Interactions

Message from the Chair

Welcome to the latest issue of Interactions, the Department of Physics newsletter. A lot has happened in our Department since our last newsletter, and I hope you will enjoy reading about some of these changes in the following pages.

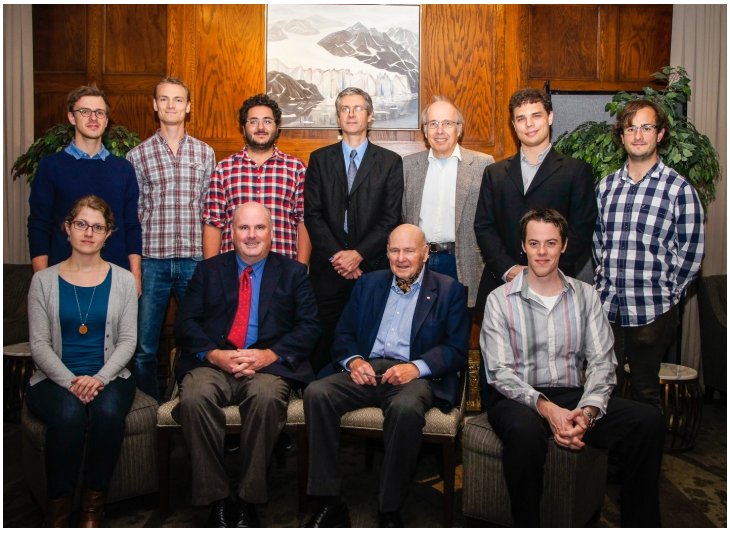
As some of you may know, I took over from Michael Luke as Chair of Physics, in July of last year. Mike's will be a tough act to follow. In 2004, and at a rather young age for an academic administrator, Michael agreed to be acting chair for six months while the Department searched for a new Chair. When that search failed, Mike continued as acting chair for a further year, while the Department searched again. This time, the search committee was successful, having the wisdom to choose Mike himself. In the end, Mike served as Chair for a total of eight years, and oversaw a period of major renewal of our faculty, teaching methods, and infrastructure, while shepherding the Department through the trauma of the double-cohort, and the financial crisis of 2008, which continues to have challenging repercussions for the University.

I am proud to be chairing this great department. My involvement with it goes back a long way - I first entered the doors of the McLennan Physical Laboratories in 1978, as a first-year undergraduate. I stayed to get my M Sc (1983) and Ph D degrees (1988) under the supervision of Jim Daniels. I spent the next 16 years at the Cavendish Laboratory at the University of Cambridge, UK, eventually becoming Head of the Low Temperature Physics group. In 2004 I returned to UofT as a Canada Research Chair in Experimental Condensed Matter Physics. Despite the many challenges that we face, notably the decline in funding for both research and teaching, and changing models of what university education can be, this is a very exciting time: there are major advances happening in many fields of physics, and some of the really big questions that have been around for years now seem ripe for solution. Our Department will continue to play a major role in these advances. At the same time, innovative models of teaching, which place more emphasis on peer instruction, two-way interaction between students and their professors, and online delivery of course content, make this a very interesting time to be involved in charting the future course of the Department. I'm looking forward to my five year term as Chair.

Yours sincerely,

Stephen Julian

Meet the E.F. Burton Fellowship Recipients



On October 8, 2013, the Department of Physics was happy to host members of the Burton family for a lunch to meet recipients of the E.F. Burton Fellowship in Physics

Read the full story on page 2.

Physics
UNIVERSITY OF TORONTO

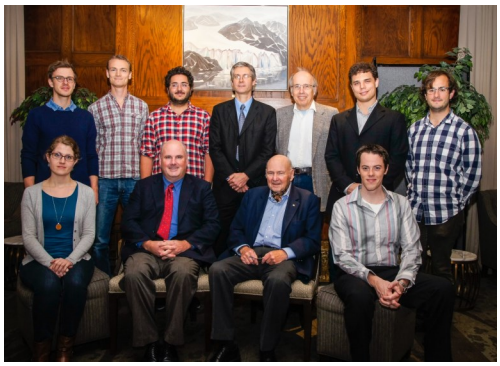
Meet the E.F. Burton Fellowship Recipients

On October 8, 2013, the Department of Physics was happy to host members of the Burton family for lunch to meet recipients of the E.F. Burton Fellowship in Physics.

The event took place at the Faculty Club and was attended by PhD candidates and scholarship recipients: Ossama Abouzeid, Dylan Mahler, Lukas Kontenis, Anjan Reijnders, Daniel O'Keefe, Adam Lewis, Melanie Cooke. Jackie Vanterpool (Advancement Office), Prof. Stephen Julian (Chair of the Department of Physics) and Prof. David Bailey (Associate Chair for Graduate Studies in Physics) were present as well .

Andrew Thomas Burton Stuart (MASc, C Eng 8T7), and his father, Alexander Stuart (BASc, C Eng 4T7), were delighted to participate in the lunch. Andrew, a trustee of the C. L. Burton Trust, called the luncheon inspirational and said, "This was a very special day. As a Trustee of the C.L. Burton Trust – University College and E.F. Burton Fellowship Fund, I was very pleased to have lunch with Professors Julian and Bailey at the Department of Physics and seven of their PhD students who receive financial support from the E.F. Burton Fellowship Fund. My great grandfather Charles Burton established the fund in honour of his brother, Professor Frank Burton, who developed the first practical electron microscope in the world at U of T in the 1930s. I was incredibly impressed with the work the professors and graduate students are undertaking today. I know their future is bright and they will build a stronger Canada that will help us all. It is very gratifying to see my great grandfather's trust continue to support the cutting-edge research in the Physics Department of the University of Toronto."

