager of a department of almost 300 staff, graduate students, postdocs and research associates, John was in charge of hiring and recruiting staff, overseeing the Departmental budget, finding offices and furniture for faculty, staff, research associates and graduate students. He also oversaw the operations of the Technical and Computing Services, renovating research laboratories and teaching space, and dealing with infrastructure issues. For the past eight years John kept the Department running and achieved all of this with his characteristic conscientiousness, professionalism, good humour, and excellent management style. We wish you all the best for a fulfilling and well-earned retirement

Henry Van Driel
Professor



Henry Van Driel

Henry Van Driel received his Bachelor of Science, Master of Science, and PhD, all from the University of Toronto. As a faculty member in the Quantum Optics and Condensed Matter Physics groups, Henry also demonstrated unstinting service to the larger physics community. Henry served on countless program committees, been associate editor of numerous journals, editor–in-chief of the Journal of the Optical Society of America, and held a number of posts in professional organizations, including President of the Canadian Association of Physicists. Henry held the position of Associate Chair for Undergraduate Studies, and later Chair of the Department. During his time at the Department, he contributed to the accomplishments and careers of many students and postdoctoral fellows. The list includes recipients of 34 Masters Degrees, 20 PhD degrees, and 25 postdoctoral fellows. Some are now senior researchers in universities, government labs and in industry and some have become heads of institutes, chairs of departments, and presidents of companies. All the best to you for your retirement Henry!

Henry's Retirement Party will be held on Saturday, October 25th, 2014. Please contact iyer@physics.utoronto.ca for more information.

Spring Reunion 2014

On Saturday, May 31st, 2014 the University of Toronto hosted the campus-wide annual Spring Reunion. The Department of Physics participated in the festivities as well. Professor Stephen Morris gave a talk on icicle physics called "Consider the Icicle" at Sidney Smith Hall. After the talk, alumni from the Faculty of Arts and Science were brought back to the Department of Physics for a tour of Stephen Morris' icicle lab, the Undergraduate Labs and the technical facilities. After the tour, the alumni had the opportunity to mingle with faculty and other alumni at a wine and cheese. The next U of T Spring Reunion will be held on May 29-30, 2015. For more information on Spring Reunion contact: alumni@physics.utoronto.ca or 416 978 3307

Left to right: Professor Stephen Morris and Andrea Vargas Sanchez HBSC 1T3

Left to right: Chair Stephen Julian, Kitty Antonik and Paul Wakfer BASC 5T9 & MSC 6T0

Left to right: Henry Ng BBA 1T1, Alexandra Peng HBA 1T2, George Valenta BASC 8T4 & Professor Stephen Morris

Left to right: Chief Administrative Officer Peter Hurley, Maria Cefalas and Asif Khan HBSC 2T3

Left to right: Department of Physics receptionist Joanna De Gouveia and Erich Kralik BASC 6T5 & MASC 6T9

Undergraduate Student Profile

Cathy Su, Biological Physics Specialist

Why did you decide to major in Physics? What was your inspiration?
The main reason I'm majoring in physics is because I am determined to improve my numerical problem solving skills. I know a lot of frighteningly competent people who studied physics, but my high school physics teacher was definitely an influence. My dad, who studied engineering, was also a strong (but entirely passive!) influence. With Biology, you learn the secrets of Life, and with Physics you learn the secrets of the Universe, so the combination is perfect.

"With Physics you learn the secrets of the universe…"

What do you enjoy most about the physics program?
It's really great that physics classes allow me to be in the same space as really talented people. Working on problem sets and assignments with my friends in these classes is definitely the most enjoyable part of taking physics.

What is your favourite course and why?
This year, it was probably Genetics, but my favourite physics course was Electromagnetism. I found Genetics really relevant to the research I was doing and wanted to do, and really liked the quirky problem sets. Electromagnetism was a bit like a classic novel; it was scary at the beginning but got better as I progressed.

Cathy Su

What are your research interests?
I've been interested in epigenetics since high school, because it studies genetic changes that happen during the lifetime of the organism. In particular I'd like to be able to do epigenetics research that applies to curing cancer and to myopia - working at the intersection of epigenetics and cancer.

What extra-curricular activities are you involved in during your degree?
My main extra-curricular activity since first year has been iGEM (the international Genetically Engineered Machines competition). I am also a physics peer tutor at the Academic Success Centre. Along the way I have sought out other cool experiences, such as being an Orientation Exec and a Webmaster. I've been hired for a Frosh camping trip at the end of the month too, despite zero camping experience. That will be very fun!

What are your immediate future plans?
I'd like to do a professional year-long research internship in industry next year so that I can really take the time to do a meaningful research project. Whether positions are available, unfortunately, remains to be seen.