The E.F. Burton Fellowships has financially supported graduate students in the department since it was established in 1956, and to date has supported approximately 335 recipients.



Front Row from left to right: Melanie Cooke, Andrew Stuart, Alexander Stuart, Daniel O'Keefe
Back Row from left to right: Lukas Kontenis, Anjan Reijnders, Ossama Abouzeid, Stephen Julian, David Bailey, Adam Lewis, Dylan Mahler

Important Upcoming Event- Spring Reunion - May 28 – June 1, 2014

Spring Reunion is a campus wide event and your chance to get together with your fellow alumni to celebrate your experiences, accomplishments and friendships at U of T. This special occasion brings together thousands of alumni for the chance to reconnect with old friends and make new ones. Enjoy dinners, socials, awards events, networking opportunities and, of course, what you know and love so much about U of T—stimulating talks on interesting topics by leading intellectuals.

Graduates from the Department of Physics are invited to a Stress-Free Degree lecture by Professor Stephen Morris called "Consider the Icicle" on Saturday, May 31st from 4:00-5:00pm.

Please register for the lecture on the Spring Reunion website: https://springreunion.utoronto.ca/events/find

You're also invited to join us for a Physics Tour after the lecture from 5:00-7:00pm, which will include a wine and cheese reception. Register for this tour/ reception by emailing smanek@physics.utoronto.ca

The Next Holder of the J.Tuzo Wilson Professorship is Professor Stephen Morris

Professor Stephen Morris

Stephen Julian announced that the next holder of the J. Tuzo Wilson Professorship will be Professor Stephen Morris.

John Tuzo Wilson was one of the most distinguished professors ever to grace our Department. Among his many important contributions to the field of geophysics, his name is closely associated with the theory of plate tectonics.

In his honour a named Professorship was set up in 1995.

Stephen will be the 4th J Tuzo Wilson Professor, and he follows Professor R N Edwards. Stephen's inaugural lecture as Wilson Professor will be next fall.

You can catch Stephen Morris at the Spring Reunion 2014 where he will be presenting his work on icicle physics in "Stephen Morris – Consider the Icicle".

Register at https:springreunion.utoronto.ca/events/find
(free)

2014 Welsh Lecture Series— April 30 and May 1, 2014

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

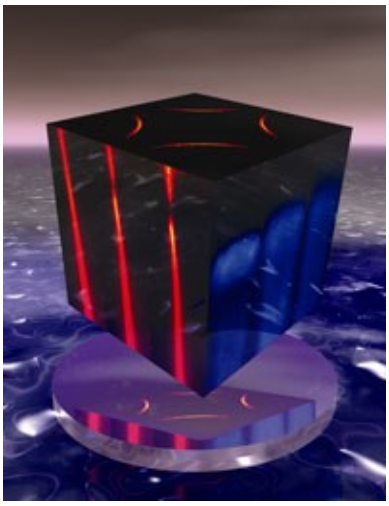


Image courtesy of Z-X Shen

The Welsh Lecturers for 2014 are:

Professor Zhi-Xun Shen, Department of Physics, Stanford University -
"High Temperature Superconductivity - Insights from Einstein's electrons"

Dr. Rolf Heuer, CERN -
"Breaking the wall of the hidden universe - What the discovery of the Higgs boson tells us about Physics, Mankind and the Universe"

These public lectures are addressed to an audience with broad interests in the physical sciences.

For information go to: http://www.physics.utoronto.ca/welsh/

Undergraduate Laboratories: Renewing our Experimental Physics Program

The Department of Physics has embarked on an initiative to renew our Undergraduate Experimental Physics Program. As Physics Alumni, you know that the Physics lab is where, to a great extent, your real Physics learning happens: where theory is put to the test, new phenomena are discovered, understanding of errors and uncertainty takes place, and a host of practical hands-on skills are acquired. Our Undergraduate Physics Program provides a top-notch training in experimental physics starting with first year introductory lab courses and culminating in our challenging Advanced Physics Labs. But our infrastructure has become an obstacle to pedagogical renewal in the labs. Most of the lab space that occupies the North Wing of the McLennan Physical Laboratories building has not been renovated since the building opened in 1966, and much of our equipment in use now is also in serious need of updating.

Our renewal plans build on the pioneering and highly successful 2007-2009 renewal of the First Year Introductory Physics courses and labs for students in the Life Science streams. This renewal centred on pedagogical renewal and modernization of equipment and lab space to reflect best pedagogical practice for these Life Science students. The award-winning Physics Practicals have resulted in a significant increase in student satisfaction with their physics experience and improvement in learning of physics concepts and skills acquisition. We believe the time is overdue to extend this success to students in Physics and are developing a plan to:

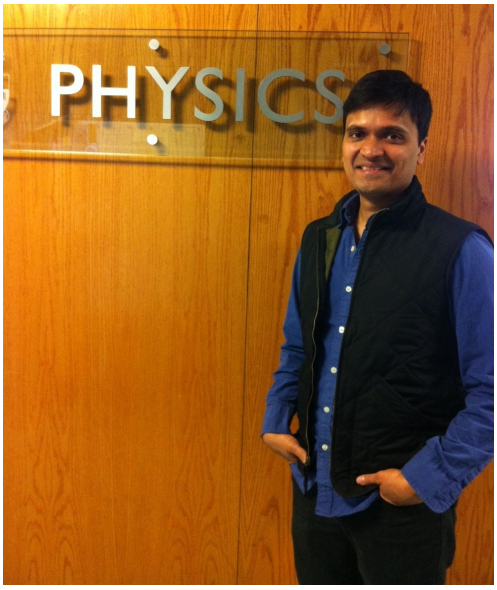
- Integrate lectures and labs in our first year Physics stream courses (starting September 2014).
- Completely renew our first year lab space with the construction of a specially designed "Practicals Room", creation of new open-lab and drop-in learning space, and renovation of the space of our technologist staff.
- Renovate the second- and third-year lab space on the second floor of the MP north wing for our Physics Majors, Specialists, and Joint Specialists.
- Introduce new computer rooms for our growing Computational Physics curriculum activities.
- Renovate and re-equip our Advanced Physics Labs.

Lab Renewal in Progress

This multi-year effort is scheduled to begin this spring, and the Department will seek support from the University, from our Alumni, and from other partners, to realize our vision of an end-to-end renewal of our Physics Labs. We will keep you posted on our developing plans and opportunities for you as Alumni to contribute with ideas and support. In the meantime, please contact me (ugchair@physics.utoronto.ca) for more information.

New Faculty

Sid Goyal



Sid Goyal

Sidhartha Goyal is a new faculty member at the Faculty of Physics. He has an interest in developing an interdisciplinary biophysics research program to understand how evolution works at the molecular level. According to Sid, research at the intersection of biology and physics is not new, but there is certainly a new wave of excitement. Much of this excitement stems from the new tools such as sequencing and imaging that can now observe biological phenomena with unprecedented detail.

Sid started in medical school at KMC, Manipal and while he enjoyed his mornings dissecting cadavers, he jumped at the chance to join the India Institute for Technology at Bombay to pursue a degree in Electrical Engineering, just to get a chance to learn more math! After having spent four years designing analog and digital circuits, Sid found himself working for McKinsey, a business consulting company.

This was all very exciting except he still had some urge left to find out more about how the natural world worked, and having caught the biology bug through various internships during his undergrad, he joined a PhD program in Bioengineering at University of Washington (UW), Seattle. At UW he primarily worked on two projects, design and fabrication of hydrophobic non-fouling surfaces and the fabrication and modeling of droplet based micro-electro-fluidic system.

Though his research afforded him the opportunity to do basic research while creating tools for basic and applied research in medicine and biology, it kept him far from exploring the core biological processes. Or perhaps just to test the validity of the basic law of nature as “rolling stone gathers no moss”, Sid then moved to Princeton for a PhD in theoretical physics.

At Princeton, he was a part of the biophysics theory group under physicists Bill Bialek, Curtis Callan, and Ned Wingreen, and was also a de facto member of the interdisciplinary signaling group run by molecular biologists Bonnie Bassler and Fredrick Hughson. He primarily worked on addressing the structure-function relationship in biological networks. Sid studied a variety of bio-molecular networks particularly in the context of metabolic regulation, cell-cell communication, and cellular signal-transduction pathways in bacteria.

As a post-doctoral fellow at the Kavli Institute for Theoretical Physics (KITP), University of California, Santa Barbara (UCSB), Sid addressed the problem of genetic diversity and the role of natural selection in various processes. In particular, he argued for a dynamic mutation-selection balance for long-term evolutionary stability of asexual organisms, and developed bioinformatics tools for analyzing low frequency mutations as they arise in a population. He has also begun addressing the role of natural selection in mitochondrial aging. His work at KITP was also done in collaboration with physicist Boris Shraiman, biologists Joel Rothman at UCSB and Dan Gottschling at the Fred Hutchinson Cancer Research Center, Seattle.

Sid is now at the University of Toronto’s Department of Physics. He is the latest hire to help in the University of Toronto’s effort in developing a broad program in biophysics that includes a number of Departments across the University, such as biochemis-try and molecular biology.

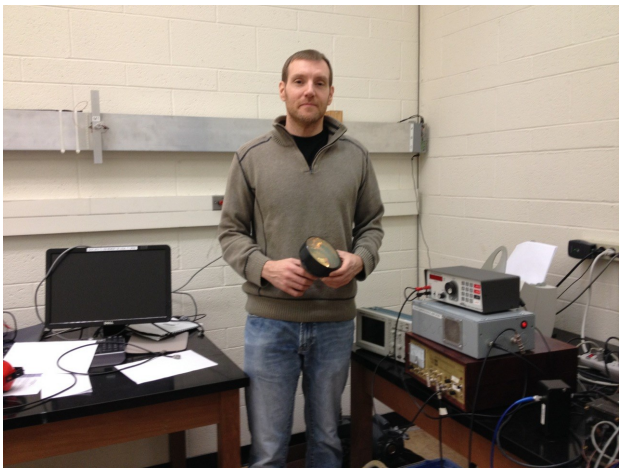
Sid’s lab will utilize laboratory microbial systems to study how evolution works at the molecular level. Two primary areas that drive his research are the maintenance of mitochondrial genomes and the CRISPR system in bacteria.