Where do you see yourself in 10 years?
I aim to be working on my own research project involving the application of epigenetics towards disease, but I'd also like to design a floating castle for Disneyland, develop a technology for never losing your keys again, study bioengineering in the Amazon rainforest, etc etc.

Tell me something interesting about yourself.
I'd really like the ability to teleport because I hate commuting. It gives me incredible satisfaction to shave even a minute off of my bike ride in the mornings. This is why I'm constantly searching for new routes… and getting lost.

(Please see page 10 for Cathy's work on iGEM.)

Undergraduate Student Profile

Oguzhan Can, Mathematics and Physics Specialist

Why did you decide to major in Physics? What was your inspiration?
I guess everything started with physics olympiads. That was sort of an introduction apart from regular high school material which did not really seem interesting to me. There were some olympiad problems that really sparked an interest and curiosity. I remember estimating the time it takes for the Earth and Moon to have the same period of rotation due to tidal forces. Another one was calculating how big a star should be in order to achieve fusion. Being able to make calculations like that and understanding how such phenomena happen really fascinated me as a high school kid.

Although I was never totally sure what I wanted to do with my life, I chose physics only because I really enjoy solving interesting problems and it also offers a wide range of different opportunities other than academia.

"I remember estimating the time it takes for the Earth and Moon to have the same period of rotation due to tidal forces.."

What do you enjoy most about the physics program?
I find the faculty members really approachable and willing to help. When you go to office hours, you can get more than the answers of your class related questions. They give invaluable career advice and generously answer your questions unrelated to class. From my experiences, if you are really interested in learning they always give a hand as long as they have time.

Oguzhan Can

What is your favorite course and why?
My favorite course until now is PHY478, Undergraduate Research Project, which I did with Prof. Daniel James. Trials and errors, weekly meetings, reports and presentations have been great experiences. This course gives you a chance to ask questions about every detail, and make sure you understand what is going on. Another great experience was attending the research group meetings weekly for a semester. They gave me a chance to meet amazingly friendly people while I was getting an idea of what is happening on the cutting edge.

What are your research interests?
For now, I find condensed matter physics and quantum foundations interesting. There are many courses to take, so many people to talk to and lots of articles to read in order to get solid ideas and choose a field of specialization. I would like to do as many different research projects with different supervisors as I can before graduating for that purpose.

What other extra-curricular activities are you involved in during your degree?
I have been trying different things since I came to UofT: Dragonboat, archery and tango. I enjoy charcoal drawing and fishing. I have also been playing guitar for about five years and I have a group of friends here with whom I go to the studio with on weekends to jam.

What are your future plans?
I am planning to go to graduate school and hopefully do theory in accordance with my research interests. I do not like the idea of planning ahead too much, especially in detail. I am just trying to do as well as possible while enjoying life outside the class as much as possible.

Tell me something interesting about yourself.
Here is a funny story that my mom told me. It was the time when Mars Pathfinder landed on Mars. I was three years old. It was on the news and everyone was talking about it. As a kid, I probably had seen pictures that the probe sent. I seemed to be interested in all of that, according to my mother. One day during a bus trip, I saw a field next to the road, she says. The soil was reddish and there were dark colored chunks of stone all over the place. And then, amusing everyone on the bus, I yelled: "Look, Mom! We came to Mars!!"

Graduate Student Profile

Steven Schramm, PhD Experimental High Energy Physics

Steven in front of the ATLAS detector at CERN

Steven Schramm is now entering the 4th year of a PhD in Experimental High Energy Physics under the guidance of Prof. Pierre Savard. He has long been fascinated by particle physics, dating back to high school, where he first learned that the proton is a divisible particle comprised of even smaller entities. From that moment, he was hooked, and that fascination has only grown with time. Upon completion of high school, he attended the University of British Columbia, entering the physics program. Through multiple undergraduate research placements both with a future collider research group and the ATLAS collaboration, he quickly learned that particle physics and scientific computing are inextricably linked. Steven took this into account and changed his degree path, graduating with a Combined Honours B.Sc. in Physics and Computer Science.

In May 2011, days after the completion of his undergraduate studies, Steven moved to the University of Toronto. With the support of NSERC USRA and under the supervision of Prof. Pierre Savard, he began to study the topic which would capture his interest for the coming years – Dark Matter.

Dark Matter is a fascinating subject simply because we know so little about it. The amount of material which makes up all of the stars, planets, people, and other objects we can see in the universe actually accounts for only 1/6th of the matter in the universe. The remaining 5/6ths is Dark Matter, and we currently have no experimentally verified theory for what it is. We know its relative abundance and that it feels the gravitational force but not the strong or electromagnetic forces, but that's about it, we don't even know if it's a particle or not. Any progress towards understanding what Dark Matter is, or is not, is a major step toward understanding what comprises the large majority of the universe.