Along with research, Sid hopes to introduce a new graduate course that will be targeted towards new graduate students in both physics and biology. The course will involve the reading of published papers illustrating the principles, achievements and difficulties that lie at the interface of theory and experiment in biology. Two important papers, read in advance by all students, will be considered each week; the emphasis will be on discussion with students as opposed to formal lectures. The course will include problem sets that require both some biological insight and some analysis.

Welcome to the Department of Physics Sid!

New Faculty

Ken Clark



Ken Clark

Ken Clark began his career in physics in earnest by transferring into the University of Toronto to complete his undergraduate education. It was during this time that he developed his pervasive interest in the experimental aspects of physics and experimental particle physics specifically. Following on from these interests, Ken moved to Queen's University in Kingston to work on the PICASSO (Project in Canada to Search for Supersymmetric Objects) dark matter detection experiment for his PhD. This work led naturally to a postdoctoral position working on the CDMS (Cryogenic Dark Matter Search) and LUX (Large Underground Xenon) dark matter detectors at Case Western Reserve University. Ken led the construction, commissioning and testing effort for the liquid xenon heat exchanger, one of the vital components of the detector which currently holds the world best limits on spin-independent dark matter. A quest for adventure led to his postdoctoral position on the SNO+ neutrino experiment located primarily at Oxford University. Here Ken was responsible for the simulation and design of an optical calibration system intended to monitor changes in the detector over time. For his final post doc, a solution to the "two body problem" was presented at Pennsylvania State University with the opportunity to work on the IceCube neutrino detector. Ken is continuing his work on the IceCube detector at the University of Toronto, where he has been since July of 2013.IceCube is the world's largest neutrino detector, encompassing a cubic kilometer of ice at the South Pole, recording the interactions of the nearly massless sub-atomic particle called the neutrino. IceCube searches for neutrinos from the most violent astrophysical sources: events like exploding stars, gamma ray bursts, and cataclysmic phenomena involving black holes and neutron stars. The IceCube telescope is a powerful tool to search for dark matter, and could reveal the new physical processes associated with the enigmatic origin of the highest energy particles in nature. In addition, using the background of neutrinos produced in the atmosphere, IceCube studies the neutrinos themselves; their energies far exceed those produced by accelerator beams. Most recently, Ken has been working on an extension to the IceCube detector used to study lower energy neutrinos called PINGU (the Precision IceCube Next Generation Upgrade).

The IceCube detector consists of 86 long strings buried in the ice, upon which are located many photomultiplier tubes (PMTs) used to detect the light produced as a neutrino interacts. The space between these strings defines the amount of light collected and therefore the energy threshold of the detector. The PINGU experiment will supplement the IceCube detector by adding up to 40 more of these strings located much closer together. In doing this, the energy threshold can be lowered to several GeV, opening up a great deal of physics for study. In particular, the area of most interest, and the focus of Ken's work, is the determination of the neutrino mass hierarchy using the PINGU detector. This fundamental question concerning the ordering of the neutrino mass states is one of the few remaining unknown parameters in the neutrino sector and is of great interest to the neutrino community. In addition to the mass hierarchy, PINGU will be used to study other neutrino oscillation parameters as well as dark matter and the signals from supernovae.

Currently, PINGU is being proposed to funding agencies in several countries including Canada, the US, Germany and Sweden. The majority of the work Ken has done on the detector has been the simulation of the response of the detector to incoming neutrinos and the analysis of the data from these simulations with a focus on the neutrino mass hierarchy. This has proven to be challenging yet rewarding work, and Ken is looking forward to having data from the final detector.

Welcome to the Department of Physics Ken!

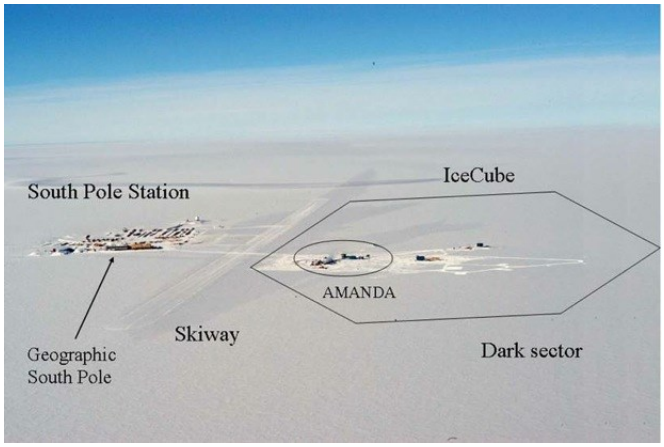


Diagram of Ken's work in the South Pole

What are our graduate students up to?

Anjan Reijnders

Anjan Reijnders is a 4th year PhD physics student under the supervision of Dr. Ken Burch, and has focused on the study of optical and electronic properties of novel materials by means of broadband optical spectroscopy. This technique, which exploits the interaction of electromagnetic radiation (typically infrared or visible light) with matter, can yield invaluable new information about intrinsic material properties. While such research is fundamental in nature, a better understanding of these physical properties could lead to enhanced fuel efficiency (e.g. the use of thermoelectrics in engines); faster, smaller, and more efficient computers (e.g. topological insulators and superconductors for novel computing techniques); and provide a quantum mechanical environment conducive to fundamental research on entirely new physical phenomena and undiscovered particles (e.g. Majorana fermions and magnetic monopoles).

Anjan Reijnders

Originally from the Netherlands, Anjan developed his interest in science at Delft University of Technology, after which he moved to the United States and obtained a B.S. Physics, and B.A. Mathematics at the University of Michigan-Flint. Anjan is the recipient of several international awards and scholarships, including an NSERC CREATE fellowship, and a Prins Bernhard Cultuurfonds, and he was recognized for his teaching with a First Year Physics Practicals Outstanding Teaching Assistant Award.

Over the past few years, Anjan has focused primarily on topological insulators. This is a new class of materials, in which theory predicts that the interior (bulk) is electrically insulating, while the surface is highly conductive. By analogy, this is much like an insulating glass brick wrapped in a thin film of highly conductive gold, except that in a topological insulator both the brick and the film are the same material. Interestingly, cutting a topological insulator in half does not expose its insulating interior. Instead, two new conductive surfaces are found at the cut. Since electrons on this highly conductive surface are less susceptible to scattering compared to traditional semiconductors they dissipate less heat, making these materials more efficient in transistors and memory devices. In addition, electrons with opposite spin move in opposite directions, making topological insulators a useful material for spintronics (electronics in which the spin degree of freedom is used as an additional information carrying variable). However, these great theoretical predictions turn out to be nontrivial in practice. Experimentally, the interior of topological insulators is not quite insulating, which complicates the independent study of electron dynamics on the surface and in the interior. This experimental separation and characterization of surface and bulk behavior has been the focus of Anjan's recent research efforts. A more detailed description of this work can be found in his recent publication in the journal Physical Review B. The title of the article is "Optical evidence of surface state suppression in Bi-based topological insulators" (Phys. Rev. B 89, 075138 (2014))

Besides his thesis research, Anjan has also dedicated much of his time to the development of highly sensitive and repeatable optical research equipment, improving the experimental toolbox of condensed matter physicists.

Attesting to his strong commitment to physics education, Anjan is an active member in the Physics Department Graduate Liaison Committee, a participant in the recently launched Physics Mentorship Program, and frequently trains and supervises undergraduate students during their summer/year-round research internships.

Outside of physics, Anjan is an avid outdoorsman, particularly enjoying backpacking, fishing, photography, and literature, and spending time with his family.

What are our graduate students up to?

Melanie Cooke

Melanie Cooke

Melanie is a third year PhD student in Dr. Paul Kushner's research group in Earth Atmospheric and Planetary Physics. Her work is motivated by the need to understand the variability of climate and climate change at the regional scale. Translating how global climate change impacts local weather, human populations and ecosystems is a research challenge because the statistical connection between large and small scale climate is not well understood. Melanie is studying this connection as it applies to vertical mixing of water in Arctic lakes - a biologically important dynamical process in a region known to be particularly sensitive to climate change. Focusing on one particular lake in Alaska with a long, high-resolution data record - Toolik Lake - she analyses the lake's state over time to detect the onset of mixing in the ice-free season. She is finding that the passage of individual storms and fronts or the presence of calm, clear weather control this mixing by controlling wind stress and surface heat flux.

Melanie is researching these weather dynamics and their associated large-scale upper atmospheric states as a means to uncover the weather and climate regimes that are most conducive to lake mixing at Toolik. She will later use model-derived simulations of future climate to predict whether there may be changes in store for these regimes. This question is especially important when faced with an increasing mean Arctic summer surface temperature that would tend to inhibit vertical mixing in the lake.

Melanie is from St. John's, Newfoundland and Labrador, and received her undergraduate degree in Physics at Memorial University with an honours project in Oceanography. She obtained her M.Sc. from McGill University in Atmospheric and Oceanic Sciences, focusing on Meteorology. She then worked as a Research Assistant at Memorial and a researcher at the Department of Fisheries and Oceans before beginning her Ph.D. She runs the Weather Club in the Physics Department and is the team manager for the U of T wxchallenge.com team. She also pursues her lifelong interests in drawing, painting and photography in her spare time.

George Luste Lends his Support to Four Prizes in Undergraduate Physics

George Luste

The Department is very pleased to announce that Prof. George Luste has generously provided funding to the following four scholarship prizes for the support of our undergraduate physics students:

A new "CAP Prize Exam Award", which is to be awarded to the student or students placing in the top 10 in the Canadian Association of Physics (CAP) Undergraduate Prize Exam.

A new "Biological Physics Prize" to be awarded to a top student in our Biological Physics Specialist Program, with a preference for third year students.

Additional support for the "Prize in Experimental Physics" to be awarded to top students enrolled in Arts and Science Programs in the 2nd, 3rd, or 4th year laboratories

All four prizes will be awarded annually. We have named the first three prizes in honour of Prof. Luste.

The Prize in Experimental Physics will be jointly named for Prof. Luste and the late Prof. Statt.

We wish to express our profound thanks to Prof. Luste for the generous donation that made these prizes possible.

2013 Retired Faculty

Nigel Edwards

Nigel Edwards graduated in Physics and Mathematics from Imperial College in 1966, a year when there were far more good jobs than physicists to fill them. Nigel, a qualified pilot at the time, was offered a research position on the jump jet design team at Hawker aircraft but, perhaps foolishly in retrospect, decided instead to look for a PhD graduate studentship – subject to be decided.