If Dark Matter is a particle which interacts with the Standard Model through some very weak force, and if it's not too heavy, then it can be produced in high energy proton-proton collisions at the LHC (Large Hadron Collider). Steven's research focuses on searching for the creation of such Dark Matter particles with the ATLAS detector. Any Dark Matter which is created will escape the ATLAS detector as an invisible particle, leading to an imbalance in the observed momentum. There are known Standard Model particles which are also invisible, such as neutrinos, thus sophisticated estimation techniques are needed in order to understand all Standard Model backgrounds. Only once this is done can any measurements of the presence or absence of particulate weakly interacting Dark Matter be conducted.

In addition to his thesis research, Steven has made several significant software and performance contributions to the ATLAS experiment, including tools which are now used by the majority of the ~3000 person collaboration. He has also closely collaborated with the theory community, leading to improved experiment-theory dialogue and mutual support on the topic of collider Dark Matter searches.

During Steven's PhD studies, he has received several major awards and scholarships, including an NSERC CGS-M, NSERC CGS-D3, and an inaugural W. Garfield Weston Doctoral Fellowship. Thanks to the support of these awards, ATLAS Canada, and Prof. Pierre Savard, Steven has been based at CERN in Geneva, Switzerland since June 2012.

When Steven is not working, his love of nature and photography often keep him outdoors. He particularly enjoys hiking, climbing, backpacking, skiing, and other mountainous activities.

Graduate Student Profile

Masood Samin, PhD Biophysics

Masood Samim is a PhD candidate in the Barzda Biophysics group, lead by Professor Virginijus Barzda, in the Department of Physics. His research is focused on the contractility of muscle cells as well as their biophysical and photo-physical properties. Understanding the molecular mechanism driving periodic muscle contractions is a crucial requirement for proper diagnosis of cardiac arrhythmia, and other abnormal muscular behaviors.

The contraction of a muscle cell is a complex process that involves synchronized action of thousands of myosin nanomotors. His PhD thesis addresses the understanding of the molecular interactions that lead to a muscle contraction. For this project, an innovative multibeam, multicontrast microscope, which employs two pulsed laser-beams and incorporates deformable and resonant scanning mirrors, has been developed for true real-time 3D scanning.

In addition, Masood is working on developing a theoretical framework for a nonlinear optical polarization technique to rapidly probe the dynamics of muscle cell contraction. Together, the microscope setup and the theory can be used to investigate a variety of other biological specimens besides muscle cells such as collagen, muscle, starch and more.

Masood obtained his Honors BSc in Physics and Biology (2T8), and subsequently was the recipient of the University of Toronto Excellence Award that allowed him to pursue single-molecule biophysics research in Professor Claudiu Gradinaru's lab. He followed up the project and obtained his MSc. (2T9) in the Collaborative Optics Program from the Department of Physics.

Masood is the recipient of the Ontario Graduate Scholarship and the Canadian Association of Physicists' awards among others. He is active in a number of extracurricular activities and has been serving as a board member on the UTM Campus Council and at the Cystic Fibrosis Canada Peel and District Chapter.

Masood Samin

Announcements

Nicolas Grisouard - Atmosphere/Ocean Theorist, Dr. Nicolas Grisouard has been appointed to a tenure-track assistant professorship in our Department, to start on 1 January, 2015. Dr. Grisouard is a geophysical fluid dynamicist whose research focuses on the theory of internal waves in the oceans. He got his PhD from the University of Grenoble, followed by post-doctoral work at the Courant Institute and Stanford.

William Trischuk - Has been appointed the Chair of Graduate studies.

Natural Philosophers

Do you have an enduring interest in developments in modern science?

The Natural Philosophers are a group of physics alumni and other enthusiasts of all fields of science.

During the academic year they meet once each month in the Physics Department for a presentation by a guest speaker followed by a lively discussion.

For more information on the Natural Philosophers, visit: uoft.me/naturalphilosophers

To be added to the mailing list for these events, please send an email to outreach@physics.utoronto.ca.

Undergraduate Laboratory Renewal: Change is in the Air!

MP 126

MP 126

This is an update on the status of the end-to-end renewal of our Undergraduate Experimental Physics Program we described in the last newsletter (see our article on Page 3 of the last newsletter at http://uoft.me/newsletter-summer-2014).

We have been very busy this summer with two key components of our lab renewal:

- We are implementing a new pedagogical approach for our lectures and labs in our first year Physics stream courses (starting September 2014), building on our *Physics Practical* experience in the life science stream courses. To support this, we have re-equipped the first year lab and carried out the first phase of a renovation of MP126. The renewed space includes well equipped experimental pods (pictured at left) where student teams carry out experiments and tutorial activities, in close interaction with teaching assistants and instructors. This is a functional space that puts us on track for our subsequent plans. We are eager to see this space in action!
- We have undertaken an expansion and complete renovation of the computer lab in MP257. This space will serve the needs of our growing Computational Physics program. This space is still under construction (as shown below) and scheduled to be completed by November 2014. The space will accommodate computer labs, study and computer space for our students, and smart lecture theatre capabilities.