Nigel signed up with Sir Edward Bullard at Cambridge. Teddy Bullard, a former chair of physics at Toronto, was one of the most distinguished and charismatic geophysicists of his time. He still had no research plan and was considering Dynamo theory, Heat Flow, Gravity and Electromagnetic Induction. Bullard suggested that Nigel work with Lawrie Law, a Canadian on leave from the Earth Physics Branch, Ottawa. Nigel and Lawrie measured the geomagnetic variations all over the British Isles. They built and installed three component magnetometers with some data collected digitally, unusual at the time, on large rolls of punched paper tape. The tape had to be changed every three days which meant a trip from Cambridge to at least as far as Edinburgh or western Ireland once a week! The data they collected were explained by the influence of transient induced natural electric currents in sea water. The research was published by the Royal Society in 1971.

Near the end of his stay in Cambridge, Nigel met Tuzo Wilson who invited Nigel to Toronto where he continued his geomagnetic studies in eastern North America with George Garland. Eventually, Nigel accepted a faculty position at the University in Exploration Geophysics – a subject he knew little about! He published a number of papers on unusual exploration methods which unfortunately never really caught on

The turning point came when he was reunited with Lawrie Law. Nigel was on leave at the Pacific Geoscience Centre in Victoria when Edward Bullard passed away. The American Geophysical Union asked his former students to contribute a paper to a special volume. Nigel and Lawrie had nothing original to contribute, but knew that Teddy wanted to build something to look at the conductivity of the ocean floor. They conjured up a method called MOSES, Magnetometric Off Shore Electrical Sounding. This was a cunning low frequency system to probe the electrical section under the sea using vertical current dipole and a magnetic receiver. They submitted this theory for publication in the special volume. The reviews were very antagonistic, saying they had theory without data and no experience in marine science, Nigel thought that this was the end of his career. Fortunately, colleagues including Roy Hyndman pointed out the method might/could/should actually work. Nigel applied to NSERC for funding and he received a very large equipment and research grant. He also received strong support from the Geological Survey of Canada. The method was successful and is still being used today. Nigel became a marine geophysicist!

Nigel continued his interest in marine science for the remainder of his career. He set out to understand marine frequency and time domain electromagnetic methods with an international group including Alan Chave, Steve Constable, and Steve Cheesman. The ability of these methods to detect resistive zones in sub sea sediments, such as petroleum, natural gas and gas hydrate zones, ultimately led to a multi hundred million dollar industry. Major companies such as EMGS and OHM were formed to carry out surveys using methods developed by the group.

Nigel's research has taken him to many continents, to the Arctic Ice in Winter and to the bottom of the Atlantic on deep diving submersibles exploiting unique, novel geophysical methodologies to search for geological economic targets.

During his time at the University of Toronto, Nigel served as the Associate Chair for Undergraduate Studies and held the J. Tuzo Wilson Professorship of Geophysics.

Nigel and his wife Patricia formed close friendships with his gifted graduate students. Many have continued in marine science and now hold very senior positions worldwide. When Nigel was seriously ill six years ago, and needed a new liver, his former PhD student Graham Cairns donated two thirds of his. You can read more about this remarkable gift here.
http://www.magazine.utoronto.ca/life-on-campus/gift-of-a-lifetime/

We wish Nigel all the best in his retirement!

2013 Retired Faculty

Dick Bailey

Richard “Dick” Bailey obtained his Honours Physics degree at Dalhousie University in 1965. During his time at Dalhousie, Dick spent summers working at the Bedford Institute of Oceanography near Halifax, doing geophysics in the North Atlantic and in the Arctic. He also worked at the Defense Research Board Labs near Ottawa, variously analyzing data from Canada’s first satellite, and designing liquid lasers. These summer jobs confirmed his passion for physics.

While at Dalhousie, Dick was picked by the distinguished geophysicist, Sir Edward Bullard. He went to Cambridge to do his PhD in geophysics. There, between rowing for King’s College and motorcycling around the UK, he obtained a solution for the inverse scattering problem in magnetotellurics (imaging the earth’s interior using diffusing magnetic fields) for his Ph.D. (1970).

After post-doctoral time at Leicester (doing ionospheric physics, during which time he met and married his wife Monika, also a physicist) and Toronto (doing field work in magnetotellurics) Dick permanently joined the faculty at Toronto in 1978 in a faculty position split between Physics and Geology. He worked initially in geophysical electromagnetism, in particular magnetotelluric imaging and subsequently more on speculative theories about the crustal dynamics of the very early Earth. Not surprisingly, his interdisciplinary position also led him to occasional publication on more esoteric subjects, such as remote estimation of iceberg stability, coping with Compton scattering in airborne gamma-ray surveys, inference of larval stages of ancient biota from fossil remains, statistical prediction of gold deposits from borehole data, the leakiness of nuclear waste-disposal sites, detection of unexploded land-mines for post-war rehabilitation projects, the behaviour of oscillating air bubbles underwater, and estimation of unobservable magnetization in rocks.

Before retiring in 2013, Dick was Acting Chair of the Department of Geology for a year, and then spent another year as Acting Chair of Physics, drawing upon his experience, he says, of helping to raise four children.

We wish Dick all the best in his retirement!

Dick Bailey and Nigel Edwards at their retirement party in the summer of 2013

Retired Staff

Beth Ernstberger
Chair's Administrative Assistant
(2005 - 2013)

Beth Ernstberger joined the Department in 2005 after a long career at the Scarborough Hospital. For the next eight years she was the public face of the Department for many, arranging job candidate visits, convening tenure and search committees, scheduling meetings and visitors, communicating with faculty and administration both inside and outside the University, and all in all making sure all the responsibilities of the Chair's office were carried out with her characteristic warmth, wit and professionalism.

(Mike Luke – Chair of Physics 2004-2012)

Paula Granfield
Assistant to the Chief
Administrative Officer
(1991- 2013)

After serving the Department of Physics for 22 years Paula Granfield decided on a well -deserved early retirement in November 2013. In 1991 Paula joined the Department as the Clerk/Receptionist on the third floor. She progressed through the ranks and as the Assistant to the Chief Administrative Officer Paula played a key role in the management of the maintenance and repair budget. She interacted extensively with Facilities and Services and University Trades to correct building and infrastructure issues, and also oversaw the activities of the Physics main office. As well, Paula was the Physics telecommunications and corporate card coordinator and acted as a back up to the Physics financial group. From all accounts Paula is actively pursuing her life-long love of travel and her passion for the visual arts, and her Physics colleagues trust she is fulfilling her pre-retirement goal of rediscovering her artistic self.

(John Muto—Chief Administrative Officer)

Serge Ulanday
Physics Stores
(1973 - 2013)

Serge Ulanday became a near-permanent fixture in the Department, joining Physics Stores in 1981 after an eight-year stint in the Department of Zoology. For well over three decades Serge attended to the needs of the Physics community in a variety of areas including shipping and receiving, courier and mail services, sales in the open stores facility, the general purchase of material and equipment, and special orders for research purposes. Serge became the Stores Services Manager in 2003 and his smile, sense of humour and his willingness to get the job done, quickly and efficiently, were some of his strongest traits. Serge had a particular talent in taking the lead in office moves and related operational tasks and was often seen working side by side with his casual staffers. Serge received his 40 year service plaque from the University mere weeks before his retirement date last July 31st, and says that he misses his friends and colleagues in Physics.

(John Muto—Chief Administrative Officer)

In Memoriam

Richard Azuma
Emeritus professor and former department chair and member of the Nuclear Physics group

Patrick O'Donnel
Emeritus professor of the Particle Theory group

Joe Vise
Lecturer in the Department from 1978 until his retirement in 1997

For more information visit our "In Memoriam Page"
https://www.physics.utoronto.ca/people/in-memoriam

Physics Mentorship Program – Are You Interested in Participating?

The Physics Mentorship Program started in 2010 to provide the opportunity for 3rd and 4th year physics undergraduate students to start thinking ahead about their postgraduate career and life plans. In the Mentorship Program, students are matched with alumni or academic volunteer mentors who can provide advice and guidance as students prepare to make their way into the working world or begin to explore post graduate research.

The 2013-2014 Program had 33 mentor-mentee matches, the greatest number to date! Mentees met each month with their mentors to engage in discussions such as goal setting, career choices and the job application process. Mentors provided mentees with things like relevant reading material or initiated introductions to contacts in their area of interest.

The 2013-2014 program came to an end on April 3, 2014 with a special closing event. The participants in the program had the opportunity to socialize, have a bite to eat and receive certificates for completing the program.

Here is what some of the participants appreciated about the 2013-2014 Program:

"I really enjoyed the one on one meetings with my mentee, I feel like our discussions were productive and a lot of fun" - mentor

"I like helping U of T grads get on with their lives in the best way possible" – mentor

"Fun to be able to help current undergrads struggling with the same issues I struggled with during undergrad – rewarding" – mentor

"One on one conversations with a mentor who has gone through everything that I am going through is extremely helpful, having someone to ask questions" – mentee

"I made contact with people in the relevant career path and I learned a lot about what it would be like" - mentee

"Opened my eyes to how my degree is useful and where it can take me"- mentee

Are you interested in helping out as a Mentor in the 2014-2015 Undergraduate Mentorship Program? If so, please contact us at mentorship@physics.utoronto.ca

Mentorship Program Closing Event

Back Row right to left: David Bailey, Mark Staley, Charles Dyer, Emanuel Istrate, Aharon Kageden, Anjan Reijnders, Pek-ka Sinervo

Middle Row right to left: Vincent Malik, Daniel Cheng, Paul Godin, Robert Les, Amy Qu , Vivian Britto, Timjan Kalajdzievski, Joel Foo, Yara Mohajerani, Sabine Stanley, Jeong Yeon Yook , Helen Freedhoff

Front Row right to left: John Sipe, Jaspinder Nijjer, Harris Snyder, Jason Hamilton, Jane Dong, Paul Kushner

Congratulations to our November 2013 PhD Graduates!

from left to right Igor Fridman, Aylia Mohammadi, Omar Gamel, Wei Cui and Chao Zhuang received their PhDs in November 2013

Physics Degrees Awarded in 2013

November 2013

R. CHANG, “Exploring Matter-wave Dynamics with a Bose-Einstein Condensate”, (A.M. Steinberg).

W. CUI, “Multipartite Entangled Quantum States: Transformations, Entanglement Monotones and Application”, (H.K. Lo).

G. DHARMARAJ, “Planetary Dynamo Models: Generation Mechanisms and the Influence of Boundary Conditions”, (S. Stanley).

T. DODDS, “Exotic Phases in Geometrically Frustrated Quantum Magnets”, (Y.B. Kim).

T. FAROOQUE, “Search for Heavy Resonances Decaying to Top Quark Pairs in the Boosted All-Hadronic Decay Channel”, (P.K. Sinervo).