Both these renovations were undertaken with resources of the Department. In the coming months you will hear more about our ambitious plans to completely renovate the Year 1 and Years 2-4 labs, many parts of which remain as they were when MP opened almost 50 years ago. The Department has received a commitment of partial support from the Faculty of Arts and Science, and will continue to seek additional support from our whole community to help realize our vision of lab renewal. Please feel free to contact us for more information.

MP 257

MP 257

UNDERGRADUATE LAB RENEWAL PROJECT

This fund will support the Department of Physics' plan to turn the undergraduate labs into highly effective, hands-on and interactive spaces that will enhance the student learning experience.

A 1:1 match will be provided for donations to this fund (up to a maximum of $50,000).

To donate to this fund, please visit: https://donate.utoronto.ca/physics

Recent PhD Graduates

Congratulations!!!

Left to right: Patricia Pernica, Thomas Walker and Alexei Halpin

Physics PhD Degrees Awarded in 2014 at the University of Toronto

March 2014

A. S. CHEN, "Experiments on the Growth and Form of Icicles", (S.W. Morris).

W. H. HELWIG, "Multipartite Entanglement: Transformations, Quantum Secret Sharing, Quantum Error Correction", (H.K. Lo).

June 2014

A. DELFAN, "Planar Resonant Structures for Biosensing Applications".

M. GAO, "Mapping Organic Molecular Motions with RF Compressed Femtosecond Electron Diffraction", (R. J. D. Miller).

H. A. HALPIN , "Two-dimensional Spectroscopy of Molecular Excitons in a Model Dimer System", (R. J. D. Miller).

H. JEAN-RUEL, "Femtosecond Electron Diffraction and Spectroscopic Studies of a Solid State Organic Chemical Reaction", (R. J. D. Miller).

P. M. PERNICA, "Implications of Periodic Weak Thermal Stratification in the Epilimnion of Lake Opeongo", (M. G. Wells).

T. W. WALKER, "Applications of Adjoint Modelling in Chemical Composition: Studies of Tropospheric Ozone at Middle and High Northern Latitudes", (D. B. A. Jones).

Getting involved with U of T Physics: Focus on Undergraduate Programs

A key focus for the Department in the coming years is to renew our Undergraduate Programs and provide mentorship and career guidance for our Physics graduates through the Physics Career Accelerator Program. You might be surprised to learn how critical alumni engagement is to the success of our efforts in this area. There are lots of opportunities!

- We need your engagement in our Explore More (Job Shadowing Program) in which we pair alumni with current undergraduate students for a day. If you are interested in being a job shadow host please contact: mentorship@physics.utoronto.ca.
- **"What can I do with a Physics degree?"** This is the most common question we hear from high school students who are interested in studying physics but are concerned about how they will be able to use the degree after graduation. In 2013, the Department of Physics reached out to our alumni to ask if they would be willing post their "Personal Story" on our web page. Postgraduate statistics show that while a lot of physics grads go on to graduate studies in the field, many others seek other postgraduate training or successfully transition straight to the workforce. Physics has been called "the liberal arts education for a technological society" in the sense that it opens doors to an array of careers involving problem solving in science and technology. Employment statistics for physics graduates are excellent compared to other degrees in science, social sciences, and humanities. So we are looking for good stories from alumni about where their physics degrees have taken them. If you are interested, please contact outreach@physics.utoronto.ca

We will continue to keep you posted of new initiatives as they arise! In the meantime, if you would like to be involved with our Department, please contact the:

Outreach Coordinator at
outreach@physics.utoronto.ca or
call 416-978-3307

Support the Department of Physics

Canada's leading department of physics is proud to offer an unrivalled breadth of cutting-edge research opportunities and educational programming designed to expand our knowledge of nature. These range from traditional core areas of condensed matter physics, quantum optics, subatomic physics and astrophysics, through globally influential work in climate change to the exciting emerging areas of quantum information, string theory and biological physics. Internationally renowned faculty are training future generations of scientists—all in an effort to respond strategically to some of the most pressing questions of our time. Your support will play a vital role in fostering advancing the department's reputation for excellence and innovation.
You can make a donation online here: https://donate.utoronto.ca/physics

Do you have an idea for a story? We would love to hear from you.

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Email: newsletter@physics.utoronto.ca

We are now on Twitter!

Follow @uoftphysics

Physics Funny!

A photon walks into a hotel. The bell hop asks "Do you have any luggage"?
The photon replies "No, I'm travelling light".