I. FRIDMAN, “Scanning Tunneling Spectroscopy Studies of Multiband and Unconventional Superconductivity”, (J.Y.T. Wei).

O. GAMEL, “Dynamics, Processed and Characterization in Classical and Quantum Optics”, (D.F.V. James).

A. GHAZVINI ZADEH, “AdS/CFT, Black Holes and Fuzzballs”, (A. Peet).

H. GRETARSSON, “X-ray Spectroscopy Studies of Iridates and Iron Based Superconductors”, (Y.J. Kim).

A. MASHAYEKHI, “Diapycnal Mixing in the Ocean: from Dissipation Scale to Large Scale Meridional Overturning Circulation”, (W.R. Peltier).

Continued on next page

K. MASUI, “Advancing Precision Cosmology with 21 cm Intensity Mapping”, (U.-L Pen).

A.S. MOHAMMADI, “Quantitative Behavioural Analysis of Thermal Nociception in Caenorhabditis elegans: Investigation of Neural Substrates Spatially Mediating the Noxious Response, and the Effects of Pharmacological Perturbations”, (W.S. Ryu).

K.A. O’FARRELL, “Comparisons of Spherical Shell and Plane-Layer Mantle Convection Models”, (J.P. Lowman).

S. PRODAN, “Secular Evolution of Compact Triple Systems: The Interplay of Kozai Resonances, Tidal Friction, Gravitational Wave Radiation and Mass Transfer”, (N. Murray).

C. ZHUANG, “Quantum Control of Vibrational States in an Optical Lattice”, (A.M. Steinberg).

June 2013

J. J. DEAN, “Nonlinear and Ultrafast Optical Probing of Nanoscale MnAs and Graphitic Films”, (H.M. van Driel).

J.-M. DELISLE CARTER , “Interplay between Spin-orbit Coupling, Electronic Correlations and Lattice Distortions in Perovskite Iridates”, (H.Y. Kee).

M.-E. GAGNÉ, “Understanding Oxygen Photochemistry in CO2-dominated Planetary Atmospheres”, (K. Strong).

J. HARNOIS-DÉRAPS, “Towards Robust Quantification of Cosmological Errors”, (U.L. Pen).

L. G. HELT, “Nonlinear Quantum Optics in Artificially Structured Media”, (J.E. Sipe).

H. HOSSEIN-NEJAD, “Electronic Energy Transfer in Light-Harvesting Antenna Complexes”, (G. Scholes).

Z. JIANG, “Understanding the Impact of Model Errors on the Inverse Modeling of MOPITT CO Observations”, (D. B. A. Jones).

M.P. KILLI, “Controlling the Properties of 2D Chiral Fermions and Local Moments in Graphene”, (A. Paramekanti).

B. LIU, “Single Protein under the Microscope: Conformations, Dynamics and Medicinal Therapies”, (C. Gradinaru).

A.-M. MAZOUCHI, “Visualizing Invisibles with Single-Molecule Techniques: from Protein Folding to Clinical Application”, (C. Gradinaru).

E. PELLETIER, “Development of a New Mid-Infrared Source Pumped by an Optical Parametric Chirped-Pulse Amplifier”, (R.J.D. Miller).

R. REZVANI, “Search for New Phenomena with the Mono-jet and Missing Transverse Momentum Signature, and a Direct Measurement of the Invisible Width of the Z Boson with the ATLAS Detector at CERN ”, (R.S. Orr).

P. D. THOMPSON, “Measurement of the Inclusive Jet and Dijet Cross Sections Using 2010 Data from the ATLAS Detector and Calibration Studies and Simulation of the ATLAS Forward Calorimeter”, (P. Krieger).

A. TUER, “Nonlinear Microscopy for Histology”, (V. Barzda).

A.M. VENDITTI, “Particle Definitions and the Information Loss Paradox”, (C.C. Dyer).

W. WITCZAK-KREMPA, “Interplay between Electron Correlations and Quantum Orders in the Hubbard Model”, (Y.B. Kim).

X. XINGXING, “A Quantum Light Source for Light-Matter Interaction”, (A.M. Steinberg).

March 2013

S. DHALIWAL, “Search for Neutral Minimally Supersymmetric Standard Model Higgs Decaying to Two Hadronic Taus with the ATLAS Detector in pp Collisions at 7 TeV Center of Mass Energy MSSM A/H/h → τh τh”, (R.S. Orr).

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. You might be surprised to learn how critical alumni engagement is to the success of our efforts in this area. For my part, I was happy in 2004 to renew my association with this Department -- and we need more of our alumni to re-engage with us. There are lots of opportunities!

- We need your engagement in our Mentorship Program, in which we pair alumni with current undergrads. If you are interested in mentoring please contact mentorship@physics.utoronto.ca.
- We are looking for guidance as to what a modern physics lab class should look like – what skills can we impart to our students that will do them the most good in the future? Let us know if you have ideas and send an email to smanek@physics.utoronto.ca.
- The university is also increasingly focused on helping our students plan their careers, and there will be opportunities for alumni with 'real world' experience to help them with that, including job-fairs and job-shadowing. You will be hearing from us in the next year regarding these programs and volunteer opportunities.
- "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 you would be willing post your "Personal Story" on our web page. Post graduate statistics show that while a lot of physics grads go on to graduate study 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 grads are excellent compared to other degrees in science, social sciences, and humanities. So we are looking for good stories from our alumni who have moved away from physics as well as stories from those who of you who have stayed in the field. If you are interested to include your story, please contact outreach@physics.utoronto.ca

  We will keep you posted as new initiatives as they arise! In the mean-time, 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.

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